Modern Education Society's

Nowrosjee Wadia College

(AUTONOMOUS)

NAAC Accredited A+ with CGPA 3.51

Affiliated to the
Savitribai Phule Pune University
(Formerly University of Pune)

Four Year (Honors) B.Sc. Degree Program in Information Technology

B.Sc. (Information Technology)

(Faculty of Science & Technology)

National Education Policy (NEP) Syllabus
To be implemented from Academic Year 2024-2025

Title of the Course: B.Sc. (Information Technology)

Preamble for the Syllabus:

In compliance with the directives from the University Grants Commission, under the autonomous status of the college, the syllabus for four-year B. Sc. Information Technology at the undergraduate level is revised and reframed as per the National Educational Policy (NEP 2020) curriculum framework. Nowrosjee Wadia College has decided to introduce this programme from AY 2023-24 as the college has already shifted to the autonomous status from the academic year 2022-2023. The present syllabus is prepared by the Board of Studies in Computer Science, Nowrosjee Wadia College, taking into consideration the present relevance and application of the various branches of Computer Science. While preparing this syllabus the U.G.C. model curriculum (LOCF) and existing syllabus given by Savitribai Phule Pune University is followed.

Information Technology (IT) has been evolving as an important branch of science and engineering throughout the world in the last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Information Technology isa discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Information Technology can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain.

Information Technology has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges.

B.Sc. in Information Technology is aimed at undergraduate level training facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in Information Technology leading to research , can be employable at IT industries, or can pursue a teachers" training programme such as B.Ed. in Computer Education, or can adopt a business management career. BSc in Information Technology aims at laying a strong foundation of Information Technology at an early stage of the career along with two other subjects such as Maths and Statistics. There are several employment opportunities and after successful completion of an undergraduate programme in Information Technology, graduating students can fetch employment directly in companies as Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel. The Learning Outcome-based Curriculum Framework in Information.

Objectives:

- To develop an understanding and knowledge of the basic theory of Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation.

- To develop the ability to use this knowledge to analyse new situations

- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose. The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems

- To learn skills and tools like mathematics and statistics to find the solution, interpret the results and make predictions for the future developments.

PROGRAM OUTCOMES (POs):

The Bachelor of Science with Information Technology (BSc with IT) program enables students to attain by the time of graduation following 10 PO's. The course syllabi and the overall curriculum have been designed to achieve these outcomes:

Program Outcome (PO)	Short title	Description A Graduate student in Computer Science will be able to:
PO1	Knowledge outcome	Get fundamental/systematic or coherent knowledge and understanding of Information Technology and its applications.
PO2	Problem Analysis and solution	Procedural knowledge that creates different types of professionals related to Computer Science,
PO3	Development of various allied skills	Develop skills in the area of Software, Hardware and current developments.
PO4	Modern Tool usage	Use knowledge, understanding and skills required for identifying problems and issues, collection of relevant data based on a wide range of sources and their application, analysis and evaluation using methodologies for generating solutions. Undertake hands on lab work and activities that develop practical knowledge and skills in the field of information Technology.
PO5	Environment and Sustainability	Understand, critically analyse and attempt at finding the solutions to various environmental issues and obligate themselves towards sustainable development at the local, national and global context.
PO6	Communication and Leadership	Communicate the results of studies undertaken in an academic field accurately in a range of different contexts using the main concepts, constructs and techniques of the various subjects in Information Technology. Ability to present result using different presentation tools. Communicate proficiently and develop the quality of presentation, good communication, leadership.
PO7	Research skills and Aptitude	Meet one"s own learning needs, drawing on a range of current research and development work and professional materials.
PO8	Ethics	Ability to embrace moral/ethical values in conducting one's life, and use/ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, void unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights and adopting objective, unbiased and truthful actions in all aspects of work.
PO9	Societal Applications	Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate. Attempts at analysing and inspecting varied socio-

		economic issues in computer culture perspective by applying the knowledge to the societal issues.
PO10	Life Skills	Ability to work independently, identify appropriate resources required for a project and manage a project and complete the work.

Eligibility for the Course

XIIth Science or its equivalent examination. All other criteria are same as per Savitribai Phule Pune University rules.

Teaching Scheme:

- The course is a 3 year, 6 semesters full time under graduate course and 1 more year, 2 semester B. Sc. (IT) Honors course.
- The course follows the NEP pattern as per Savitribai Phule Pune University.
- 1 credit theory = 15 hours
- 1 credit practical = 30 hours = 4 hours week per batch

MODERN EDUCATION SOCIETY'S

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NEP Course Structure and other details

For

B. Sc. (INFORMATION TECHNOLOGY)

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2024-25)

Structure showing Credits in each semester for a three year Under Graduate programme B. Sc. (Information Technology)

SEM	MAJOR		MINOR	OE	VSC/SEC		OJT/FP/CEP/CC/RP	AEC/VEC/IKS	TOTAL
	Mandatory	Elective			VSC	SEC			
I	6 (2T+1P)	0	0	4	2 EL:P	2 EL:T	2 CC 2	6 AEC 2, VEC 2, IKS 2	22
II	6 (2T+1P)	0	2 (M:T 2)	4	2 STP	2 CS:1T	2 CC 2	4 AEC 2, VEC 2	22
III	8 (3T+1P)	0	4 (EL: T 2) (EL: P 2)	2	2	0	4 FP 2, CC 2	2 AEC	22
IV	8 (3T+1P)	0	4 (M: T 2) (M: P 2)	2	0	2 ST: T	4 CEP 2 CC 2	2 AEC	22
V	10 (3T+2P)	4 (CS:1T +1P)	4 CS:2T + 2 P	0	2	0	2 FP/CEP	0	22
VI	10 (3T+2P)	4 (CS:1T +1P)	2 CS: 1T	0	2	0	4 OJT	0	22
TOTAL	48	8	16	10	10	6	18	14	132
VII	12 (2T+2P)	4 (1T+1P)	4 RM	0	0	0	0	0	22
VIII	12 (2T+2P)	4 (1T+1P)	0	0	0	0	4 OJT	0	22

Abbreviations used throughout –

OE : Open Elective , VSC : Vocational Skill Courses, VEC: Value Education Courses, CC : Co-Curricular Courses, AEC: Ability Enhancement Course, IKS : Indian Knowledge System, OJT : On Job Training, FP : Field Project, CEP : Community Engagement Project

ST : Statistics, EL : Electronics, M : Mathematics

EVALUATION PATTERN :

Note : The Department follows all rules , regulations and procedure related to the examination decided by examination section of college.

(i)   Each course shall be evaluated with Continuous Evaluation (CE) and Semester-end Examination (SEE) mechanism.

(ii)   Theory courses: Continuous Evaluation shall be of 15 marks and Final Assessment shall be of 35 marks.

(iii)   Practical courses: Continuous Evaluation shall be of 15 marks and Final Assessment shall be of 35 marks.

(iv)   To pass a course of 2 credits, a student has to earn minimum 20 marks out of 50, provided that he/she should earn minimum 6 marks in Continuous Evaluation (out of 15) and minimum 14 marks (out of 35) in End-Semester Examination. That is passing criterion is minimum 40% marks in the examination.

(v)   For Continuous Evaluation (out of 15 marks), There has to be one written test of 10 marks (Mid-Semester Examination). The remaining 05 marks shall be based on the continuous evaluation consisting of tutorial, viva, seminars, home-assignments, mini project, survey, group discussion etc.(on approval of Head of the Department) and performance and attendance in the lectures and labs.

(vi)   There shall be revaluation of the answer scripts of End-Semester Examination (out of 35 marks) of theory papers only, but not of internal assessment papers as per Ordinance No. 134 A and B.

