Mahatma Education Society's

Pillai College of Arts, Commerce & Science (Autonomous)

Affiliated to University of Mumbai

'NAAC Accredited 'A' grade (3 cycles)'
'Best College Award' by University of Mumbai
ISO 9001:2015 Certified

SYLLABUS

Program: Bachelor of Computer Applications

F.Y. Bachelor of Computer Applications

PCACS/BCA/SYL/2024-25/FY

As per National Education Policy
Choice Based Credit & Grading System

Academic Year 2024-25

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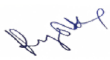
Board of Studies in the Department of Computer Science

Sr. No.	Name of the	Details	Sign
1	Prof. Deepika Sharma	Chairperson (Head of Department of Information Technology & Computer Science), Vice Principal	
2	Dr. Gajanan Wader	Principal	
3.	Mrs.Munawira Kotyad Pillai, Director Pillai Center for Innovation & Research	Management Representative	Absent
4	Dr. Amiya Kumar Tripathy Director Center for GeoAI & ML, Professor, Computer Engineering, Don Bosco Institute of Technology, Mumbai	Subject Expert From Outside Parent University	
5	Dr.. Anjali Kulkarni CKT College, New Panvel	Vice Chancellor Nominee, University of Mumbai	
6	Mr. Tito Idicula, Director, Programming Hub	Alumni representative	
7	Mr. Anant Baddi, Security Solution Architect, cloud Google Google	Industry Representative (Industry/Corporate/Allied Sector)	Absent
8	Mr. Bhupendra Kesariya Professor,N. M. .College, Vile Parle	Subject Expert in Mathematics	

		From Outside Parent University	
9	Mrs. Anju Somani	Faculty Specialization	
10	Mrs. Shubhangi Pawar	Faculty Specialization	
11	Mrs. Soly Zachariah	Faculty Specialization	
12	Mrs. Ramya S. Kumar	Faculty Specialization	
13	Mrs. Sujata Shahabade	Faculty Specialization	
14	Mrs. Sreevidya T.V.	Faculty Specialization	
15	Mr. Omkar Sherkhane	Faculty Specialization	
16	Mr. Abhijeet Salvi	Faculty Specialization	

Introduction to Bachelor of Computer Applications

Bachelor of Computer Application is a three years undergraduate programme that has been designed meticulously to meet the requirements of dynamic I.T. industry. This programme aims at fostering concepts of Information technology and business technology in students and equip them with the required technical, logical, problem solving and soft skills, which prepare them for the corporate world. It also focuses on inculcating effective communication skills which a software professional must have.

No education is complete without incorporating social and moral values. This programme takes care of this aspect as well. The core courses of the program are supplemented by electives so that students can tailor the program according to their interest. State of art computer laboratories, in the campus, help students to practically implement the concepts learned. Qualified and experienced faculty members guide students in their project work. As we all know degrees in Computer Application lead to rewarding and lucrative careers, excellent placement and incubation assistance is provided.

Program Outcomes

SR NO	PO TITLE	POS IN BRIEF
PO1	**Core Knowledge**	Develop a strong foundation in the core principles and theories of their chosen field of study to pursue a profession of choice by understanding fundamental concepts, methodologies, and key terminologies
PO2	**Research Skills**	Trigger the research aptitude by developing basic research skills, including the ability to conduct literature reviews, design experiments, collect and analyze data, and draw meaningful conclusions.
PO3	**Communication Skills**	Communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing and also ability to present their work through written, oral, and visual presentations, including an original research proposal in a clear and understandable manner to both technical and non-technical audiences.
PO4	**Ethical and Professional Behavior**	Understand and adhere to ethical standards by recognizing the importance of integrity, honesty and ethical responsibility in scientific research and professional practice.
PO5	**Teamwork and Collaboration**	Ability to work cohesively to achieve common goals, solve problems and contribute to the success of a project or task paving way to individual and collective growth.
PO6	**Adaptability and Lifelong Learning**	Engage themselves in lifelong learning to keep up with the pace of changing technology and interdisciplinary approach to provide better solutions and new ideas for the sustainable developments
PO7	**Technical Skills**	Acquisition of specialized technical skills and expertise relevant to the specific field of study i.e advanced laboratory techniques, computational skills, or other specialized methodologies.
PO8	**Critical Thinking and problem-Solving Skills**	Graduates would be equipped with the ability to analyze information critically, think logically, and solve complex problems.Applying scientific methods, mathematical reasoning, and logical approaches to real-world situations

Program Specific Outcomes

Sr No	PSOs in brief
PSO1	Understand the fundamentals and applications of programming, Data Structures, Databases, Networking, Internet of Things,Mobile Computing, Information security and Data Analytics.
PSO2	Effectively integrate I.T. based solution in the users domain after properly analyzing the requirements and the constraints.
PSO3	Unique Knowledge of Technology in Business Applications and Computational tools for simulation.
PSO4	Ability to comprehend and write effective project reports in a multidisciplinary environment in the context of changing technologies.

