Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

T.Y.B.Sc. (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2021 – 2022

Course Structure T.Y.B.Sc. (Computer Science)

Semester V (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-351	Operating Systems – I	2		15	35	50
	CS-352	Computer Networks – II	2		15	35	50
	CS-357	Practical course based on CS 351		2	15	35	50
DSEC - II	CS-353	Web Technologies – I	2		15	35	50
	CS-354	Foundations of Data Science	2		15	35	50
	CS-358	Practical course based on CS 353 and CS 354		2	15	35	50
DSEC - III	CS-355	Object Oriented Programming using Java - I	2		15	35	50
	CS-356	Theoretical Computer Science	2		15	35	50
	CS-359	Practical Course based on CS 355		2	15	35	50
SECC - I	CS-3510	Python Programming	2	0	15	35	50
SECC - II	CS-3511	Blockchain Technology	2	0	15	35	50

Semester VI (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-361	Operating Systems – II	2		15	35	50
	CS-362	Software Testing	2		15	35	50
	CS-367	Practical course based on CS 361		2	15	35	50
DSEC - II	CS-363	Web Technologies – II	2		15	35	50
	CS-364	Data Analytics	2		15	35	50
	CS-368	Practical course based on CS 363 and CS 364		2	15	35	50
DSEC - III	CS-365	Object Oriented Programming using Java - II	2		15	35	50
	CS-366	Compiler Construction	2		15	35	50
	CS-369	Practical Course based on CS 365		2	15	35	50
SECC - III	CS-3610	Software Testing Tools	2	0	15	35	50
SECC - IV	CS-3611	Project	2	0	15	35	50

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: DSEC – I Course Code : CS - 351
Course Title : Operating Systems – I

Teaching Scheme:	No. of Credits:	Examination Scheme:
03 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisites
Data structures like stack, queue, linked list, tree, graph, hashing, file structures, any structured programming language

Course Objectives:
1. To understand the concept of operation system and its principle
2. To study the various functions and services provided by operating system
3. To understand the notion of process and threads

Course Outcomes: After completion of this course students will be able to understand the concept of
1. Processes and Thread Scheduling by operating system
2. Synchronization in process and threads by operating system
3. Memory management by operating system using with the help of various schemes

Course Contents

Chapter 1	**Introduction to Operating Systems**	**6 lectures**

- Operating Systems Overview- system Overview and Functions of operating systems
- What does an OS do?
- Operating system Operations
- Operating system structure
- Protection and security
- Computing Environments- Traditional, mobile , distributed, Client/server, peer to peer computing
- Open source operating System
- Booting
- Operating System services,
- System calls Types of System calls and their working.

Chapter 2	**Processes and Threads**	**6 lectures**

- Process Concept – The processes, Process states, Process control block.
- Process Scheduling – Scheduling queues, Schedulers, context switch
- Operations on Process – Process creation with program using fork(), Process termination
- Thread Scheduling- Threads, benefits, Multithreading Models, Thread Libraries

Chapter 3	**Process Scheduling**	**7 lectures**

- Basic Concept – CPU-I/O burst cycle, Scheduling Criteria ,CPU scheduler, Preemptive scheduling, Dispatcher
- Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling

Chapter 4	**Synchronization**	**5 lectures**

- Background
- Critical Section Problem
- Semaphores: Usage, Implementation

- Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem

Chapter 5	**Memory Management**	**12 lectures**

- Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries
- Swapping
- Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation
- Paging – Basic Method, Hardware support, Protection, Shared Pages
- Segmentation – Basic concept, Hardware
- Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, Optimal, LRU, MFU

Reference Books:

1. Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, Student Edition, Wiley Asia
2. Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India.
3. Advanced Concepts in Operating Systems, M Singhal and NG Shivaratri, Tata McGraw Hill Inc, 2001
4. The 'C' Odyssey, UNIX-the open boundless C, Meeta Gandhi,Tilak Shetty,Rajiv Shah, BPB publication

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) Sem - V
Course Code: DSEC - I Course Code : CS - 352
Course Title :Computer Networks - II

Teaching Scheme	No. of Credits	Examination Scheme
03 Lect/ week	2	IE :15 marks UE: 35 marks

Prerequisites:
Prerequisites: Basic knowledge of Networking and ISO/OSI model

Course Objectives

- To understand different protocols of application layer.
- To understand concepts of multimedia.
- Explore the different methods used for Network/INTERNET security.

Course Outcomes

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

- Student will understand the different protocols of Application layer.
- Develop understanding of technical aspect of Multimedia Systems
- Develop various Multimedia Systems applicable in real time.
- Identify information security goals.
- Understand, compare and apply cryptographic techniques for data security.

Course Contents

Chapter 1	**Application Layer**	**10 Lect**

Domain Name System

- Name space-Flat name space, Hierarchical name space
- Domain Name Space -Label ,Domain name, FQDN,PQDN
- Distribution of Domain Name Space-Hierarchy of name servers, zone, Root server, Primary and secondary servers.
- DNS in the Internet: Generic domains, Country domains,inverse domain
- Resolution-Resolver,mapping names to address,mapping addresses to names,recursive resolution,iterative resolution,caching

Electronic Mail-

- Architecture-First scenario, second scenario, Third scenario, Fourth scenario
- User agent-services of user agent, types of UA Format of e-mail
- MIME-MIME header
- Message transfer agent-SMTP
- Message Access Agent: POP and IMAP

File Transfer

FTP-Communication over data control connection,File type,data structure,Transmission mode,anonymous FTP

Chapter 2	**Multimedia**	**08 Lect**

Digitizing audio and video, Audio and Video compression

Streaming Stored audio/video

- First approach
- Second approach
- Third approach
- Fourth approach

Streaming live audio/video

Real time interactive audio/video- Characteristics, Time relationship, timestamp, Playback buffer, ordering multicasting, translation

RTP-Packet format

RTCP-Message types

Voice over IP-SIP,SIP sessionH.323-

Architecture, Protocols

Chapter 3	**Cryptography and Network Security**	**09 Lect**

Terminology: Cryptography, plain text and cipher text, cipher key, categories of cryptography-Symmetric key, asymmetric key

Encryption model

Symmetric key cryptography

- Traditional ciphers – substitution cipher, shift cipher, Transposition cipher
- Simple Modern ciphers-XOR, Rotation cipher, s-box,p-box
- Modern round ciphers-DES
- Mode of operation-ECB,CBC,CFB,OFB

Asymmetric key cryptography-RSA

Security Services

- Message confidentiality-With Symmetric key cryptography, with asymmetric key cryptography
- Message integrity-Document and fingerprint, message and message digest
- Message authentication-MAC,HMAC
- Digital signature
- Entity Authentication-Passwords, Fixed passwords challenge-response

Chapter 4	**Security in the Internet**	**09 Lect**

IPSecurity(IPSec)

- Two modes
- Two security protocols
- Services provided by IPSec
- Security association
- Internet key exchange
- Virtual private network

SSL/TLS

- SSL services
- Security parameters
- Sessions and connections
- Four protocols
- Transport layer security

PGP

- Security parameters
- Services
- PGP algorithms
- Key rings
- PGP certificates

Firewalls

- Packet filter firewall
- Proxy firewall

Reference Books:

1. Data communications and networking by Behrouz Forouzan $4^{th}/5^{th}$ edition, McGraw Hill Pvt Ltd.
2. Computer Networks by Andrew S Tanenbaum, $4^{th}/5^{th}$ edition, Pearson Education
3. Cryptography and Network Security: Principles and Practice, William Stallings, 7^{th} edition, Pearson Education
4. Network Security Essentials: Applications and Standards (For VTU), William Stallings, 3^{rd} edition, Pearson Education

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem - V
Course Type:DSEC – II Course Code: CS - 353
Course Title : Web Technologies - I

Teaching Scheme	No. of Credits	Examination Scheme
03 Lect/ week	2	IE : 15 marks UE: 35 marks

Prerequisites

HTML basics for form designing

Course Objectives

- To Design dynamic and interactive Web pages.
- To Learn Core-PHP, Server Side Scripting Language
- To Learn PHP-Database handling

Course Outcomes

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

- Understand how to develop dynamic and interactive Web Page

Course Contents

Chapter 1	**Introduction to HTML, HTTP and PHP**	**10 Lects**

Overview of HTML and Basic Tags , Creating Forms ,Tables, HTML5 Semantics.
CSS basic concept ,Three ways to use CSS, Box Model, Navigation Bar .
Introduction to Web server and Web browser .
HTTP basics .
PHP Basics: Use of PHP, Lexical structure, Language basics .