PATTERN OF THE QUESTION PAPER

Continuous Evaluation (Theory papers)

(1) As a part of Internal Evaluation, there shall be written test (Mid-Semester Examination) of 10 marks. Pattern of the question paper is as follows.

(2) Continuous Evaluation (Mid-Semester Examination of 10 marks, Duration: 45 minutes)

Question No.	Total Marks	No. Of questions	Remarks
Q. 1.	05	Solve any 5 out of 7	Short answer / objective type of questions. Each question carry 1 mark.
Q. 2.	05	Solve any 1 out of 2 questions	Each question carry 5 marks

(3) Semester-End Examination for B. Sc. courses, out of 35 marks, shall be of 2 hours duration. The pattern of the question paper will be as decided by the examination section of the college.

AWARD OF GRADES AND GRADE POINTS

The mapping of percentage to letter grade and grade point (for each course) is given in the following Table.

Sr. No.	Grade Letter	Grade Point	Marks
1.	O (Outstanding)	10	$45 \leq Marks \leq 50$
2.	A+ (Excellent	9	$40 \leq Marks \leq 44$
3.	A (Very Good)	8	$35 \leq Marks \leq 39$
4.	B+ (Good)	7	$27.5 \leq Marks \leq 34$
5.	B (Above Average)	6	$25 \leq Marks < 27.5$
6.	C (Average)	5	$22.5 \leq Marks \leq 24$
7.	D (Pass)	4	$20 \leq Marks < 22.5$
8.	F (Fail)	0	$Marks < 20$
9.	Ab (Absent)	0	

CGPA :The CGPA is the weighted average of the grade points obtained in all courses (theory and Practicals) by a student in all the courses in 6 semesters.

Based on the performance of the student in the Semester Examinations, Nowrosjee Wadia College will declare the results and issue the Semester Grade sheets. Also, the College will declare the results and issue the Grade sheets at the end of the course. The class will be awarded to a student on the basis of CGPA. The award of the class shall be as per the following table

Sr. No.	CGPA	Class of the degree awarded
1	9.50 or more than 9.50	OUTSTANDING (O)
2	8.50 or more but less than 9.50	EXCELLENT (A+)
3	7.50 or more but less than 8.50	VERY GOOD (A)
4	6.25 or more but less than 7.50	GOOD (B+)
5	5.25 or more but less than 6.25	ABOVE AVERAGE (B)
6	4.75 or more but less than 5.25	AVERAGE (C)
7	4.00 or more but less than 4.75	PASS (D)

Semester 1 (First Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 2)	Major Paper 1 (Theory)	Problem Solving using 'C'	2	2	15	35	50
	Major Paper 2 (Theory)	Fundamentals of Databases	2	2	15	35	50
	Major Paper 3 (Practical)	Laboratory on Problem Solving using 'C' & Fundamentals of Databases	4	2	15	35	50
Major Electives							
Minor	NIL	NIL	0	0			
OE (2 + 2)		Open Elective 1	2		15	35	50
		Open Elective 2	2	4	15	35	50
VSC (2)	Major Specific Practical 1	Laboratory Course on Fundamentals of Electronics	4	2	15	35	50
SEC (2)	Skill Paper 1 (Theory)	Fundamentals of Electronics	2	2	15	35	50
AEC(2),	English Theory	English Communication I	2	2	15	35	50
VEC (2)	EVS Theory	Environment Science I	2	2	15	35	50
IKS (2)	Major Specific Theory	Vedic Mathematics and Computer Fundamentals	2	2	15	35	50
CC (2)	CC-I Course	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Semester 2 (First Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 2)	Major Paper 4 (Theory)	Web Designing using HTML and CSS	2	2	15	35	50
	Major Paper 5 (Theory)	Relational Database Management Systems	2	2	15	35	50
	Major Paper 6 (Practical)	Laboratory Course on Web Designing and Relational Database Management Systems	4	2	15	35	50
Major Electives							
Minor	Minor Paper 1 (Theory)	Mathematical Techniques for IT	2	4	15	35	50
OE (2 +2)		Open Elective 3	2	2	15	35	50
		Open Elective 4	2	2	15	35	50
VSC (2)	Major Specific Practical 2	Laboratory course on Basic Statistics for IT	4	2	15	35	50
SEC (2)	Skill Paper 2 (Theory)	Software Productivity Tools	2	2	15	35	50
AEC(2),	English Theory	English Communication II	2	2	15	35	50
VEC (2)	EVS Theory	Environment Science II	2	2	15	35	50
IKS (2)							
CC (2)	CC-II Course	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Semester 3 (Second Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	TOTAL
Major Mandatory (6+ 2)	Major Paper 7 (Theory)	Web Technologies	2	2	15	35	50
	Major Paper 8 (Theory)	Exploratory Data Analysis	2	2	15	35	50
	Major Paper 9 (Theory)	Computer Networks and Internet	2	2	15	35	50
	Major Paper 10 (Practical)	Laboratory Course on Web Technologies and Exploratory Data Analysis	4	2	15	35	50
Major Electives							
Minor (4)	Minor Paper 2 (Theory)	Sensors and IoT	2	2	15	35	50
	Minor Paper 3 (Practical)	Laboratory Course on Sensors and IoT	4	2	15	35	50
OE (2)		Open Elective 5	2	2	15	35	50
VSC (2)	Major Specific Theory	Python Programming	2	2	15	35	50
SEC (2)							
AEC(2)	MIL	MIL-I (Hindi) / MIL-I (Marathi)	2	2	15	35	50
VEC (2)							
IKS (2)							
FP/CEP (2)	FP –I		6	2	15	35	50
CC(2)	CC III	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Semester 4 (Second Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (6 + 2)	Major Paper 11 (Theory)	Core Java programming and Data structures	2	2	15	35	50
	Major Paper 12 (Theory)	Software Engineering	2	2	15	35	50
	Major Paper 13 (Theory)	Content Management Systems	2	2	15	35	50
	Major Paper 14 (Practical)	Laboratory Course on Core Java programming and Data structures	4	2	15	35	50
Major Electives							
Minor (4)	Minor Paper 4 (Theory)	Mathematical Structures for Information Technology	2	2	15	35	50
	Minor Paper 5 (Practical)	Mathematics Practical using Scilab and Python	4	2	15	35	50
OE (2)		Open Elective 6	2	2	15	35	50
VSC (2)							
SEC (2)	Skill Paper 3 (Theory)	Advanced Statistics for Information Technology	2	2	15	35	50
AEC(2)	MIL	MIL-II (Hindi) / MIL-II (Marathi)	2	2	15	35	50
VEC (2)							
IKS (2)							
CEP(2)	CEP –I		6	2	15	35	50
CC(2)	CC-4	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Semester 5 (Third Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (6+ 2 + 2)	Major Paper 15 (Theory)	Advanced Java Programming	2	2	15	35	50
	Major Paper 16 (Theory)	Modern Data management	2	2	15	35	50
	Major Paper 17 (Theory)	Software Quality Assurance and Testing	2	2	15	35	50
	Major Paper 18 (Practical)	Laboratory Course on Advanced Java Programming	4	2	15	35	50
	Major Paper 19 (Practical	Laboratory course on Modern Data Management	4	2	15	35	50
Major Electives	Elective 1 (Theory)	UI/UX design	2	4	15	35	50
	Elective 1 (Practical)	Laboratory Course on UI/UX design	4		15	35	50
	OR						
	Elective 2 (Theory)	Block Chain Technology	2		15	35	50
	Elective 2 (Practical)	Laboratory Course on Block Chain Technology	4		15	35	50
Minor (4)	Minor Paper 6 (Theory)	Git and Github Programming	2	4	15	35	50
	Minor Paper 7 (Practical)	Laboratory Course on Software Testing Tools	4		15	35	50
OE (2)							
VSC (2)	Major Specific Practical 4	Software development frameworks	4	2	15	35	50
SEC (2)							
AEC(2),							
VEC (2)							
IKS (2)							
FP / CEP(2)	FP –II/CEP II		6	2			