Course Structure

Semester I						
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures/ Week**
PUSCA101	MAJOR	Mathematical and Statistical Techniques	Theory	100	2	4
PUSCA102	MAJOR	Python Programming	Theory	100	2	4
PUSCA103	DISCIPLINARY MINOR	Introduction to Business Technology	Theory	100	3	4
PUSCA104	SEC (Flipped Classroom)	IT Fundamentals and Problem Solving	Theory	100	2	3
PUSCA105P	MAJOR	Mathematical and Statistical Techniques - I Practicals	Practical	50	2	2
PUSCA106P	MAJOR	Python Programming Practicals + Introduction to Business Technology Practicals	Practical	100	2	2
PUAEC101	AEC	Effective Communication Skills	Theory	100	2	3
PUVAC	VAC	Human Values	Theory	100	2	3
PUIKS101	IKS	Indian Knowledge System - I	Theory	100	2	3
PUIDC	IDC	To Be taken from the Pool	Theory	100	3	3
Total				950	22	33
All Subjects having Field Project as part of Continuous Assessment-2						

Abbreviations:

IDC: Interdisciplinary Course
AEC: Ability Enhancement Course
SEC: Skill Enhancement Course
IKS: Indian Knowledge System
VAC: Value Added Course

Semester II						
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures/ Week**
PUSCA201	MAJOR	Core JAVA	Theory	100	2	4
PUSCA202	MAJOR	Statistical Methods and testing of Hypothesis	Theory	100	2	4
PUSCA203	DISCIPLINARY MINOR	Web Programming	Theory	100	3	4
PUSCA204	SEC (Flipped Classroom	Computer Networks	Theory	100	2	3
PUSCA205 P	MAJOR	Core JAVA Practicals	Practicals	50	2	2
PUSCA206 P	MAJOR	Statistical Methods and testing of Hypothesis Practicals + WebProgramming Practicals	Practicals	100	2	2
PUAEC201	AEC	Indian Languages from pool	Theory	100	2	3
PUVAC	VAC	Environmental Management and Sustainability	Theory	100	2	3
PUIKS201	IKS	Indian Knowledge System - II	Theory	100	2	3
PUIDC	IDC	To Be taken from the Pool	Theory	100	3	3
Total				950	22	33
All Subjects having Field Project as part of Continuous Assessment-2						

Abbreviations:

IDC: Interdisciplinary Course

AEC: Ability Enhancement Course

SEC: Skill Enhancement Course

IKS: Indian Knowledge System

VAC: Value Added Course

Evaluation Pattern

Marking Code	Marking Scheme
A	60 Marks Final Exam, 20 Marks Internal Exam, 20 Marks Project.
B	60 Marks Final Exam, 40 Marks Internal Exam.
C	100 marks distributed within report /case study/ project/ presentation etc.
D	50 Marks Practical Examination.

SEMESTER I

Course Code	Course Type	Course Title	Evaluation Pattern
PUSCA101	MAJOR	Mathematical and Statistical Techniques	A
PUSCA102	MAJOR	Python Programming	A
PUSCA103	DISCIPLINARY MINOR	Introduction to Business Technology	A
PUSCA104	SEC (Flipped Classroom)	IT Fundamentals and Problem Solving	B
PUSCA105P	MAJOR - PRACTICAL	Mathematical and Statistical Techniques - I Practicals	D
PUSCA106P	MAJOR - PRACTICAL	Python Programming Practicals + Introduction to Business Technology Practicals	D

SEMESTER II

Course Code	Course Type	Course Title	Evaluation Pattern
PUSCA201	MAJOR	Core JAVA	A
PUSCA202	MAJOR	Statistical Methods and testing of Hypothesis	A
PUSCA203	DISCIPLINARY MINOR	Web Programming	A
PUSCA204	SEC (Flipped Classroom)	Computer Networks	B
PUSCA205P	MAJOR - PRACTICAL	Core JAVA Practicals	D
PUSCA206P	MAJOR - PRACTICAL	Statistical Methods and testing of Hypothesis Practicals + WebProgramming Practicals	D