Chapter 2	**Function and String**	**8 Lects**

Defining and calling a function
Default parameters
Variable parameters, Missing parameters
Variable function, Anonymous function
Types of strings in PHP
Printing functions
Encoding and escaping
Comparing strings
Manipulating and searching strings
Regular expressions

Chapter 3	**Arrays**	**6 Lectures**

Indexed Vs Associative arrays
Identifying elements of an array
Storing data in arrays
Multidimensional arrays
3.4Extracting multiple values
Converting between arrays and variables
Traversing arrays
Sorting
Action on entire array

Chapter 4	**Files and database handling**	**10 Lectures**

Working with files and directories
Opening and Closing, Getting information about file, Read/write to file,
Splitting name and path from file, Rename and delete files
Reading and writing characters in file
Reading entire file

Random access to file data
Getting information on file
Ownership and permissions
Using PHP to access a database
Relational databases and SQL
PEAR DB basics
Advanced database techniques

Chapter 5	**Handling email with php**	**2 Lectures**

Email background
Internet mail protocol
Structure of an email message
Sending email and validation of Email_id with php

Reference Books:

1. HTML & CSS: The Complete Reference, Fifth Edition Author: Thomas A. Powell First published: 01 Jan 2010.
2. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
3. Beginning PHP 5 , Wrox publication
4. PHP web sevices, Wrox publication
5. Mastering PHP , BPB Publication
6. PHP cookbook, O'Reilly publication
7. PHP for Beginners, SPD publication
8. Programming the World Wide Web , Robert W Sebesta(3rd Edition)
9. HTML 5 Black Book : Covers Css3, Javascript, XML, XHTML, Ajax, PHP And Jquery by Kogent Learning Solutions Inc, Published November 2011 by Dreamtech Press
10. Spurlock Jake, Bootstrap: Responsive Web development. O'Reilly Media, Inc

Ref. Links

11. www.php.net.in
12. www.W3schools.com
13. www.wrox.com
14 https://coreui.io/docs/layout/grid/#grid-options
15. https://www.tutorialrepublic.com/twitter-bootstrap-tutorial/bootstrap-grid-system.php

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) – Sem - V
Course Type:DSEC – II Course Code: CS - 354
Paper Title : Foundations of Data Science

Teaching Scheme	No. of Credits	Examination Scheme
03 lectures / week	2	IE : 15 marks UE: 35 marks

Prerequisites

- Problem solving using computers
- Basic mathematics and statistics
- Knowledge of Databases

Course Objectives

- Provide students with knowledge and skills for data-intensive problem solving and scientific discovery
- Be prepared with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.
- Acquire good understanding of both the theory and application of applied statistics and computer science based existing data science models to analyze huge data sets originating from diversified application areas.
- Be better trained professionals to cater the growing demand for data scientists in industry.

Course Outcomes

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

- Perform Exploratory Data Analysis
- Obtain, clean/process, and transform data.
- Detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
- Demonstrate proficiency with statistical analysis of data.
- Present results using data visualization techniques.
- Prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.

Course Contents

Chapter 1	**Introduction to Data Science**	**6 lectures**

Introduction to data science, The 3 V's: Volume, Velocity, Variety
Why learn Data Science?
Applications of Data Science
The Data Science Lifecycle
Data Scientist's Toolbox
Types of Data

Structured, semi-structured, Unstructured Data, Problems with unstructured data
Data sources
Open Data, Social Media Data, Multimodal Data, standard datasets
Data Formats
Integers, Floats, Text Data, Text Files, Dense Numerical Arrays, Compressed or Archived Data, CSV Files, JSON Files, XML Files, HTML Files , Tar Files, GZip Files, Zip Files, Image Files: Rasterized, Vectorized, and/or Compressed

Chapter 2	Statistical Data Analysis	10 lectures

2.1.Role of statistics in data science

2.2.Descriptive statistics

Measuring the Frequency

Measuring the Central Tendency: Mean, Median, and Mode

Measuring the Dispersion: Range, Standard deviation, Variance, Interquartile Range

2.3.Inferential statistics

Hypothesis testing, Multiple hypothesis testing, Parameter Estimation methods,

2.4.Measuring Data Similarity and Dissimilarity

Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal Attributes, Proximity Measures for Binary Attributes, Dissimilarity of Numeric Data: Euclidean, Manhattan, and Minkowski distances, Proximity Measures for Ordinal Attributes

2.5.Concept of Outlier, types of outliers, outlier detection methods

Chapter 3	Data Preprocessing	10 lectures

Data Objects and Attribute Types: What Is an Attribute?, Nominal , Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes

Data Quality: Why Preprocess the Data?

3.3.Data munging/wrangling operations

Cleaning Data - Missing Values, Noisy Data (Duplicate Entries, Multiple Entries for a Single Entity, Missing Entries, NULLs, Huge Outliers, Out-of-Date Data, Artificial Entries, Irregular Spacings, Formatting Issues - Irregular between Different Tables/Columns, Extra Whitespace, Irregular Capitalization, Inconsistent Delimiters, Irregular NULL Format, Invalid Characters, Incompatible Datetimes)

Data Transformation – Rescaling, Normalizing, Binarizing, Standardizing,Label and One Hot Encoding

Data reduction

Data discretization

Chapter 4	Data Visualization	10 lectures

Introduction to Exploratory Data Analysis

Data visualization and visual encoding

Data visualization libraries

Basic data visualization tools

Histograms, Bar charts/graphs, Scatter plots, Line charts, Area plots, Pie charts, Donut charts

Specialized data visualization tools

Boxplots, Bubble plots, Heat map, Dendrogram, Venn diagram, Treemap, 3D scatter plots

Advanced data visualization tools- Wordclouds

Visualization of geospatial data

Data Visualization types

Reference Books:

1) Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.
2) The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017
3) Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline

Kamber, Jian Pei, Morgan Kaufmann, 2012.
4) A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) Sem – V
Course Type:DSEC – III Course Code: CS - 355
Course Title: Object Oriented Programming using Java - I

Teaching Scheme	No. of Credits	Examination Scheme
03 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisites

- Knowledge of C Programming language

Course Objectives

- To learn Object Oriented Programming language
- To study various java programming concept like Interface, File and Exception Handling etc.
- To design User Interface using Swing and AWT

Course Outcomes

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

- Understand the concept of classes, object, packages and Collections.
- To develop GUI based application.