Semester 6 (Third Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (6 + 2 + 2)	Major Paper 20 (Theory)	Mobile Application Development	2	2	15	35	50
	Major Paper 21 (Theory)	Data Mining and Data Science	2	2	15	35	50
	Major Paper 22 (Theory)	Cloud Computing	2	2	15	35	50
	Major Paper 23 (Practical	Laboratory Course on Mobile Application Development	4	2	15	35	50
	Major Paper 24 (Practical)	Laboratory Course on Data mining and Data Science, and Cloud Computing	4	2	15	35	50
Major Electives	Elective 3 (Theory)	Multimedia Technologies and Tools	2		15	35	50
	Elective 3 (Practical)	Laboratory Course on Multimedia Editing tools	4		15	35	50
	OR			4			
	Elective 4 (Theory)	Operating Systems and Network Administration	2		15	35	50
	Elective 4 (Practical)	Laboratory Course on Operating Systems and Network Administration	4		15	35	50
Minor (2)	Minor Paper 8 (Theory)	VFX and Animation	2	2	15	35	50
OE (2)							
VSC (2)	Major Specific Practical 5	Laboratory Course on Social Media Analytics	4	2	15	35	50
SEC (2)							
AEC(2)							
VEC (2)							
IKS (2)							
FP / CEP(2)							
OJT(4)	OJT	On Job Training	12	4	15	35	50

Semester 7 (Fourth Year)

Course Type	Course	Course / Paper Title	Hours / Week	Credit
Major Mandatory (4 + 4 + 2+2)	Major Paper 25 (Theory)	DOT NET Framework	4	4
	Major Paper 26 (Theory)	Full Stack Development	4	4
	Major Paper 27 (Practical)	Laboratory Course on DOT NET Framework	2	2
	Major Paper 28 (Practical)	Laboratory Course on Full Stack Development	2	2
Major Electives	Elective 5 (Theory)	Digital Forensics and Cloud Security	2	4
	Elective 5 (Practical)	Laboratory Course on Digital Forensics and Cloud Security	2	
		OR		
	Elective 6 (Theory)	Mean-stack web development	2	
	Elective 6 (Practical)	Laboratory Course on Mean-stack web development	2	
Minor (4)	Minor Paper (Theory)	Research Methodology	4	4
OE (2)				
VSC (2)				
SEC (2)	Major Specific Practical V	CS	2	2
AEC(2),				
VEC (2)				
IKS (2)				
FP / CEP(2)				
OJT(4)				

Semester 8 (Fourth Year)

Course Type	Course	Course / Paper Title	Hours / Week	Credit
Major Mandatory (4 + 4 + 2+2)	Major Paper 29 (Theory)	Web frameworks	4	4
	Major Paper 30 (Theory)	Machine Learning and Artificial Intelligence	4	4
	Major Paper 31 (Practical)	Laboratory Course on Web frameworks	2	2
	Major Paper 32 (Practical)	Laboratory Course on Machine Learning and Artificial Intelligence	2	2
Major Electives	Elective 7 (Theory)	Software Project Management	2	
	Elective 7 (Practical)	Laboratory Course on Project Management tool	2	
		OR		4
	Elective 8 (Theory)	NLP and Large Language Models	2	
	Elective 8 (Practical)	Laboratory Course on NLP and Large Language Models	2	
OE (2)				
VSC (2)				
SEC (2)	Major Specific Practical VI	CS(P)	4	2
AEC(2),				
VEC (2)				
IKS (2)				
FP / CEP(2)				
OJT(4)			12	4

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(An Autonomous College Affiliated to Savitribai Phule Pune University)

NEP Syllabus for

Second Year

B. Sc. (INFORMATION TECHNOLOGY)

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2024-25)

Course Code:
Subject Title : Web Technologies
Semester III (Major Paper 7) Theory

Teaching Scheme	No. of Credits	Examination Scheme
30 Hours	2	CE : 15 marks ESE: 35 marks

Prerequisites
- Knowledge of HTML and CSS

Learning Objectives
1. To Design dynamic and interactive Web pages.
2. To Learn Core-PHP.
3. To Learn PHP-Database handling.
4. To Learn Java Script to program the behaviour of web pages.
5. To Learn AJAX to make our application more dynamic.

Course Contents		
Unit 1	**Introduction to PHP**	**4**

1.1 Overview :HTTP Basics ,Web Browser and Web Server, Use of PHP
1.2 Language basics
      1.2.1 Lexical structure
      1.2.2 Data Types
      1.2.3 Variables and its scope
      1.2.4 Expressions and Operators
      1.2.5 Flow Control Statements(if, switch)
      1.2.6 Loops (For , while, do while, for each construct)
      1.2.7 Include and Require Code

Unit 2	**Functions and Strings**	**6**

2.1 Defining and calling a function
2.2 Default parameters
2.3 Variable parameters,
2.4 Types of strings in PHP
      2.4.1 Single-Quoted Strings
      2.4.2 Double-Quoted Strings
      2.4.3 Variable Interpolation
      2.4.4 Here Documents
2.5 Encoding and escaping
2.6 String functions
2.7 Regular expression

Unit 3	**Arrays, Files and Database Handling**	**8**

3.1 Arrays : Indexed , Associative
3.2 Identifying elements of an array
3.3 Storing data in array
3.4 Handling Arrays with Loops(For, while, For each, print_r)
3.5 Extracting multiple values
3.6 Converting between arrays and variables
3.7 Array functions
3.8 Action on entire array

3.9 Working with files and directories
3.10 Opening, Closing, Reading and writing in file
3.11 File handling functions
3.12 Random access to file data
3.13 PHP database connectivity, Record insertion, updation and deletion on tables

Unit 4	**JavaScript and JQuery**	**8**

4.1 Overview of JavaScript

4.2 Object Orientation and JavaScript Basic Syntax(JS datatypes, JS variables)

4.3 Primitives, Operations and Expressions , Screen Output and keyboard   input
   (Verification and Validation)

4.4 JS Control statements and JS Functions

4.5 JavaScript HTML DOM Events (onmouseup, onmousedown, onclick, onload,
   onmouseover, onmouseout).

4.6 JS Strings and JS String methods

4.7 JS popup boxes (alert, confirm, prompt).

4.8 JQuery library , Including JQuery library in page JQuery selector , DOM manipulation
   using JQuery

Unit 5	**AJAX**	**4**

5.1 Introduction of AJAX

5.2 AJAX web application model

5.3 AJAX –PHP framework

5.4 Performing AJAX validation

5.5 Connecting database using PHP and AJAX

Learning Outcomes

On completion of this course, students will be able to :

1. Understand how to develop dynamic and interactive Web pages.

2. Make database operations using PHP

3. Do validations using AJAX.

Learning Resources

1. Programming PHP - Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication

2. Beginning PHP 5 - Matt Doyle, Wrox publication.

3. PHP cookbook - David Sklar, Adam Trachtenberg ,3rd Edition, O'Reilly publication.

4. The Complete Reference PHP, by Steven Holzner, Tata McGraw-Hill Publication.

5. Java Script -A beginners guide - John Pollock, 3rd Edition, McGraw Hill.

6. Ajax Programming for the Absolute Beginner- Jerry Lee Ford, Jr, Course Technology

 Reference Links

1. www.php.net.in

2. www.W3schools.com

3. www.wrox.com

4. https://api.jquery.com/

Subject Code: Subject Title: Exploratory Data Analysis Semester III (Major Paper 8) Theory		
Teaching Scheme 30 Hours	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Prerequisites
- Basic knowledge of Statistics