SEMESTER I

BOS	Mathematics & Statistics
Class	F.Y.B.C.A
Semester	I
Course Name	Mathematical Techniques
Course Code	PUSCA101
Type of Course	Major
Level of the Subject	Basic
Credit Points	2

Course Objectives:

1. To provide students with a solid understanding of fundamental mathematical concepts, including algebra, trigonometry, calculus, and geometry, necessary for advanced studies in various disciplines.
2. Developing Problem-Solving Skills: To enhance students' problem-solving abilities by exposing them to a wide range of mathematical problems and teaching them systematic problem-solving techniques and strategies.

Unit No.	Name of Unit	Topic No.	Contents	Hours
1	IKS	1.1	Introduction, Addition, Subtraction Multiplication ,Division	10
		1.2	Duplex of any Digit Number Straight Squaring using Duplex Method Square Root Using Duplex Method	
		1.3	Calendar- estimation using vedic maths	
2	Introduction to linear algebra	2.1	Definition, Types of matrices, algebra of matrices, Determinant of a matrix (up to 3 by 3 order), Eigen values & Eigen vectors.	10
		2.2	Computing Terms of a Recursively Defined Sequence, Solving Recurrence Relations by Iteration , Recursion Tree Method	
		2.3	Definition, Magnitude of Vectors, Vector Arithmetic-Addition, Subtraction , Scalar Multiplication of Vectors	

			, Product - Dot Product, Cross Product	
3	Introduction to statistics	3.1	Data collection methods: attribute, variable, discrete and continuous variable, Frequency distribution tables: Grouped and ungrouped frequency distribution tables	10
		3.2	Measures of central tendency: Mean, Median, Quartiles, and mode for raw data, discrete, grouped frequency distribution.	
		3.3	Absolute & relative measures: Range, Quartile deviation, Mean deviation from mean , Variance and standard deviation, Relative measures: Coefficient of Range, Coefficient of Quartile Deviation, coefficient of variation for raw data, discrete and grouped frequency distribution	
4	Correlation, Regression &	4.1	Correlation : Types of correlation; perfect positive, moderate positive, perfect negative, moderate negative and absolute no correlation with scatter diagram.	10
		4.2	Karl Pearson's coefficients of correlation, Spearman's Rank correlation coefficient with and without repeated rank	
		4.3	Regression equations of Y on X and X on Y using regression coefficients method . Properties of the regression equation.	
TOTAL NO. OF LECTURES				**40**

Course Outcomes:

1. Identify the ise and applications of vedic math in IKS.
2. Recognises the Eigenvectors and Eigenvalues , and identifies the rank of matrices .
3.Analyse and compare different sets of data. Also classify the data
4. Calculate and interpret the various measures of central tendency,
5. Constructing the lines of regression .
6. Estimating the relation between the variables

References:

1. Discrete Mathematics with applications, Susanna. S. Epp, Cengage Learning Publication, 4th edn.
2. Discrete Mathematics, Saymour Lipschutz, Marc Lipson, Tata MC Graw hill
3. Discrete Mathematics and its applications, Kennith H Rosen, Tata MC Graw hill

4. linear algebra , Gilbert strang
5. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi

CASE STUDY

1

Relationship Between Study Hours and Exam Scores

A university professor wants to investigate the relationship between the number of hours students study and their exam scores. To accomplish this, the professor collects data from a sample of 10 students. The table below shows the hours studied (independent variable, X) and the corresponding exam scores (dependent variable, Y) for each student:

Student	Hours Studied (X)	Exam Score (Y)
1	2	60
2	3	65
3	4	70
4	5	75
5	6	80
6	7	85
7	8	90
8	9	95
9	10	100
10	11	105

2	**Supermarket Sales** ABC Supermarket is analyzing its sales data for the past month. They are interested in understanding the average sales figures for different departments to better allocate resources and plan promotions. The following table summarizes the sales data for five departments (A, B, C, D, and E) for the month of March:

Department	Sales (in USD)
A	10,000
B	8,500
C	12,000
D	9,500
E	11,500

BOS	Mathematics and Statistics
Class	F.Y.B.C.A
Semester	I
Course Name	Mathematical and Statistical Techniques Practical
Course Code	PUSCA105P
Type of Course	Practical