Course Contents

Chapter 1 An Introduction to Java 6 Lect

Object Oriented Programming Concepts
A short history of Java
Features OR Buzzwords of Java
Java Environment
Simple Java Program
Java Tools – jdb, javap, javadoc
Types of Comments
Data Types
Final Variable
Declaring 1D, 2D Array
Accepting Input
(Command Line Arguments, BufferedReader, Scanner)

Chapter 2 Objects and Classes 7 Lect

Defining your own classes
Access Specifiers
(public, protected, private, default)
Array of Objects
Constructors, Overloading Constructors and Use of 'this' keyword
static block, static fields And methods
Predefined Classes

- Object Class, Methods (equals(), toString(),hashcode(), getClass())
- String Class And StringBuffer Class,Formatting String data using format() method

Creating , Accessing And Using Packages
Wrapper Classes

Chapter 3	Inheritance and Interface	8 Lect

Inheritance Basics (extends Keyword) and Types of Inheritance
Superclass, Subclass and use of Super Keyword
Method Overriding and runtime polymorphism
Use of final keyword related to method and class
Use of abstract class and abstract methods
Defining and Implementing Interfaces
Runtime polymorphism using interface
Concept of Marker and Functional Interfaces

Chapter 4	Exception and File Handling	5 Lect

Dealing with errors , Exception class, Checked And Unchecked Exception
Catching Exceptions, Multiple Catch Block, Nested try block
Creating User Defined Exception
Introduction to Files And Streams
Input-OutputStream : FileInput/OutputStream, BufferedInput/OutputStream, DataInput/OutputStream
Reader-Writer : FileReader/Writer, BufferedReader/Writer, InputStreamReader, OutputStreamWriter

Chapter 5	User Interface with AWT and Swing	10 Lect

What is AWT? What is Swing? Difference between AWT and Swing
The MVC Architecture And Swing
Layouts And Layout Managers
Containers And Components – JFrame, JButton, JLabel, JText, JTextArea, JCheckBox And JRadioButton, JList, JComboBox, JMenu And related Classes
Dialogs (Message, Confirmation, Input), JFileChooser, JColorChooser
Event Handling: Event Sources, Listeners
Adapters And Anonymous Inner Class

Reference Books:

R1. Complete reference Java by Herbert Schildt(5th edition)
R2. Java 2 programming black books, Steven Horlzner
R3. Programming with Java , A primer ,Forth edition , By E. Balagurusamy
R4. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Pres

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) Sem - V
Course Type: DSEC - III Course Code: CS - 356
Paper Title: Theoretical Computer Science

Teaching Scheme	No. of Credits	Examination Scheme
3 Lect/ week	2	IE : 15 marks UE: 35 marks

Prerequisites

- Mathematical Preliminaries Sets (Subset, Set Operations), Relations (Properties of Relations, Closure of Relations) and Functions
- Discrete Mathematics- Graphs, Trees, Logic and Proof Techniques

Course Objectives

- To understand the Finite Automata, Pushdown Automata and Turing Machine.
- To understand the Regular Language, Context Free Language, Context Sensitive Language and Unrestricted Language.
- To understand the relation between Automaton and Language

Course Outcomes

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

- Understand the use of automata during language design.
- Relate various automata and Languages.

Course Contents

Chapter 1	**Finite Automaton**	**10 Lect**

Introduction: Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages.
Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as pattern recognizer.
Nondeterministic finite automaton – Definition and Examples.
NFA To DFA (Myhill Nerode Method)
NFA with ε- transitions Definition and Examples.
NFA with ε-Transitions to DFA & Examples
Finite automaton with output – Mealy and Moore machine, Definition and Examples.
Minimization of DFA, Algorithm & Problem using Table Method.

Chapter 2	**Regular Expressions and Languages**	**6 Lect**

Regular Expressions (RE): Definition & Example
Regular Expressions Identities.
Regular language-Definition and Examples.
Conversion of RE to FA-Examples.
Pumping lemma for regular languages and applications.
Closure Properties of regular Languages

Chapter 3	**Context-Free Grammars and Languages**	**10 Lect**
Grammar - Definition and Examples. Derivation-Reduction - Definition and Examples. Chomsky Hierarchy. CFG: Definition & Examples. LMD, RMD, Parse Tree Ambiguous Grammar: Concept & Examples. Simplification of CFG: Removing Useless Symbols, Unit Production, ϵ-production and Nullable Symbol. Normal Forms: Greibach Normal Form (GNF) and Chomsky Normal Form (CNF) Regular Grammar: Definition. Left linear and Right Linear Grammar-Definition and Example. Equivalence of FA & Regular Grammar Construction of regular grammar equivalent to a given DFA. Construction of a FA from the given right linear grammar		
Chapter 4	**Push Down Automata**	**5 Lect**
Definition of PDA and examples. Construction of PDA using empty stack and final State method: Examples using stack method. Definition DPDA & NPDA, their correlation and Examples of NPDA CFG (in GNF) to PDA: Method and examples		
Chapter 5	Turing Machine	**5 Lect**
The Turing Machine Model, Definition and Design of TM Problems on language recognizers. Language accepted by TM. Types of Turing Machines (Multitrack TM, Two-way TM, Multitape TM, Non-deterministic TM) Introduction to LBA (Basic Model) & CSG. (Without Problems)		
Reference Books		
1. Introduction to Automata Theory, Languages and Computation, John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education Publication, 2008 2. Introduction to Automata theory, Languages and computation By John E. Hopcroft and JeffreyUllman – Narosa Publishing House, 1995 3. Theory of Computer Science Automata, Languages and Computation, K.L.P. Mishra, N. Chandrasekaran, Publication- Prentice Hall of India, 2008 4. Introduction to Computer Theory Daniel I. A. Cohen – 2nd edition – John Wiley & Sons, 1996 5. Introduction to Languages and The Theory of Computation John C. Martin The McGraw-Hill, Fourth Edition, 2011		

Savitribai Phule Pune University

T.Y.B.Sc. (Computer Science) - Sem - V

Course Type: DSEC - I Course Code: CS - 357

Course Title : Practical Course based on CS - 351

Teaching Scheme:	No. of Credits:	Examination Scheme:
5 Lect/ week	2	IE : 15 marks UE: 35 marks

Course Objectives:

1. To understand the concept of process scheduling with the help of simulation.
2. To study the concept demand paging concepts in operating system.
3. To understand the working of operating system shell.

Course Outcomes: After completion of this course students will be able to understand the concept of

1. Process synchronization
2. Processes and Thread Scheduling by operating system
3. Memory management by operating system using with the help of various schemes

Guidelines:

1. Operating system platform – Linux
2. Programming language - C

List of Assignments:

- Operations on processes : (2 slot)
  (Create a child process using fork() and commands like exec(),execv() and execvp())
- Simulation of Operating System Shell and its working (commands)(2 slots)
- Simulation of CPU Scheduling Algorithms – FCFS, SJF, Priority and Round Robin(4 slots)
- Simulation of demand paging using memory page replacement algorithms – FIFO, LRU, OPT, MFU(4 slots)

Savitribai Phule Pune University

T.Y.B.Sc. (Computer Science) Sem – V

Course Type: DSEC - II **Course Code: CS - 358**

Course Title : Practical Course based on CS - 353 and CS - 354

Teaching Scheme:	No. of Credits:	Examination Scheme:
5 Lect/ week	2	IE : 15 marks
Batch Size : 12		UE: 35 marks

Course Objectives:

- To Design dynamic and interactive Web pages.
- To Learn Core-PHP, Server Side Scripting Language
- To Learn PHP- Database handling
- To apply statistical, data preprocessing and visualization techniques on data sets

Course Outcomes:

- Understand how to develop dynamic and interactive Web Page
- Prepare data for use with a variety of statistical methods and recognize how the quality of the data may affect conclusions.
- Perform exploratory data analysis

Guidelines:

Operating Environment for web technologies: HTML5.0, PHP 5.0 and above , Webserver

Operating Environment for Data Science: Linux + python

List of Assignments on web technologies:

1 : HTML and HTML5.0
2 : CSS, Box Model, Navigation Bar
3 : Bootstrap
4 : Function and String
5 : Arrays
6: Files
7: Databases (PHP-PostgreSQL)

Suggested Assignments for Foundations of Data Science

Assignment 1: The Data Science environment

Getting introduced to Python IDLE, command line, online tools like google colaboratory and essential packages like NumPy, SciPy, pandas, scikit-learn, matplotlib, jupyter, beautiful-soup, etc.