Learning Objectives
1. Understand the Fundamentals of Exploratory Data Analysis
2. Conduct descriptive statistics to summarize data characteristics
3. Visualize Data Effectively
4. Apply Data cleaning and Pre-processing techniques to handle missing values, outliers, and duplicates Techniques
5. Apply statistics for making data-driven decisions

Course Contents		

Unit 1	**Introduction to EDA**	**8**

1.1 Introduction to data science, the data science lifecycle
1.2 Exploratory Data Analysis (EDA): Significance of EDA
1.3 Role of EDA in data science, Applications of Exploratory Data Analysis
1.4 Steps in EDA
1.5 Types of Data: Structured, semi-structured, Unstructured Data, Problems with unstructured data
1.6 Data sources: Open Data, Social Media Data, Multimodal Data, standard datasets
1.7 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
1.8 Python Tools for EDA

Unit 2	**Statistical Data Analysis**	**6**

2.1 Role of statistics in Exploratory data analysis
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

Unit 3	**Data Preprocessing**	**8**

3.1 Data Sources
3.2 Data Objects and Attribute Types: What Is an Attribute?, Nominal , Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes
3.3 Data Quality: Why Preprocess the Data? 3.3.Data munging/wrangling operations

3.4 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)

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

3.6 Data reduction

3.7 Data discretization

Unit 4	**Data Visualization**	**8**

4.1 Data visualization and visual encoding

4.2 Data visualization libraries

4.3 Basic data visualization tools

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

4.5 Specialized data visualization tools: Boxplots, Bubble plots, Heat map, Dendrogram, Venn diagram, Treemap, 3D scatter plots

4.6 Advanced data visualization tools- Wordclouds

4.7 Visualization of geospatial data

Learning Outcomes

1. Perform Exploratory Data Analysis
2. Obtain, clean/process, and transform data.
3. Detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
4. Demonstrate proficiency with statistical analysis of data.
5. Present results using data visualization techniques.
6. 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.

Learning Resources

1. Hands-On Exploratory Data Analysis with Python, Suresh Kumar Mukhiya, Usman Ahmed, Packt Publishing, 2020.
2. Python for Data Analysis, Wes McKinney, o'Reilly Media, 2013.
3. Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.
4. A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press
5. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012.

Other Resources

https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

Subject Code:
Subject Title: Computer Networks and Internet
Semester III (Major Paper 9) Theory

Teaching Scheme 30 Hours	No. of Credits 2	Examination Scheme CE: 15 marks ESE: 35 marks

Learning Objectives
1. To understand basic terms of computer networks and the internet environment.
2. To prepare students with basic networking concepts: data communication, protocols and standards, various topologies and applications of network.

Course Contents		
Unit 1	**Networking Fundamentals**	**6**

1.1 Data communication model, components, data representation
1.2 Networks, Point-to-Point, Multipoint, Network Topology (Bus, Ring, Star, Tree, Mesh, Hybrid)
1.3 The Need for a Protocol Architecture, Protocol hierarchies, Design Issues of the layer, Connection-Oriented and Connectionless Services
1.4 Reference models - OSI Reference Models, TCP/IP Reference model, Connection devices in different layers, Comparison of OSI and TCP/IP Reference Models.

Unit 2	**Data Transmission and Network Devices**	**8**

2.1 Basics of Data Transmission: Bits, Bytes, Bandwidth
2.2 Network Devices: Hubs, Switches, Routers
2.3 Network Media: Wired (Twisted Pair, Coaxial, Fiber Optic) and Wireless (Radio, Infrared, Microwave)
2.4 Network types – PAN, LAN, WAN, MAN, Wireless LANs: IEEE 802.11, Bluetooth
2.5 The Internet, Origins of the internet, Key Elements, Internet architecture

Unit 3	**Data Link Layer and Network Layer**	**8**

3.1 Data Link Layer: Services - Framing, Error Detection and Correction
3.2 Medium Access Control (MAC) Protocols
3.3 Network Layer: Routing and Forwarding
3.4 IP Addressing and Subnetting
3.5 IPv4 and IPv6
3.6 Role of ICMP and ARP protocol
3.7 Routing - General idea, Algorithms - Distance vector routing, link state routing, path vector routing

Unit 4	**Transport Layer and Application Layer**	**8**

4.1 Transport Layer: Services, Protocols (TCP, UDP), Flow Control, Error Control Connectionless and Connection-oriented service, Port numbers

4.2 Application Layer: HTTP, FTP, DNS, SMTP, IMAP, POP3
4.3   Key Internet Services: World Wide Web, Email, FTP
4.4   Domain Name System (DNS)
4.5   Web Browsers and HTTP

Learning Outcomes

On completion of this course, students will be able to :

1. Have a good understanding of the OSI and TCP/IP Reference Models.

2. Understand the working of various layers and protocols in the layers.

3. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

Learning Resources

1. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education.

2. Data Communication and Networking, Behrouz Fourouzan, 6th Edition, McGraw HillPvt. Ltd.

3. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education.

Course Code:
Subject Title : Laboratory Course on Web Technologies and Exploratory Data Analysis Semester III (Major Paper 10) Practical

Teaching Scheme	No. of Credits	Examination Scheme
4 Hours/ per week /per batch Batch Size : 12	2	CE : 15 marks ESE: 35 marks

Prerequisites:
- HTML and CSS basics
- The Basics of PHP.

Learning Objectives
1. To Design dynamic and interactive Web pages.
2. To Learn Core-PHP.
3. To Learn PHP- Database handling.
4. To Learn different technologies used at client Side Scripting Language
5. To Learn Java Script to program the behaviour of web pages.
6. To Learn AJAX to make our application more dynamic.
7. To apply statistical, data pre-processing and visualization techniques on data sets

<div align="center">Course Contents</div>

List of Assignments on web technologies:
 1. **Assignment Using Function and String**
      1) Program using user defined functions
      2) Program making use of built-in functions on strings.
2. **Assignment Using Arrays**
    1) Program to create and display an indexed array.
    2) Program to create and display associative arrays.
    3) Program to insert and delete elements from array.
    4) Program to sort arrays on keys and values.
    5) Program to demonstrate use of built-in array function.
3. **Assignment Using Files and Databases (PHP-PostgreSQL)**
    1) Program to read from the file.
    2) Program to write into file.
    3) Program to fetch and display records from database table.(PHP-Postgresql)
4 . **JavaScript**
    1) Java Script program using conditional statements and loops.
    2) Java Script program demonstrating window object: 'alert box'.
    3) Java Script program demonstrating window object: 'prompt box'.
    4) Java Script program demonstrating window object: 'Confirm box'.
    5) Java Script program demonstrating use of HTML events like 'OnClick,Onkeydown etc .
5 . **Ajax**
    1) Performing validation using AJAX.

List of Assignments on Exploratory Data Analysis

Assignment 1: 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 data format 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 2: 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 3: 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 4: 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

Learning Outcomes
On completion of the course, students will be able to–
1. Write and execute simple programs in Php.
2. Develop dynamic and interactive web pages.
3. PHP database connectivity.
4. Prepare data for use with a variety of statistical methods and recognize how the quality of the data may affect conclusions.
5. Perform exploratory data analysis

Subject Code: Subject Title: Sensors and IoT Semester III Minor Paper 2 (Theory)		
Teaching Scheme 30 Hours	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning Objectives

1**.** Study basic principles and types of different sensors.
2. Understand the basics of Operational Amplifier.
3. Know the basic circuit applications using OPAMP.
4. To understand the Data converters and their performance parameters.
5. Understanding of Internet of Things.