Practical No.	**Details**	**Hours**
1.	Introduction to R-Software : Basic commands in R	2
2.	Graphs and Diagram : Bar , Histogram, Pie, frequency polygon	2
3.	Matrix Operations : Addition, Subtraction, Multiplication,Power of a matrix	2
4	Rank & Inverse of Matrices	2
5.	Measures of Central Tendency: Mean , median, mode, quantiles of ungrouped data	2
6.	Measures of Central Tendency: Mean , median, mode, quantiles of grouped data	2
7.	Measure of Dispersion: Absolute & relative measures of grouped data	2
8.	Measure of Dispersion: Absolute & relative measures of ungrouped data	2
9.	Correlation & Scatter diagram: Karl Pearson's correlation coefficient	2
10.	Regression - line of regressions	2
No. of Lectures		20

BOS	Computer Science
Class	F.Y.B.C.A
Semester	I
Course Name	Python Programming
Course Code	PUSCA102
Level of the Subject	Basic
Credit Points	2

Course Objectives:

1. Students will be able to acquire programming skills and Object Oriented Skills in Python
2. To develop the skill of designing Graphical user Interfaces and to develop the ability to visualize the data using Visualization libraries.

Unit No.	Name of Unit	Topic No.	Contents	Hours
1	Introduction , Control flow statement & String	1.1	**Overview:** what is python? Features of python. Installation of python. Running Python program, Interactive Mode and Script Mode. Comments,variable,keyword,DataType, Type conversion,Operators, indentation.	10
		1.2	**Order of Operations.** Conditionals and Loops: if statement, else Statement, elif Statement, while loop, for loop, break, continue, pass Statement, else statement.	
		1.3	**Strings:** String Slices, Searching, Looping and Counting, String Methods, String Comparison, String Operations.	
2	Working with Lists, Tuples & Sets	2.1	**Lists:** Defining List, Updating and Accessing Elements, traversing a List, Deleting elements from List, Built-in List Operators, basic list operation, Built-in List functions and methods	10

		2.2	**Tuples:** Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Iteration, Built-in Tuple Functions	
		2.3	**Sets:** Creating a Set, Access Set Items, Add Set Items, Remove Set Items, Loop Sets, Join Sets, Set Methods.	
3	Dictionary, Array & Functions	3.1	**Dictionary:** Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Methods.	10
		3.2	**Array:** Advantages of Array, Creating An Array, Importing the array module and numpy module, Processing the arrays.writing modules,importing objects from modules, Python Built-in built Modules (Math, Random.)	
		3.3	**Functions:** types of function, Defining-calling and returning (single and multiple) results from a function, Arbitrary arguments, Keyword arguments, default arguments, recursion,.	
4	Files , GUI Programming and Visualization	4.1	**Files:** Types of Files, Creating and reading Text Data, File Methods to read and write data, file modes, seek() method, the Pickle module ,reading and writing CSV files.	10
		4.2	**Layout management in Tkinter(pack,grid,place)** GUI Programming using tkinter (Widgets) : Button, Checkbutton, Entry, Frame, Label, Listbox, Radiobutton,	
		4.3	**Visualization library:** Gain knowledge of python visualization libraries matplotlib, etc.. create a plot of retrieved data (Scatter plot, Histogram, Line chart, Bar Chart, Pie Chart)	
TOTAL NO. OF LECTURES				40

Course Outcomes:

1. Memorize the variable usability, conditional checking, looping structure.
2. Differentiate the data storage and accessibility from various types of data storage.
3. Illustrating the functionality of breaking down the task and reusing the code using functions.
4. Building the data hierarchy using Inheritance by classes and objects.
5. Apply the functionality to store/retrieve the input and output data on the permanent basis.
6. Create the GUI applications to solve real-life problems and Develop the various graphs to visualize the data.