Assignment 2: Loading the dataset

Select a dataset from a list of publicly available datasets at UCI Machine Learning Repository and load it using Pandas. (Import different dataformat files like .CSV,.htm,.json etc. Briefly describe what the dataset is about and size of the dataset (e.g. number of tables, number of instances and attributes, etc.)

Assignment 3: Basic statistical operations

Apply basic statistical operations on a dataset. For example - compute the mean, median, mode, range, quartiles, and variance for one or more attributes.

Assignment 4: Data preprocessing

Apply data preprocessing techniques that are likely required for the dataset.

1) Partition them into appropriate number of bins by equal-frequency as well as equal-width partitioning.

2) Use smoothing by bin means to smooth the data based on the above partitioning,

3) Normalize the attribute based on min-max normalization and z-score normalization.

Comment on which method you would prefer to use for partitioning, smoothing, and normalization for the given attribute.

Assignment 5: Data Visualization with matplotlib

View the data using various 2-D, 3-D plots and charts, setting styles, saving the figures, customizing the legends, multiple subplots,

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: DSEC - III Course Code: CS - 359
Course Title : Practical Course based on CS - 355

Teaching Scheme	No. of Credits	Examination Scheme
5 Lect / week Batch Size : 12	2	IE : 15 marks UE: 35 marks

Course Objectives:

Covers the complete scope of the syllabus.

1. Bringing uniformity in the way course is conducted across different colleges.
2. Continuous assessment of the students.

Course Outcomes:

1. Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
2. Read and make elementary modifications to Java programs that solve real-world problems.
3. Validate input in a Java program.

Guidelines:

Operating Environment :

- **Operating system :** Linux
- **Editor :** Anylinux based editor like vi, gedit and Use of IDE – Eclipse etc.
- **Compiler** : javac

Submission :

Each assignment will be assessed on a scale of 0 to 5 as indicated below.

- Not done 0
- Incomplete 1
- Late Complete 2
- Needs improvement 3
- Complete 4
- Well Done 5

Assessment :

Easy : All exercises are compulsory.
Medium : All exercises are compulsory.

List of Assignments :

Assignment 1 : Java Tools and IDE, Simple java programs [Slot – 1]

Introduction to the java environment
Use of java tools like java, javac, jdb and javadoc
Defining simple classes and creating objects.

Assignment 2 : Array of Objects and Packages [Slot – 2]

Defining a class.
Creating an array of objects.
Creating a package.

Assignment 3 : Inheritance and Interfaces [Slot – 2]

To implement inheritance in java.
To define abstract classes.
To define and use interfaces and Functional Interface.

Assignment 4 : Exception And File Handling [Slot – 2]

Demonstrate Exception Handling Mechanism in Java.
Use of try, catch, throw, throws ,finally blocks
Defining User defined Exception classes.
Creation of files and demonstration of I-O operations

Assignment 5 : GUI Designing, Event Handling [Slot – 5]

To demonstrate GUI creation using Swing Package and Layout managers.
To understand Event handling mechanism in Java.
Using Event classes, Event Listeners and Adapters

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: SECC – I Course Code : CS-3510
Course Title: Python Programming

Teaching Scheme	No. of Credits	Examination Scheme:
03 Lect / week	2	IE : 15 marks UE: 35 marks

Course Objectives

1. To introduce programming concepts using python
2. Student should be able to develop Programming logic using python
3. To develop basic concepts and terminology of python programming
4. To test and execute python programs

Course Outcomes

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

- Develop logic for problem solving
- Determine the methods to create and develop **Python programs** by utilizing the data
- structures like lists, dictionaries, tuples and sets.
- To be familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc.
- To write python programs and develop a small application project

Course Contents

Chapter 1	**An Introduction to Python**	**3 Lect**

Introduction to Python

The Python Programming Language, History, features, Applications, Installing Python, Running Simple Python program

Basics of Python

Standard data types - basic, none, Boolean (true & False), numbers, Variables, Constants,Python identifiers and reserved words, Lines and indentation, multi-line statements and Comments,Input/output with print and input ,functions Declaration, Operations on Data such as assignment, arithmetic, relational, logical and bitwise operations, dry run, Simple Input and output etc.

Chapter 2	**Control Statements**	**4 Lect**

Sequence Control – Precedence of operators, Type conversion

Conditional Statements: if, if-else, nested if-else,

Looping- for, while, nested loops, loop control statements (break, continue, pass)

a. **Strings**: declaration, manipulation, special operations, escape character, string formatting operator, Raw String, Unicode strings, Built-in String methods.

Chapter 3	**Lists, functions, tuples and dictionaries, Sets**	**7 Lect**

Python Lists: Concept, creating and accessing elements, updating & deleting lists, traversing a List, reverse Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods.

Functions: Definitions and Uses, Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Flow of Execution, Parameters and Arguments, Variables and Parameters, Stack Diagrams, Void Functions, Anonymous functions Importing with from, Return Values, Boolean Functions, More Recursion, Functional programming tools - filter(), map(), and reduce(),recursion, lambda forms.

Tuples and Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, and Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in tuple functions, indexing, slicing and matrices. Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods.

Sets- Definition, transaction of set(Adding, Union, intersection), working with sets

Chapter 4	**Modules ,Working with files, Exception handling**	**4 Lect**

Modules: Importing module, Creating & exploring modules, Math module, Random module, Time module

Packages: Importing package, creating package,examples

Working with files: Creating files and Operations on files (open, close, read, write), File object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing files and directories, copying and renaming files, splitting pathnames, creating and moving directories

Regular Expression- Concept of regular expression, various types of regular expressions, using match function.

Exception Handling: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions.

Demonstration	**Programming Assignments:**	**18 Lect**

Out of 36 lectures, 18 are assigned for demonstration. Teacher should give demonstration of various programs mentioned below in the classroom or in the laboratory as per their convenience.

Programming assignments should be done individually by the student in their respective login from the list given in Labbook. The codes should be uploaded on either the local server, Moodle, Github or any LMS.

Assignment 1 - Python Basics
Assignment 2 – Arrays, Strings, and Functions
Assignment 3 - List, Tuples, Sets, and Dictionary
Assignment 4 - File Handling and Date-Time
Assignment 5 - Exception handling and Regular expression

Reference Books:

1. An Introduction to Computer Science using Python 3 by Jason Montojo, Jennifer Campbell, Paul Gries, The pragmatic bookshelf-2013
2. James Payne, "Beginning Python: Using Python and Python 3.1,Wrox Publication
3. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python ", Green Tea Press, 2002
4. Introduction to Problem Solving with Python by E balguruswamy,TMH publication-2016
5. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller
6. Object-oriented Programming in Python, Michael H. Goldwasser, David Letscher, Pearson Prentice Hall-2008

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: SECC – II Course Code : CS-3511
Course Title: Blockchain Technology

Teaching Scheme	No. of Credits	Examination Scheme:
03 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisite:
Understanding of Object Oriented Programming Concepts
Knowledge of Python

Course Objectives

1. Understand what and why of blockchain technology.
2. Explore major components of blockchain.
3. Learn about Bitcoin, Cryptocurrency and Ethereum.
4. To learn blockchain programming using Python, Flask Web Framework, and HTTP client Postman.