Course Contents		
Unit 1	**Sensors and Transducers**	**10**

1.1 Definition of Sensors and Transducer.
1.2 Sensor parameters.
1.3 Types of Sensors (Working principle and specifications)
      1.3.1 Temperature Sensor: RTD, Thermocouple, LM35
      1.3.2 Displacement Sensor: LVDT
      1.3.3 Motion Sensor: PIR
      1.3.4 Proximity sensor
      1.3.5 Tilt sensor
      1.3.6 Humidity sensor
1.4 Transducers: Working Principle of DC Motors and Stepper Motors.

Unit 2	**Introduction to OPAMP**	**7**

2.1 Block diagram, Symbol and Parameters of OPAMP IC741
2.2 Signal Conditioning circuits using OPAMP
    2.2.1 Inverting and Non inverting Amplifier
    2.2.2 Buffer
    2.2.3 Adder
    2.2.4 Subtractor
    2.2.5 Instrumentation Amplifier
    2.2.6 Current to Voltage and Voltage to Current converter

Unit 3	**Data Converters**	**6**

3.1 Need of Data converters
3.2 DAC types, R-2R DAC, Parameters
3.3 ADC: Flash ADC, Successive approximation ADC, DUAL slope ADC, Parameters

Unit 4	**Introduction to Internet of Things**	**7**

4.1 Fundamentals of IoT: Introduction, Block diagram of DAS, Definition and
      Characteristics of IoT
4.2 IoT Architecture
4.3 Physical and Logical design of IoT
4.4 Enabling Technologies in IoT
4.5 Things in IoT, Identifiers in IoT, Internet in IoT

4.6   IoT frameworks
4.7   IoT and Machine to Machine(M2M)

Learning Outcomes

On the completion of the course student will be able to

1. Know the working principles of various types of sensors.
2. Understand the working principle of OPAMP and its circuit application.
3. Use the knowledge of Data converters and their performance parameters.
4. Have the knowledge of basics of IoT.

Learning Resources

1. Sensors and Transducers, D. Patranbis, Prentice Hall Publication,2nd Edition, 2008
2. Sensors and Transducers, Dr. A. D. Shaligram, Chintan Publication,2013
3. Electric and Electronic Measurements and Instrumentation, A. K. Sawhney, Dhanpat Rai and Co.,2nd edition,1976
4. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi,1st Edition, MK publishers,May 2016
5. Internet of Things, Mayur Ramgir, Pearson publication
6. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Francis daCosta, 1st Edition, Apress Publications, 2013
7. Op-Amps and Linear Integrated Circuits, Ramakant .A. Gaikwad , 4th Edition, Pearson Publications.

Subject Code:		
Subject Title : Laboratory course on Sensors and IoT (Electronics) **Semester-III Minor Paper 3 (Practical)**		
Teaching Scheme 4 Hours/ per week /per batch	**No. of credits** 02	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning Objectives

1. To design build and test circuits using OPAMP.
2. To design sequential and combinational circuits.
3. Study of converters.
4. Study of different types of Sensors

Course Contents

Any eight from the following:

1. Study of LVDT
2. Study of LM 35
3. OPAMP IC 741 as Adder and Subtractor
4. Inverting and Non Inverting Amplifier Using IC 741
5. Study of Instrumentation Amplifier
6. Study of R-2R DAC
7. Study of 3-bit Flash ADC
8. Study of RAM IC 7489
9. Study of Diode Matrix ROM
10. Study of 74192 4-bit UP-Down Counter
11. Study of 3-bit Synchronous Up-Down Counter
12. Study of Astable Multivibrator
13. Inter-Conversions of Gates
14. Study of Shift Register IC 7495
15. Study of Electronics Components.
16. Sample and Hold Circuit.
17. Study of Analog Multiplexer using IC 4051
18. Study of Voltage to Frequency Convertor

Learning outcomes

On the completion of the course student will be able to:
1. Identify and test various types of sensors.
2. Understand Different digital circuit applications.
3. Use of these circuits for IoT system design.

Course Code: Course Title: Python Programming Semester III Major Specific VSC (Theory)		
Teaching Scheme 30 Hours	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning 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

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Course Contents

</div>

Unit 1	**An Introduction to Python**	**3**

1.1 Introduction to Python-History, features, Applications, Installing Python, Running Simple Python program
1.2 Basics of Python
1.3 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.

Unit 2	**Control Statements**	**5**

2.1 Sequence Control – Precedence of operators, Type conversion
2.2 Conditional Statements: if, if-else, nested if-else,
2.3 Looping- for, while, nested loops, loop control statements (break, continue, pass)
2.4 Strings: declaration, manipulation, special operations, escape character, string formatting operator, Raw String, Unicode Strings, Built-in String methods.

Unit 3	**Lists, functions, tuples and dictionaries, Sets**	**10**

3.1 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.
3.2 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.
3.3 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.
3.4 Sets- Definition, transaction of set(Adding, Union, intersection), working with sets

Unit 4	Modules ,Working with files, Exception handling	12

4.1 Modules: Importing module, Creating & exploring modules, Math module, Random module, Time module Packages: Importing package, creating package, examples

4.2 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

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

4.4 Classes and Objects: Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding

4.5 Multithreaded Programming: Thread Module, creating a thread, synchronizing threads, multithreaded priority queue Modules: Importing module, Creating and exploring

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

Learning Outcomes

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

1. Develop logic for problem solving

2. Determine the methods to create and develop Python programs by utilizing the data

3. Structures like lists, dictionaries, tuples and sets.

4. To be familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc.

5. To write python programs and develop a small application project

Learning Resources

1. James Payne, "Beginning Python: Using Python and Python 3.1,Wrox Publication

2. Introduction to Problem Solving with Python by E Balguruswamy, TMH publication-2016

3. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller

4. Object-oriented Programming in Python, Michael H. Goldwasser, David Letscher, Pearson Prentice Hall-2008

SEMESTER –IV

<table>
<tr>
<td colspan="3" align="center">Course Code:
Title: Core Java programming and Data structures
Semester IV (Major Paper 11) Theory</td>
</tr>
<tr>
<td align="center">Teaching Scheme
30 Hours</td>
<td align="center">No. of Credits
2</td>
<td align="center">Examination Scheme
CE:15 marks
ESE: 35 marks</td>
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</table>

Prerequisite
- Knowledge of C Programming language

Learning Objectives
 1. To enable the students to learn the basic concepts of Java programming
 2. To use class and objects to create applications
 3. To have an overview of interfaces, packages, multithreading and exceptions.
 4. To familiarize students with basic data structures and their use in algorithms.