References:

1. Core Python Programming , Dr. R. Nageswara Rao, dreamtech, 2017
2. Fundamentals of Python: First Programs, Kenneth A. Lambert, CENGAGE 3. Learning, 2012
3. https://www.geeksforgeeks.org/python-gui-tkinter/
4. https://www.geeksforgeeks.org/turtle-programming-python/
5. Data Visualization with Python, Mario Dobler, Tim Grobmann, Packt Publishing, 2019
6. https://www.w3schools.com/python/
7. Core Python Programming (2nd Edition) by Wesley J. Chun

CASE STUDY	
1	ABC Company wants to digitize their food ordering system by creating an application that records order id, dish name, table no, quantity, customer name . (a) Write a python program to display the above mentioned details and print the message that your order is successfully placed. (b) Create a python program to display data in the form key and value where key is order id and value is dish name. (c) Write a python GUI program to create a frame and label all customer names with their ordered dish.
2	**Building a Temperature Converter Application** Imagine you've been tasked with creating a simple temperature converter application using Python. The goal is to design a user-friendly interface where users can convert temperatures between Celsius and Fahrenheit

BOS	Computer Science
Class	F.Y.B.C.A
Semester	I
Course Name	Python Programming Practicals
Course Code	PUSCA106P
Level of the Subject	Basic
Credit Points	2

Practical No.	Details	Hours
1.	a. Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old. b. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user. c. Write a program to generate the Fibonacci series. d. Conditional Statement : In a company an employee is paid as under: If his basic salary is less than Rs. 1500, then HRA = 10% of basic salary and DA = 90% of basic salary. If his salary is either equal to or above Rs. 1500, then HRA = Rs. 500 and DA = 98% of basic salary. If the employee's salary is input through the keyboard, write a program to find his gross salary. e. Write a python program to generate the various patterns.	2
2.	a. Write a program that takes two lists and returns True if they have at least one common member. b. Write a Python program to display sum of list elements c. write a program to find even and odd nos from given list	2
3.	a. Take a list, say for example this one: a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89] and write a program that prints out all the elements of the list that are less than 5. b. WAP to display cumulative elements of a given list: For eg: List is[10,20,30,40] Output: [10,30,60,100] c. WAP to remove all odd numbers from a given list d. WAP to accept values from a user and create a tuple	2

4.	a. Write a Python script to sort (ascending and descending) a dictionary by value. b. Write a Python script to concatenate the following dictionaries to create a new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60} c. Write a Python program to sum all the items in a dictionary.	2
5.	a. Write a Python program to write and read from a text file. b. Write a Python program to append text to a file and display the text. c. Write a Python program to write and read from binary file	2
6.	a. Write a program that makes use of built-in mathematical functions. b. Write a program that makes use of built-in random module functions.	2
7.	a. Write a recursive function to print the factorial for a given number. b. Write a python function to perform the basic mathematical operations. c. Write a function that reverses the user defined value. d. Write a function to check the input value is Armstrong and also write the function for Palindrome.	2
8.	a.Write a python program to study , define edit arrays and perform arithmetic operations using array module b. Write a python program to generate an array with numpy and perform following operations - traversing an array - accessing an array element - insertion and deletion of element	2
9.	a. Create a GUI based calculator using the tkinter library. b. Create a login interface and validate username and password.	2
10.	a. Write a Python program to plot the function y = x2 using the matplotlib visualization libraries. b. Write a Python programming to create a pie chart of the popularity of programming Languages. Sample data: Programming languages: Java, Python, PHP, JavaScript, C#, C++ Popularity: 22.2, 17.6, 8.8, 8, 7.7, 6.7 c. Write a Python programming to display a bar chart of the popularity of programming Languages. Use a different color for each bar.	2

	Sample data: Programming languages: Java, Python, PHP, JavaScript, C#, C++ Popularity: 22.2, 17.6, 8.8, 8, 7.7, 6.7	
Total No.of Lectures		20

BOS	Computer Science
Class	F.Y.B.C.A
Semester	I
Course Name	Introduction to Business Technology
Course Code	PUSCA103
Level of the Subject	Basic
Credit Points	2

Course Objectives:

1. Students will be able to acquire knowledge on business culture
2. To develop the skill of Communication and exploring the web.