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

Chapter 1	**Introduction to Blockchain**	**7 Lect**

- Foundational Computing Concepts (Client-Server systems vs Peer to Peer Systems)
- Evolution of Blockchain
- Blockchain Vs Database
- Essentials of Blockchain (Blockchain generations, types of blockchain, benefits and challenges of blockchain usage)
- Types of Networks
- Layered Architecture of Blockchain Ecosystem
- Components of blockchain
- Cryptography (private and public keys, Hashing &
- Digital Signature)
- Consensus Mechanisms
- Cryptocurrency, Digital Currency Bitcoin and Ethereum
- Smart Contracts
- Blockchain use cases

Chapter 2	**How Blockchain Works?**	**5 Lect**

- Understanding SHA256 Hash
- Immutable Ledger
- Distributed P2P Network
- How Mining Works? (The NONCE and Cryptographic Puzzle)
- Byzantine Fault Tolerance
- Consensus Protocols: Proof of Work, Proof of State, Défense Against Attackers, Competing Chains
- Blockchain Demo

Chapter 3	Smart Contracts	6 Lect

- Ethereum Network
- What is a Smart Contract?
- Ethereum Virtual Machine, Ether, Gas
- DApps
- Decentralized Autonomous Organizations (DAO)
- Hard and Soft Forks
- Initial Coin Offerings
- Demo of Smart Contracts

Demonstration	Programming Assignments:	18 Lect

Out of 36 lectures, 18 are assigned for demonstration. Teacher should give demonstration of various programs mentioned below in the classroom or in the laboratory as per their convenience.

Assignment 1 –Demonstration of Blockchain
https://andersbrownworth.com/blockchain

Assignment 2 – Installation of Ganache, Flask and Postman

Assignment 3 –Write a Simple Python program to create a Block class that contains index, timestamp, and previous hash. Connect the blocks to create a Blockchain.

Assignment 4 –Demo of Remix-Ethereum IDE https://remix.ethereum.org and Test Networks

Assignment5–1. Write a Simple Smart Contract for Bank with withdraw and deposit functionality.

Assignment 6 – 2. Write a Smart Contract for storing and retrieving information of Degree Certificates.

Reference Books:

Textbook:

1. **Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media**

Reference Books:

2. Mastering Blockchain by Imran Bashir, Third Edition, Packt Publication
3. Waterhole, The Science of the Blockchain
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
5. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication

Reference Web Links

1. https://www.investopedia.com/terms/b/blockchain.asp

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - IV Course Code: CS - 361
Course Title : Operating Systems-II

Teaching Scheme: 03 Lect / week	No. of Credits: 2	Examination Scheme: IE : 15 marks UE: 35 marks

Prerequisites
Concepts of Operating System, Processes and Threads Scheduling, Synchronization

Course Objectives:
1. To understand the issue of Deadlocks in Process management.
2. To understand the concept of File system management & disk scheduling
3. To study the concept of distributed and mobile operating systems

Course Outcomes: After completion of this course students will be able to understand the concept of
1. Management of deadlocks and File System by operating system
2. Scheduling storage or disk for processes
3. Distributed Operating System and its architecture and the extended features in mobile OS.

Course Contents

Chapter 1	**Process Deadlocks**	**7 lectures**

- System model
- Deadlock Characterization – Necessary conditions, Resource allocation graph
- Deadlock Methods- Prevention and Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm
- Deadlock Detection
- Recovery from Deadlock – Process termination, Resource preemption

Chapter 2	**File system Management**	**6 lectures**

- File concept , File attributes, File operations
- Access Methods – Sequential, Direct, Other access methods
- Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory
- Allocation Methods – Contiguous allocation, Linked allocation, Indexed allocation
- Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps

Chapter 3	**Disk scheduling**	**4 lectures**

- Overview, Disk Structure
- Disk Scheduling, FCFS Scheduling, SSTF Scheduling, Scan Scheduling-Scan Scheduling, Look Scheduling , Disk Management

Chapter 4	**Introduction to Distributed operating systems & Architecture**	**11 lectures**

- What is a distributed system, Design goals
- Types of distributed systems
- Architectural styles : Layered architectures , Object-based architectures, Resource-centered architectures
- System architecture – Centralized organization, Decentralized organizations, peer-to-peer systems, Hybrid architectures.

- Example architectures : Network file system(NFS), Web-based distributed systems

Chapter 5	**Mobile Operating Systems**	**7 lectures**

- Introduction
- Features
- Special Constraints and Requirements of Mobile Operating System
- Special Service Requirements
- ARM & Intel architectures – Power management
- Mobile OS architectures – Underlying OS, kernel structure & native level programming, Runtime issues, Approaches to power management
- Commercial Mobile Operating Systems - Windows Mobile, iPhone OS (iOS), Android
- A Comparative Study of Mobile Operating Systems (Palm OS, Android, Symbian OS, Blackberry OS, Apple iOS)

Reference Books:

1) Advanced Concepts in Operating Systems, M Singhal and NG Shivaratri, Tata McGraw Hill Inc, 2001 (Text Book)

2) Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, Student Edition, Wiley Asia

3) Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India.

4) Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI

5) Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi – 2012.

6) A. Tannenbum, Herbert Bos, "Modern Operating systems", Pearson Publication, 4th Edition

7) A. Tannenbum, Maarten van Steen, "Distributed systems", 3rd Edition

8) Source wikipedia, Mobile operating systems, General books, LLC,2010

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - IV Course Code: CS - 362
Course Title : Software Testing

Teaching Scheme:	No. of Credits:	Examination Scheme:
3 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisites:

- Basic knowledge of algorithms, problem solving, expected inputs/outputs
- Knowledge of C and java Programming Language, compilation, debugging.

Course Objectives:

- To provide the knowledge of software testing techniques
- To understand how testing methods can be used as an effective tools in quality assurance of software.
- To provide skills to design test case plan for testing software.
- To provide knowledge of latest testing methods

Course Outcomes:

- To understand various software testing methods and strategies.
- To understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.
- To design test cases and test plans, review reports of testing for qualitative software.
- 4. To understand latest testing methods used in the software industries.

Course Contents

Chapter 1	**Introduction to Software Testing**	**5 lectures**

Basics of Software Testing – faults, errors and failures
Testing objectives
Principles of testing
Testing and debugging
Testing metrics and measurements
Verification and Validation
Testing Life Cycle

Chapter 2	**Software Testing Strategies & Techniques**	**10 lectures**

Testability - Characteristics lead to testable software.
Test characteristics
Test Case Design for Desktop, Mobile, Web application using Excel
White Box Testing - Basis path testing, Control Structure Testing.
Black Box Testing- Boundary Value Analysis, Equivalence partitioning.
Differences between BBT & WBT

Chapter 3	**Levels of Testing**	**10 lectures**

A Strategic Approach to Software Testing
Test strategies for conventional Software
Unit testing
Integration testing – Top-Down, Bottom-up integration
System Testing – Acceptance, performance, regression, Load/Stress testing, Security testing, Internationalization testing.
Alpha, Beta Testing

Usability and accessibility testing Configuration, compatibility testing		
Chapter 4	**Testing Web Applications**	**6 lectures**
Dimension of Quality, Error within a WebApp Environment Testing Strategy for WebApp Test Planning The Testing Process –an overview		
Chapter 5	**Agile Testing**	**5 lectures**
Agile Testing, Difference between Traditional and Agile testing, Agile principles and values, Agile Testing Quadrants, Automated Tests.		