<table>
<tr>
<td colspan="3" align="center">Course Contents</td>
</tr>
<tr>
<td>Unit 1</td>
<td>An Introduction to Java, Classes and Objects</td>
<td>10</td>
</tr>
<tr>
<td colspan="3">
1.1 Object Oriented Programming Concepts
1.2 Features OR Buzzwords of Java
1.3 Comments, Data Types Final variable
1.4 Accepting Input(BufferedReader, Scanner)
1.5 Defining your own classes Access Specifiers(public, protected, private, default)
1.6 Array of Objects
1.7 Constructors, Overloading.Constructors and Use of 'this' keyword static block, static fields and methods.
1.8 Predefined Classes
1.9 Object Class, Methods (equals(), toString(),hashcode(), getClass())
1.10 String Class
1.11 Creating , Accessing And Using Packages: Wrapper Classes
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<tr>
<td>Unit 2</td>
<td align="center">Inheritance, Interface and Multithreading</td>
<td>6</td>
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<tr>
<td colspan="3">
 2.1 Inheritance Basics (extends Keyword) and Types of Inheritance Superclass, Subclass and use of Super Keyword Method Overriding and runtime polymorphism
 2.2 Use of final keyword related to method and class Use of abstract class and abstract methods Defining and Implementing Interfaces
 2.3 Dealing with errors and Exception, Catching Exceptions.
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<tr>
<td>Unit 3</td>
<td>User Interface with AWT and Swing</td>
<td>8</td>
</tr>
<tr>
<td colspan="3">
3.1 Introduction to AWT and Swing
3.2 The MVC Architecture and Swing
3.3 Layouts And Layout Managers
3.4 Containers And Components – JFrame, JButton, JLabel, JText, JTextArea, JCheckBox And JRadioButton, JList, JComboBox, JMenu and related Classes
3.5 Dialogs (Message, Confirmation, Input), JFileChooser, JColorChooser
3.6 Event Handling: Event Sources, Listeners
</td>
</tr>
<tr>
<td>Unit 4</td>
<td>Introduction To Data Structures</td>
<td>6</td>
</tr>
</table>

4.1 Concept of Data Structures
4.2 Linear and Non-linear Data Structures
4.3 Concept of Array, Stack, Queue, Tree, graph, linked list with types, and operations.
4.4 Data Structures in java: Collection Framework (Array list, Linked list, Tree set)

Learning Outcomes

On the completion of this course student will be able to:
1. Develop Java Standalone Java applications.
2. To create attractive User interfaces in Java.
3. Choose the appropriate data structure for modelling a given problem.

Learning Resources

1. "JAVA 2: The Complete Reference", Herbert Schildt, , 11th Edition, McGraw Hill 2018
2. "Programming with Java", By E. Balagurusamy ,4th edition, A primer
3. "Data Structures and Algorithms ", By Aho, Hopcroft and Ullman, Pearson Education, 2003.
4. "Data Structures, Algorithms and Applications in JAVA", S. Sahni, 2nd Edition Universities Press, 2005

Online Resources

1. NPTEL & MOOC courses titled Java and Data Structures
2. https://nptel.ac.in/courses/106106127/
3. https://nptel.ac.in/courses/106105191/

Course Code: Subject Title: Software Engineering Semester IV (Major Paper 12) Theory		
Teaching Scheme 30 Hours	**No. of Credits** 2	**Examination Scheme** CE : 15 marks ESE: 35marks

Learning Objectives
1. To get knowledge and understanding of software engineering discipline.
2. Know the role played by requirements analysis in requirement integration.
3. Appreciate the idea behind Design Patterns in handling common problems faced during Building an application.
4.   To learn analysis and design principles for software project development

Course Contents

Unit 1	Introduction to Software Engineering and Process Models	4

1.1 Definition of Software
1.2 Nature of Software Engineering
1.3 Changing nature of software
1.4 Software Process
  1.4.1 The Process Framework
  1.4.2 Umbrella Activities
  1.4.3 Process Adaptation
1.5 Generic Process Model
1.6 Prescriptive Process Models
  1.6.1 The Waterfall Model
  1.6.2 Incremental Process Models
  1.6.3 Evolutionary Process Models

Unit2	Agile Development	4

2.1 What is Agility?
2.2 Agile Process
  2.2.1 Agility Principles
  2.2.2 The Politics of Agile Development
  2.2.3 Human Factors
2.3 Scrum
2.4 Other Agile Frameworks
  2.4.1 Extreme Programming(XP)- XP Values, XP Process, Industrial XP
  2.4.2 Kanban
  2.4.3 DevOps

Unit3	Requirements Analysis	3

3.1 Requirement Elicitation,
3.2 Software requirement specification (SRS)
  3.2.1 Developing Use Cases (UML)
3.3 Building the Analysis Model
  3.3.1 Elements of the Analysis Model
  3.3.2 Analysis Patterns
  3.3.3 Agile Requirements Engineering
3.4 Negotiating Requirements
3.5 Validating Requirements

Unit4	Requirements Modeling	13

4.1 Introduction to UML
4.2 Structural Modeling
  4.6.1 Use case model
  4.6.2 Class model
4.3 Behavioral Modeling
  4.3.1   Sequence model
  4.3.2   Activity model
  4.3.3   Communication or Collaboration model
4.4 Architectural Modeling
  4.4.1   Component model
  4.4.2   Artifact model
  4.4.3   Deployment model
4.5 Data Modeling Concepts- Data Objects, Data Attributes and Relationship
4.6 Design Process
  4.6.1 Software Quality Guidelines and Attributes
  4.6.2 Evolution of Software Design
4.7   Design Concepts:
Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information
Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object Oriented
Design Concepts, Design Classes

Unit 5	Design for Mobility	6

5.1 The Challenges
  5.1.1 Development Considerations
  5.1.2 Technical Considerations
5.2 Mobile Development Life Cycle
  5.2.1 User Interface Design
5.3 Mobile Architectures
5.4 Context Aware Apps
5.5 Web Design Pyramid
5.6 WebApp Interface Design
  5.6.1 Aesthetic Design
  5.6.2 Content Design
  5.6.3 Architecture Design
  5.6.4 Navigation Design

Learning outcomes
On completion of this course, students will be able to:
1. Compare and chose a process model for a software project development.
2. Identify requirements analyze and prepare models.
3. Prepare the SRS, Design document, Project plan of a given software system

Learning resources
1. Software Engineering: A Practioner's Approach, Roger S. Pressman, 9th Edition, Tata McGraw-Hill
2. Software Engineering Concepts, Richard Fairley, Tata McGraw-Hill.
3. Information Technology Project Management, Kathy Schwalbe, 6th Edition,Thomson Publication
4. Software Engineering, Ian Sommerville,10th Edition Pearson publication

Course Code: **Title : Content Management Systems** **Semester IV Major Paper 13 Theory**		
Teaching Scheme 30 hours	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning Objectives
1. To introduce Content Management System and its Applications.
2. To introduce components of CMS.
3. To use WordPress tool for Web Application Development.

Course Contents		
Unit 1	**Introduction to CMS**	**4**

1.1 Introduction to Content Management Systems
1.2 Main Features of CMS
1.3 Web Content Management System
1.4 Components of Content Management System
1.5 Enterprise Content Management System

Unit 2	**Introduction to WordPress**	**4**

2.1 Introduction to WordPress
2.2 Setting up WordPress
2.3 Setting Up Database
2.4 Installing WordPress
2.5 Working of WordPress
2.6 Dashboard
2.7 User Management

Unit 3	**Pages and Menus**	**10**

3.1 Components of a page in WordPress
  3.1.1 Authors
  3.1.2 Contents
  3.1.3 Header
  3.1.4 Footer
  3.1.5 Image
  3.1.6 Comments
3.2 Managing Media Library
3.3 Managing Menus:
  3.3.1 Defining Menu
  3.3.2 Adding Items to Menus
  3.3.3 Deleting a Menu Items
  3.3.4 Creating Multilevel Menus
  3.3.5 Adding Menus to your Site

Unit 4	**Forms and Widgets**	**7**

4.1 Forms
  4.1.1 Types (Contact Form, Appointment Form, Registration Form, Feedback Form, etc)
  4.1.2 Form Fields (Name, Email, URL, Phone Number, Text input Field, Multi-line Text Field, Date Picker, Drop Down Field, Single Choice Radio Button, Check-Boxes, etc)
  4.1.3 Form Configuration Settings
4.2 Installing Widgets