Reference Books:

1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7th Edition, Tata McGraw Hill, 20
2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999
4. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin and Janet Gregory, 1st Edition, Addison-Wesley Professional, 2008
5. Software Testing Principles and Practices By Srinivasan Desikan, Gopalaswamy Ramesh, Pearson

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science)- Sem - VI
Course Type:DSEC – V Course Code: CS - 363
Course Title : Web Technologies - II

Teaching Scheme	No. of Credits	Examination Scheme
3 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisites
- HTML5,CSS
- Core PHP
- Bootstrap framework utility

Course Objectives
- To Learn different technologies used at client Side Scripting Language
- To Learn XML and XML parsers.
- To One PHP framework for effective design of web application.
- To Learn Java Script to program the behavior of web pages.
- To Learn AJAX to make our application more dynamic.
- Framework has

Course Outcomes
On completion of the course, student will be able to–
- Build dynamic website.
- Using MVC based framework easy to design and handling the errors in dynamic website.

Course Contents

Chapter 1	**Introduction to Web Techniques**	**6 Lect**

Variables
- Server information
- Processing forms
- Setting response headers
- Maintaining state
- PHP error handling

Chapter 2	**XML**	**6 Lect**

What is XML?
- XML document Structure
- PHP and XML
- XML parser
- The document object model
- The simple XML extension
- Changing a value with simple XML

Chapter 3	**Java Script and Jquery**	**10 Lect**

Overview of JavaScript
- Object Orientation and JavaScript Basic Syntax(JS datatypes, JS variables)

Primitives, Operations and Expressions
Screen Output and keyboard input(Verification and Validation)
JS Control statements and JS Functions
JavaScript HTML DOM Events(onmouseup, onmousedown, onclick, onload, onmouseover, onmouseout).

JS Strings and JS String methods

JS popup boxes(alert, confirm, prompt).
Jquery library , Including jquery library in page
Jquery selector , DOM manipulation using jquery

Chapter 4	AJAX	**6 Lect**

Introduction of AJAX
AJAX web application model
AJAX –PHP framework
Performing AJAX validation
Handling XML data using php and AJAX
Connecting database using php and AJAX

Chapter 5	PHP framework CodeIgniter	**8 Lect**

CodeIgniter - Overview, Installing CodeIgnite
Application Architecture
MVC Framework , Basic concept of CodeIgniter, Libraries
Working with databases
Load external JS and CSS page & redirecting from controller , Adding JS and CSS ,
Page redirection.
Loading dynamic data on page & session management, cookies management

Reference Books:

1. **Programming PHP By Rasmus Lerdorf and Kevin Tatroe O'Reilly publication**
2. **Beginning PHP 5, Wrox publication**
3. **AJAX Black Book Kogent solution**
4. **Mastering PHP BPB Publication**
5. **Professional Codeigniter By Thomas Myer ,Wrox Publication,**
6. **Codeihniter 2 CookBook By Rob Foster ,PACKT Publication ,**
7. **JQuery CookBook, O'reilly Publication.**

Ref. Links:

1. **www.php.net.in**
2. **www.W3schools.com**
3. **https://www.tutorialspoint.com/codeigniter/index.htm**
4. **https://api.jquery.com/**
5. **http://codeigniter.com/docs**

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) – Sem VI
Course Type:DSEC – V Course Code: CS - 364
Course Title : Data Analytics

Teaching Scheme	No. of Credits	Examination Scheme
03 lectures / week	2	IE : 15 marks UE: 35 marks

Prerequisites

- Basic of mathematics and statistics
- Basic programming Knowledge of python
- Knowledge of databases

Course Objectives

- Deploy the Data Analytics Lifecycle to address data analytics projects.
- Develop in depth understanding of the key technologies in data analytics.
- Apply appropriate analytic techniques and tools to analyze data, create models, and identify insights that can lead to actionable results.

Course Outcomes

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

- Use appropriate models of analysis, assess the quality of input, and derive insight from results.
- Analyze data, choose relevant models and algorithms for respective applications
- Understand different data mining techniques like classification, prediction, clustering and association rule mining
- Apply modeling and data analysis techniques to the solution of real world business problems

Course Contents

Chapter 1	**Introduction to Data Analytics**	**6 lectures**

Concept of data analytics
Data analysis vs Data analytics
Types of analytics
Diagnostic Analytics, Predictive Analytics , Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis
Mathematical models - Concept
Model evaluation: metrics for evaluating classifiers - Class imbalance - AUC, ROC (Receiver-Operator Characteristic) curves, Evaluating value prediction models

Chapter 2	**Machine Learning Overview**	**6 Lectures**

Introduction to Machine Learning, deep learning, Artificial intelligence
Applications for machine learning in data science
The modeling process
Engineering features and selecting a model, Training the model, Validating the model, Predicting new observations
Types of machine learning
Supervised learning, Unsupervised learning, Semi-supervised learning, ensemble techniques
Regression models
Linear Regression

Polynomial Regression
Logistic Regression

2.6. Concept of classification, clustering and reinforcement learning.

Chapter 3	Mining Frequent Patterns, Associations, and Correlations	12 lectures

What kind of patterns can be mined

Class/Concept Description: Characterization and Discrimination, Mining Frequent Patterns, Associations, and Correlations, Classification and Regression for Predictive Analysis, Cluster Analysis, Outlier Analysis

Mining frequent patterns - Market Basket Analysis.
Frequent Itemsets, Closed Itemsets, and Association Rules
Frequent Itemset Mining Methods
Apriori Algorithm
Generating Association Rules from Frequent Itemsets
Improving efficiency of apriori algorithm
Frequent pattern growth (FP-growth) algorithm

Chapter 4	Social Media and Text Analytics	12 lectures

Overview of social media analytics

Social Media Analytics Process, Seven layers of social media analytics, accessing social media data

Key social media analytics methods
Social network analysis

Link prediction, Community detection, Influence maximization, Expert finding, Prediction of trust and distrust among individuals

Introduction to Natural Language Processing
Text Analytics : Tokenization, Bag of words, Word weighting : TF-IDF, n-Grams, stop words, Stemming and lemmatization, synonyms and parts of speech tagging
Sentiment Analysis
Document or text summarization

Trend analytics

Challenges to social media analytics

Reference Books:

1) Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.
2) The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017
3) Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, Third Edition, 2012.
4) A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press
5) The Data Science Design Manual, Steven S. Skiena, Springer, 2017
6) Introducing data science: big data, machine learning, and more, using Python tools, Cielen D., Meysman A. D., & Ali M., Manning Publications Co., 2016

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC – VI Course Code : CS - 365
Course Title : Object Oriented Programming using Java – II

Teaching Scheme	No. of Credits	Examination Scheme
03 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisites

- Knowledge of Core Java (CS – 355)

Course Objectives

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- To develop a game application using multithreading
- To learn socket programming concept

Course Outcomes

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

- To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application.
- Understand and Create dynamic web pages, using Servlets and JSP.
- Work with basics of framework to develop secure web applications.

Course Contents

Chapter 1	**Collections**	**6 Lect**

Introduction to the Collection framework
List - ArrayList, LinkedList
Set - HashSet, TreeSet,
Map - HashMap and TreeMap
Interfaces such as Comparator, Iterator, ListIterator, Enumeration

Chapter 2	**Multithreading**	**6 Lect**

What are threads?
Life cycle of thread
Creating threads - Thread class , Runnable interface
Thread priorities
Running multiple threads
Synchronization and interthread communication

Chapter 3	**Database Programming**	**6 Lect**

The design of jdbc
Types of drivers
Executing sql statements, query execution
Scrollable and updatable Resultset

Chapter 4	**Servlets and JSP**	**12 Lect**

Introduction to Servlet and Hierarchy of Servlet
Life cycle of servlet
Handing get and post request (HTTP)
Handling data from HTML to servlet
Retrieving data from database to servlet

Session tracking – User Authorization, URL rewriting, Hidden form fields,Cookies and HttpSession

Introduction to JSP, Life cycle of JSP
Implicit Objects
Scripting elements - Declarations, Expressions, Scriplets, Comments
JSP Directives - Page Directive, include directive
Mixing Scriplets and HTML
JSP Actions - jsp:forward , jsp:include, jsp:useBean, jsp:setProperty and jsp:getProperty

Chapter 5	**Spring Framework**	**6 Lect**

Introduction of Spring framework
Spring Modules / Architecture
Spring Applications
Spring MVC
Spring MVC Forms, Validation

Reference Books:

R1. Complete reference Java by Herbert Schildt(5th edition)
R2. Java 2 programming black books, Steven Horlzner
R3. Programming with Java , A primer ,Forth edition , By E. Balagurusamy
R4. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press
R5. Core Java Volume-II-Advanced Features, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press
R6. Getting started with Spring Framework: covers Spring 5 by J Sharma and Ashish Sarin
R7. Spring 4 for Developing Enterprise Applications: An End-to-End Approach by Henry H. Liu

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem - VI
Course Type: DSEC - VI Course Code: CS - 366
Course Title: Compiler Construction

Teaching Scheme	No. of Credits	Examination Scheme
3 Lect / week	2	IE: 15 marks UE: 35 marks

Prerequisites

- Knowledge of Automata Theory and Languages.

Course Objectives

- To understand design issues of a lexical analyzer and use of LEX tool.
- To understand design issues of a parser and use of YACC tool.
- To understand and design code generation and optimization techniques.

Course Outcomes

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

- Understand the process of scanning and parsing of source code.
- Learn the conversion code written in source language to machine language.
- Understand tools like LEX and YACC.

Course Contents

Chapter 1	**Introduction**	**4 Lect**

Definition of Compiler, Aspects of compilation.
The structure of Compiler.
Phases of Compiler – Lexical Analysis, Syntax Analysis, Semantic Analysis,
Intermediate Code generation, code optimization, code generation.
Error Handling.
Introduction to one pass & Multipass compilers, cross compiler, Bootstrapping.

Chapter 2	**Lexical Analysis (Scanner)**	**4 Lect**

Review of Finite automata as a lexical analyzer,
Applications of Regular Expressions and Finite Automata (lexical analyzer,
searching using RE), Input buffering, Recognition of tokens.
LEX: A Lexical analyzer generator (Simple Lex Program)

Chapter 3	**Syntax Analysis (Parser)**	**14 Lect**

Definition, Types of Parsers
Top-Down Parser –
Top-Down Parsing with Backtracking: Method & Problems
Drawbacks of Top-Down parsing with backtracking, 3.2.3Elimination of Left Recursion (direct & indirect) 3.2.4Need for Left Factoring & examples
Recursive Descent Parsing: Definition
Implementation of Recursive Descent Parser Using Recursive Procedures
3.4 Predictive [LL (1)] Parser (Definition, Model)
3.4.1Implementation of Predictive Parser [LL (1)]
3.4.2 FIRST & FOLLOW

Construction of LL (1) Parsing Table

Parsing of a String using LL (1) Table.

Bottom-Up Parsers

Operator Precedence Parser -Basic Concepts

Operator Precedence Relations form Associativity & Precedence

Operator Precedence Grammar

Algorithm for LEADING & TRAILING (with ex.)

Algorithm for Operator Precedence Parsing (with ex.)

Precedence Functions

Shift Reduce Parser

Reduction, Handle, Handle Pruning

Stack Implementation of Shift Reduce Parser (with examples)

LR Parser: Model, Types [SLR (1), Canonical LR, LALR]-Method & examples.

YACC (from Book 3) –program sections, simple YACC program for expression evaluation

Chapter 4	**Syntax Directed Definition**	**7 Lect**

Syntax Directed Definitions (SDD)

Inherited & Synthesized Attributes

Evaluating an SDD at the nodes of a Parse Tree, Example

Evaluation Orders for SDD's

Dependency Graph

Ordering the Evaluation of Attributes

S-Attributed Definition

L-Attributed Definition

Application of SDT

Construction of syntax trees,

The Structure of a Type

4. 4 Translation Schemes

4.4.1 Definition, Postfix Translation Scheme

Chapter 5	**Code Generation and Optimization**	**7 Lect**

Compilation of expression –

Concepts of operand descriptors and register descriptors with example.

Intermediate code for expressions – postfix notations,

Triples, Quadruples and Expression trees.

Code Optimization – Optimizing transformations – compile time evaluation, elimination of common sub expressions, dead code elimination, frequency reduction, strength reduction.

Three address code

DAG for Three address code

The Value-number method for constructing DAG's.

Definition of basic block, Basic blocks, and flow graphs

Directed acyclic graph (DAG) representation of basic block.

Issues in design of code generator.

Reference Books
1. Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, 2004 2. Principles of Compiler Design By: Alfred V. Aho, Jeffrey D. Ullman, Narosa Publication House, 2002 3. LEX & YACC, 2nd edition, O'reilly Publication, 2012

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC- IV Course Code: CS - 367
Course Title : Practical Course based on CS - 361

Teaching Scheme:	No. of Credits:	Examination Scheme:
5 Lect/ week	2	IE : 15 marks UE: 35 marks

Course Objectives:

1. To implement Banker's algorithm for Deadlocks in Process management.
2. To simulate File system management
3. To study and implement various algorithms of disk scheduling

Course Outcomes: After completion of this course students will be able to understand the concept of

1. Management of deadlocks by operating system
2. File System management
3. Disk space management and scheduling for processes

Guidelines:

1. Operating system platform – Linux
2. Programming language - C

List of Assignments:

- Simulation of Banker's algorithm of deadlock avoidance in processes of operating system (3 slots)
- Simulation of File Allocation methods and free space management in storage - Contiguous allocation, Linked allocation, Indexed allocation (4 slots)
- Simulation of Disk Scheduling algorithms – FCFS, SSTF, Scan, Look (2 slots)
- Assignment based on distributed and mobile OS (3 slots)

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - V **Course Code: CS - 368**
Course Title : Practical Course based on CS - 363 and CS - 364

Teaching Scheme	No. of Credits:	Examination Scheme:
5 Lect/ week Batch Size : 12	2	IE : 15 marks UE: 35 marks

Course Objectives:

- To Learn different technologies used at client Side Scripting Language
- To Learn XML and XML parsers.
- To One PHP framework for effective design of web application.
- To Learn Java Script to program the behavior of web pages.
- To Learn AJAX to make our application more dynamic.

Framework has some utility features that make easy to write API in more efficient way than

Core PHP

Course Outcomes:

- Build dynamic website.
- Using MVC based framework easy to design and handling the errors in dynamic website.