4.3 Displaying Widgets 4.4 Widgets Areas 4.5 Using Text Widgets 4.6 Using RSS Widgets		
Unit 5	**Plugins and SEO**	**5**
5.1 WordPress Plugins 5.2 Installing a WordPress Plugins 5.3 Updating Plugins 5.4 Creating SEO-friendly (URLs) for the site 5.5 Customizing the URL of an individual Page 5.6 Setting Titles and Meta Description with an SEO Plugin		
Learning Outcomes On completion of this course , students will be able to: 1. In-depth knowledge about WordPress configuration 2. A suite of plugins to enhance their site to their needs 3. The ability to use industry-standard developer tools 4. An understanding of Search Engine Optimization		
Learning Resources 1. Building Web Apps with WordPress second addition by Brian Messenlehner, Jason Coleman O'reilly Publication 2 . Professional WordPress: Design and Development second edition Brad Williams, David Damstra, Hal Stern		

Course Code: Subject Title: Practical based on Core Java programming and Data Structures Semester IV (Major Paper 14) Practical		
Teaching Scheme 4 Hours/ per week /per batch Batch Size : 12	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning Objectives

1. To write programs for solving real world problems using java collection frame work.
2. To understand the basic concepts and fundamentals of platform independent object -oriented language.
3. To demonstrate skills in writing programs using exception handling techniques and multithreading.
4. To understand streams and efficient user interface design techniques.
5. To write GUI programs using swing controls in Java.
6. To write Programs for Data Structures using Collection framework.

List of Assignments:

Assignment 1 : Java Tools and IDE

Use of java tools like java, javac, jdb and javadoc,

Assignment 2 : Simple java programs

Creation of simple classes and objects.

Assignment 3 : Array of Objects and Packages

Creating an array of objects, creating a package using Package Command
and Import Package.

Assignment 4 : Inheritance

Program To implement inheritance in java.

Assignment 5: Exception Handling

Demonstrate Exception Handling Mechanism in Java and Use of try, catch, throw, throws, finally blocks.

Assignment 6 : GUI Designing,

To demonstrate GUI creation using Swing Package and Layout managers.

Assignment 7 : Event Handling

To demonstrate GUI creation using Swing Package and Layout managers.
To understand Event handling mechanism in Java.

Assignment 8 : Data Structure using Collection Framewor

List Interface : Array List , Linked List.

Learning Outcomes

On completion of this course , students will be able to:

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.

Subject Code:		
Subject Title: Mathematical Structures for Information Technology		
Semester IV (Minor Paper 4) Theory		
Teaching Scheme 30 Hours	**No. of Credits** 2	**Examination Scheme** CE : 15 marks ESE: 35 marks

Learning Objectives

1. To build the necessary skill and analytical abilities for developing computer based solutions using mathematical concepts.
2. To get the relational understanding of mathematical concepts.
3. To translate information presented verbally into mathematical form.
4. To develop a positive attitude towards mathematics as an interesting subjects in study of Computer Science.

Course Contents		
Unit 1	**Set**	**6**

1.1 Introduction, Sets and Definition, Examples
1.2 Types of Sets : Empty set, Singleton set
1.3 Operations On Set (Union, Intersection, Complement)
1.4 Cardinality Of Set, Finite and Infinite Set
1.5 Power Set
1.6 Subsets
1.7 Venn Diagram

Unit 2	**Functions**	**6**

2.1 Functions (Definition and Examples)
2.2 One-to-one Function, Onto Function.
2.3 Inverse Functions and Composition Function.
2.4 Some important Functions.

Unit 3	**Relations**	**8**

3.1 Ordered Pairs, Cartesian product of sets.
3.2 Relations, type of relations, equivalence relations, partial ordering, poset.
3.3 Equivalence class, properties and partition of a set.
3.4 Diagraph of relations, matrix representation and Hasse Diagram.

Unit 4	**Counting Principles**	**10**

4.1 Introduction
4.2 Basic Rule:
   4.2.1 The Multiplication Rule.
   4.2.2 The Addition Rule.
4.3 Principle of Inclusion and Exclusion.
4.4 Pigeon Hole Principle
4.5 Permutation and Combination (definition, Examples and basic properties)
4.6 Binomial Theorem (Statements only and Examples)

Learning outcomes

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

1. Students will understand basic concepts of Set theory.
2. Learn some fundamental concepts and terminology.
3. They will be able to solve problems based on permutation, Combinations.
4. Understand the general concept of a function, such as domain, range, function type etc.

Learning resources

1. Discrete Mathematics and its applications (Tata McGraw Hill) by Kenneth Rosen, 7th edition.

Unit-I : Text Book 1:

Chapter 2: section 2.1, 2.2

Unit-II: Text Book 1:

Chapter 5 : section 5.1

Unit-III: Text Book 1:

Chapter 9: section 9.1, 9.5, 9.6

Unit-IV: Text Book 1:

Chapter 6 : section 6.1, 6.2, 6.3, 6.4

2. Discrete Mathematics Structure by Bernard Kolman, Robert Busby, Sharon Culter Ross.

Nadeem-ur-Rehman, Pearson Education fifth edition.

Subject Code: Subject Title: Mathematics Practical using Scilab and Python Semester-IV Minor paper 5 (Practical)		
Teaching Scheme 4 Hours/Week	**No. of Credits** 2	**Examination Scheme** CE: 15 marks ESE: 35 marks

Learning Objectives
  1. The use Scilab tools and its application for mathematical computations.
  2. The basic syntax and features of Python programming, as well as mathematical concepts in linear algebra

Course Contents	
Unit 1	**Introduction to Scilab**

1.1 Introduction to Scilab.
1.2 Creating real variables and predefined mathematical variable.
1.3 String, list, Length, Size
1.4 Polynomial and roots of polynomial
1.5 Use of 'deff' command for one and two variable function
1.6 Find value of function at particular point.
1.7 Plot 2-D and 3-D graph of some standard functions

Unit 2	**Matrix operations using Scilab**

2.1 Generate random matrix
2.2 Generate matrix: Null matrix, identity matrix, ones matrix
2.3 Operations on matrices: addition, multiplication, power Determinant, Trace, Inverse, Transpose, Rank of matrix.
2.4 Reduced row echelon form and rank of matrix
2.5 Solution for system of linear equations
2.6 Characteristic Polynomial of Matrix
2.7 Eigenvalues and Eigenvectors

Unit 3	**Introduction to Python**

3.1 Installation of Python.
3.2 Values and types: int, float and str,
3.3 Variables: assignment statements, printing variable values, types of variables.
3.4 Operators, operands and precedence:+, -, /, *, **, % PEMDAS(Rules of precedence)
3.5 Mathematical functions from math, cmath modules.
3.6 Looping statements such as while, for etc, Tables using while

Unit 4	**String, list, tuple**

4.1 Strings
  4.1.1 String operations: + : Concatenation, * : Repetition
  4.1.2 String slice
4.2 Lists
  4.2.1 List operations

4.2.2 Use of range function and Accessing list elements

4.2.3 Updating list: addition, removal or updating of elements of a list

4.3 Tuples

4.3.1 Defining a tuple,

4.3.2 Index operator and slice operator,

4.3.3 Tuple assignment,

4.3.4 Tuple as a return value.

Unit 5	Linear Algebra

5.1 Matrix construct, eye(n), zeros(n, m) matrices

5.2 Addition, Subtraction, Multiplication of matrices, powers and invers of a matrix.

5.3 Accessing Rows and Columns, Deleting and Inserting Rows and Columns

5.4 Determinant, reduced row echelon form, null space, column space, Rank

5.5 Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method)

5.6 Eigenvalues, Eigen vectors.

Practical's :

1. Introduction to Scilab (Unit 1)

2. Polynomial and roots of polynomial and use deff function for one or two variables (Unit 1 – 1.4, 1.5)

3. Plot 2D and 3D graphs for standard function. (Unit 1- 1.7)

4. Application: Matrices and its operations. (Unit 2- 2.2 , 2.2)

5. Application : Determinants, Inverse, Trace, rank of matrix , reduced row echelon form. (Unit 2- 2.3, 2.4)

6. Application : Solution for System of linear equation, Eigenvalue and Eigenvectors.   (Unit 2 - 2.5, 2.6, 2.7)

7. Introduction to Python. (Unit 3- 3.1 to 3.6)

8. Python Data Types. (Unit 4 – 4.1 to 4.3)

9. Application : Matrices and its operations. (Unit 5 – 5.1, 5.2)

10. Application : Determinants, Rank, Column space, null space, reduced row echelon form, Accessing rows and columns, deleting rows and columns.(Unit 5- 5.3, 5.4)

11. Application : System of linear equations. (Unit 5- 5.5)

12. Application : Eigen values, Eigenvectors. (Unit 5 – 5.6)

Learning Outcomes

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

1. Understand the basic syntax and tools of Scilab.

2. Use Scilab to perform basic mathematical computations, such as addition, subtraction, multiplication, and division.

3. Use Scilab tool for perform matrix operations.

4. Use Python to manipulate strings, lists, and tuples.

5. Use Python to perform linear algebra operations such as matrix addition, subtraction, multiplication, and inversion.

6. Solve systems of linear equations using various methods such as Gauss Elimination GaussJordan.

Learning Resources

1. "Scilab by Examples" by S. Abbas, A. Muhammad, and A. Muhammad.

2. "Introduction to Scilab for Engineers and Scientists" by Sandeep Nagar.

3. "Scilab: A Practical Introduction and Examples" by D. Varsamopoulos.

4. "Numerical Methods in Engineering with Scilab" by Fausto Saleri and Paola Gervasio.

5. How to think like a Computer Scientist: Learning with Python, Downey. A. et al., John Wiley, 2015.Sections: 1, 2, 3

6. Introduction to Scientific Computing in Python, Robert Johansson, Apress, 2nd Edition.Section: 4

7. Fundamentals of Python - First Programs, Lambert K. A., Cengage Learning India,2015.
8. Introduction to Computing and Programming in Python,Guzdial, M. J.,Pearson,India,2012.
9. Introduction to Computing Using Python, Perkovic, L., John Wiley, 2nd Edition2015.
10. Python Programming: An Introduction to Computer Science, Zelle, J., Franklin,Beedle & Associates Inc.,2004.
11. Matplotlib for Python Developers, Sandro Tosi, Packet Publishing Ltd.(2009)

Subject Code:
Subject Title : Advanced Statistics for Information Technology
Semester IV Skill Paper 3 (SEC) Theory

Teaching Scheme	No. of Credits	Examination Scheme
30 hours	2	CE: 15 marks ESE: 35 marks

Prerequisites
- Knowledge of Counting Principles and Basic statistics.

Learning Objectives
1. To study basic statistical concepts & procedures required for Information Technology
2. To understand basic terminology and techniques of Non-Linear regression analysis for bivariate data.
3. To understand basic terminology of probability theory and to explain probability theory and also to revise prerequisite concepts like set theory etc
4. To solve problems which later on can be applied in data analysis
5. To apply these statistical tools in IT applications
6. To understand and apply various hypothesis testing procedures.

Course Contents		
Unit 1	**Non –Linear Regression**	**6**

1.1 Nonlinear regression concept
1.2 Fitting a second-degree curve
1.3 Fitting an exponential curve of the type $Y=ab^x$ and $Y=ax^b$.
1.4 Fitting a Logistic curve
1.5 Numerical problems related to real life situations

Unit 2	**Advanced Probability tools**	**7**

2.1 Concepts and definitions of conditional probability, multiplication theorem $P(A\cap B)=P(A).P(B|A)$
2.2 Bayes' theorem (without proof). True positive , false positive and sensitivity of test as application of Bayes' theorem.
2.3 Concept of Posterior probability, problems on posterior probability.
2.4 Concept and definition of independence of two events.
2.5 Numerical problems related to real life situations.

Unit 3	**Testing of hypothesis**	**12**

3.1 Terminology - null & alternate hypothesis, parameter, statistic, type I & II errors, level of significance, large and small sample test, one sided and two sided tests, p-value
3.2 Large Sample Tests
$\quad$ Ho: $\mu = \mu o$ Vs H1: $\mu \neq \mu o$, $\mu < \mu o$, $\mu > \mu o$ (One sided and two sided tests)
$\quad$ Ho: $\mu 1 = \mu 2$ Vs H1: $\mu 1 \neq \mu 2$, $\mu 1 < \mu 2$, $\mu 1 > \mu 2$ (One sided and two sided tests)
$\quad$ Ho: $P = Po$ Vs H1: $P \neq Po$, $P < Po$, $P > Po$ (One sided and two sided tests)
$\quad$ Ho: $P1 = P2$ Vs H1: $P1 \neq P2$, $P1 < P2$, $P1 > P2$ (One sided and two sided tests).
3.3 F-test for testing significance of equality of two population variances.
3.4 Tests based on t – distribution
$\quad$ Ho: $\mu 1 = \mu 2$ Vs H1: $\mu 1 \neq \mu 2$, $\mu 1 < \mu 2$, $\mu 1 > \mu 2$ (One sided and two sided tests)

3.5 Paired t-test. 3.6 Tests based on Chi square distribution Chi-square test for goodness of fit 3.7 Test for independence of attributes (m x n and 2x2)		
Unit 4	**Time series**	**5**
4.1 Meaning and utility 4.2 Components of time series 4.3 Additive and multiplicative models 4.4 Methods of estimating trend : moving average method and exponential smoothing Method. 4.5 Numerical problems related to real life situations		

List of Tutorial (A student should submit any 5 of these tutorials)

1. Fitting of non-linear regression. (use of scatter plot for explaining the non- linear relationship between two variables)
2. Large sample tests.
3. F test, (one problem each with equal and unequal variance), t test, $\chi 2$ test ,($\chi 2$ test – for goodness of fit-use fitted problems of Binomial, Poisson and Normal distribution in previous practical problems)
4. Time Series- Estimation of trend by using the method of moving average
5. Conditional Probability, Independence and Bayes theorem example
6. Real life data collection and Data analysis using statistical concept – the activity to be done in group of 2 to 4 students.

Learning Outcomes

On completion of this course, students will be able to :

1. get knowledge of basic statistical concepts.
2. get basic knowledge of statistical procedures.
3. get basic information about methods of data representation.
4. Apply probability techniques in a specific problem.
5. Apply these tools in simple analytical situations related to IT.
6. Strengthen themselves both computationally and analytically.

Learning Resources

1. Introduction to linear regression analysis Douglas C. Montgomery. (fifth edition) Wiley Students edition.
2. Fundamentals of Applied Statistics Gupta and Kapoor, (3rd Edition), S. Chand and Sons, New Delhi, 1987.
3. Fundamentals of Mathematical Statistics (3rd Edition), Gupta S. C. and Kapoor V. K.1987 S. Chand and Sons, New Delhi.
4. Fundamentals of Statistics, Vol. 1, , Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Sixth Revised Edition The World Press Pvt. Ltd., Calcutta
5. Mathematical Statistics , Mukhopadhyay P. 2015, (3rd Edition) Books And Allied (P), Ltd.
6. Introduction to Time Series and Forecasting Peter J. Brockwell Richard A. Davis Third Edition .Publication –Springer.