Guidelines:

Operating Environment :Linux, HTML, PHP5.0 and above, Codeigniter, Python

List of Assignments based on Web Technology CS-363:

1 : Self Processing Forms, Sticky Forms, File Upload.
2 : COOKIES and SESSIONS.
3 : XML documents and DOM
4 : JavaScript
5 : Ajax
6 : PHP framework CodeIgniter

List of Assignments for Data Analytics

Assignment 1: Frequent itemset and association rule mining

Load Transactional data set. Do the needful data preprocessing. Display the set of frequent 2-itemsets and 3-itemsets. Repeat the process for different min_sup value.

Assignment 2: Linear and Logistic regression

For Given dataset predict the value of specific attribute.

Assignment 3: Text Analytics

Take text file as input. Create bag of words. Find frequent item sets. Display word cloud

Assignment 4: Sentiment analysis

SavitribaiPhule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: DSEC - VI Course Code: CS - 369
Course Title : Practical Course based on CS - 365

Teaching Scheme	No. of Credits	Examination Scheme
5 Lect/ week Batch Size : 12	2	IE : 15 marks UE: 35 marks

Course Objectives:

1. Covers the complete scope of the syllabus.
2. Bringing uniformity in the way course is conducted across different colleges.
3. Continuous assessment of the students.
4. Advanced Java is designed to develop web based, network centric, Enterprise level applications

Course Outcomes:

1. To Learn database Programming using Java
2. Understand and Create dynamic web pagesusing Servlets and JSP.
3. Work with basics of framework to develop secure web applications

Guidelines:

Operating Environment :

- **Operating system:** Linux
- **Editor:**Anylinux based editor like vi, gedit and Use of IDE – Eclipse etc.
- **Compiler** :javac
- **Database** :postgresql

Submission :

Each assignment will be assessed on a scale of 0 to 5 as indicated below.

- Not done 0
- Incomplete 1
- Late Complete 2
- Needs improvement 3
- Complete 4
- Well Done 5

Assessment :

Easy : All exercises are compulsory.
Medium : All exercises are compulsory.

List of Assignments:

Assignment 1 : Database Programming [Slot-2]

Study the Collection framework in java.
To Implement various Interfaces and classes through algorithms.
To Demonstrate Cursor Objects (Enumeration, Iterator, ListIterator, Comparator)

Assignment 2 : Multithreading [Slot-2]

To create and use threads in java.
To demonstrate multithreading using Thread Synchronization, Inter-thread .
Communication, Thread Priorities.

Assignment 3 : Database Programming [Slot-2]

To communicate with a database using java.
To execute queries on tables.
To obtain information about the database and tables.

Assignment 4 : Servlets [Slot-2]

To understand server-side programming.
Simple steps to create and execute servlets.
How to pass parameters using doGet and doPost methods.
Handling data from HTML to servlet .
How to connect servlet to a database .
Use of various session tracking methods like Cookies.

Assignment 5 : Java Server Pages [Slot-2]

JSP life-cycle.
Use of JSP implicit objects.
JSP Directives.
Use of Scripting Elements.
To understand actionstags in JSP.
Understanding flow of JSP custom tags.

Assignment 6 : Spring Framework [Slot-2]

To create and understand the steps to develop Spring application.

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – VI
Course Type: SECC - III Course Code: CS - 3610
Course Title: Software Testing Tools

Teaching Scheme:	No. of Credits:	Examination Scheme:
03 Lect / week	2	IE:15 marks UE: 35 marks

Prerequisites

- Basic knowledge of algorithms, problem solving, expected inputs/outputs
- Knowledge of C and Java Programming Language, compilation, debugging

Course Objectives:

- To provide the knowledge of software testing methods and strategies.
- To understand how testing methods can be used as an effective tool in quality assurance of software.
- To provide skills to design test case plan for testing software.
- 4.To provide knowledge of latest testing tools

Course Outcomes:

- To understand various software testing methods and strategies.
- To understand a variety of software metrics and identify defects and managing those defects for improvement in quality for given software.
- To design test cases and test plans, review reports of testing for qualitative software.
- 4. To understand latest testing tools used in the software industries.

Course Contents

Chapter 1	**Introduction to Test case design**	**4 lectures**
How to identify errors, bugs in the given application. Design entry and exit criteria for test case, design test cases in excel. Describe feature of a testing method used.		
Chapter 2	**Test cases for simple programs**	**4 lectures**
Write simple programs make use of loops and control structures. Write Test Cases for above programs.		
Chapter 3	**Test cases and Test plan**	**4 lectures**
Write Test Plan for given application with resources required. Write Test case for given application. Prepare Test report for test cases executed.		
Chapter 4	**Defect Report**	**3 lectures**
Defect Life Cycle Classification of Defect Write Defect Report		
Chapter 5	**Testing Tools**	**3 lectures**
How to make use of Automation Tools Types of Testing Tools		
Demonstration	**Programming Assignments**	**18 Lect**

Out of 36 lectures, 18 are assigned for demonstration. Teacher should give demonstration of various assignments based on above theory topics in the classroom or in the laboratory as per their convenience. Demonstration of any open source testing tool should be given.

Programming assignments should be done individually by the student in their respective login from the list given in Labbook. The code/ documentation should be uploaded on either the local server, Moodle, Github or any LMS.

Reference Books:

1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7thEdition, Tata McGraw Hill, 20
2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999
4. Software Testing Principles and Practices by Srinivasan Desikan, Gopalaswamy Ramesh, Pearson.

Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem - VI
Course Type: SECC - IV Course Code: CS - 3611
Course Title : Project

Teaching Scheme	No. of Credits	Examination Scheme
03 Lect/ week/Batch Batch Size : 20	2	IE : 15 marks UE: 35 marks

Project Guidelines:

- Students should work in a team of minimum 3 and maximum 4 students.
- Students can choose a project topic and implement the same using any language/technology covered in the curriculum so far. The operating environment must be linux.
- The student group will work independently throughout the project work including: problem identification, information searching, literature study, design and analysis, implementation, testing, and the final reporting.
- Project guide must conduct project presentations (minimum 2) to monitor the progress of the project groups.
- At the end of the project, the group should prepare a report which should conform to international academic standards. The report should follow the style in academic journals and books, with clear elements such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.
- The final project presentation with demonstration (UE) will be evaluated by the project guide (appointed by the college) and one external examiner (appointed by the University).

Recommended Documentation contents:

Abstract

Introduction

- motivation
- problem statement
- purpose/objective and goals
- literature survey
- project scope and limitations

System analysis

- Existing systems
- scope and limitations of existing systems
- project perspective, features
- stakeholders
- Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: Using OOSE
- Data Model
- User interfaces

Implementation details

- Software/hardware specifications

Outputs and Reports Testing

- Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion a*nd* Recommendations

Future Scope

Bibliography and References

Project Related Assignments

Guidelines:

- The project assignments are a compulsory part of the project course and should be carried out by each project group.
- Project assignments are to be given by the guide for continuous internal evaluation.
- The project assignments are to be allotted to each group separately by the project guide on the basis of the implementation technology. A suggested list of assignments is given below.
  1. Project Time management: plan (schedule table), Gantt chart, Roles and responsibilities, data collection, Implementation
  2. Simple assignments to evaluate choice of technology
  3. Assignments on UI elements in chosen technology
  4. Assignments on User interfaces in the project
  5. Assignments on event handling in chosen technology
  6. Assignments on Data handling in chosen technology
  7. Online and offline connectivity
  8. Report generation
  9. Deployment considerations
  10. Test cases
- Each student within the group must work actively and contribute to the assignments, project work and report writing.

Evaluation guidelines:

IA (15 marks)			**UE (35 marks)**		
First presentation	Second presentation	Assignments	Project Logic/ Presentation	Assignments and Project Documentation	Viva
05	05	05	20	10	05