Unit No.	Name of Unit	Topic No.	Name of Topic	Hours
1	Understanding business culture	1.1	Understanding Business Careers -The Culture of Business ,Succeeding at Work ,Business Law and Ethics ,Business Insurance	10
		1.2	Communicating through letters and email:Setting the Right Tone ,Business Letters ,Using Email	
		1.3	Communication through formal business documents:Formal Business Documents Researching a Formal Business Document, Writing a Formal Business Document ,Art and Visual Support Planning and Organizing Projects	
2	Presentations, Microsoft Excel	2.1	Communicating through presentations:Presentation Software , Creating a Presentation,Delivering the Presentation ,Using Charts,Transitions and Animations	10

		2.2	Microsoft Excel:Perform Operations with Formulas and Functions :Summarize Data by using Functions,.Perform Conditional Operations by using Functions,Format and Modify Text by using Functions	
		2.3	Create Advanced Charts and Tables:.Create and Manage PivotTables,Create and Manage Pivot Charts	
3	Exploring information technology	3.1	Information Technology,Systems and Networking:Exploring information technology,information systems,networking,Your IT Career	10
		3.2	Exploring the web:Using the internet ,internet security,laws and ethics,web page design, Application Software,Software vs. Hardware,Word Processors and Spreadsheets,Killer Apps,Microsoft Office Suite,GUIs, mobile vs. PC	
		3.3	MS Access - Overview, MS Access - RDBMS, MS Access - Objects , MS Access - Data Types, MS Access - Create Database ,MS Access - Create Tables,MS Access -Adding Data	
4	Social media	4.1	Social media:Social websites,how social sites make money,Businesses use social sites for marketing	10
		4.2	Controversies in social media,Recent developments in social media,Crowdfunding	
		4.3	Introducing Dreamweaver,Learning the interface, Defining a local site,Creating a website,Adding Content to a Site,Adding content	
TOTAL NO. OF LECTURES				**40**

Course Outcomes:

1. Understand the business communication technology
2. Illustrating different communication methods in business
3 Analyze different types of presentations
4. Explore information technology for successful IT Career
5.Understand the controversies in social media
6. Create the Dreamweaver with interface

References:

1.Introduction to Business Technology ,Dr. Betty J. Brown ,McGraw Hill Education
2.https://edu.gcfglobal.org/en/business-communication/business-writing-essentials–
3.https://www.managebt.org/book/introduction/introduction-to-business-technology-standard/
4.Business Communication for Success , University of Minnesota
5. "Information Technology for Management: Advancing Sustainable, Profitable Business Growth" by Efraim Turban, Linda Volonino, and Gregory R. Wood

CASE STUDY	
1	ABC Company is a manufacturing company launched in 2000.They started their business on producing materials like engine,gearbox etc.By the year 2008,they observed the sales declined sharply due to the unavailability of transport vehicles.The company when discussed with stakeholders ,it came in observation that the report analysis in every financial year was not updated and shared with the stakeholders on time .With the reference of this case suggest the company
2	Security and disaster training is identified as a top Information Technology (IT) required skill that needs to be taught in Information Systems (IS) curriculums. Accordingly, information security and privacy have become core concepts in information system education. Providing IT security on a shoestring budget is always difficult and many small universities are challenged with balancing cost and effectiveness. Many colleges and universities have additional security challenges, such as relaxed working environments, less formalized policies and procedures, and employees that “wear many hats.” Therefore, it is not surprising to note that the majority of data breaches since 2005 occur in educational settings. So, it is imperative that this segment (i.e., educational settings) be represented in classroom discussions to prepare future employees.

BOS	Bachelor of Computer Application
Class	F.Y.B.C.A
Semester	I
Course Name	Introduction to Business Technology Practical
Course Code	PUSCA106P
Level of the Subject	Basic
Credit Points	2

Practical No.	Details	Hours
1	**Email (Word):** i. write two proper business like emails in Microsoft Word ii. Create a demand draft for SY BCA tuition fees	2
2	i. Create a Mathematics Question paper ii. Draw a flowchart in word.	2
3	**PowerPoint** Demonstrate use of Microsoft Powerpoint by creating presentation of minimum 5 slides(use graphics, insert images, tables, bullets, videos, links, font formatting etc)	2
4	**Excel** i. Introduction to MS Excel files, Workbooks, Worksheets, Columns and Rows. Formatting Worksheets (AutoFill, Numeric formats, previewing worksheets.)	2
5	i. Header and Footers. Number, Commas and Decimal numeric formats.	2

	ii.Working with Formulas (Maximum, Minimum, Average, Count and Sum).Percentage Numeric Formats.	
6	**Advanced Excel:** i. Conditional Formatting ,Sorting, Subtotal, AdvanceFiltering	2
7	i. Pivot Tables- Building Pivot Tables, Pivot Table regions, Rearranging Pivot Table , ii. What-if Analysis ,Conditional Functions	2
8	**Access** Create a database for a grocery store in access	2
9	**Dreamweaver** i. Demonstrate usage of dreamweaver software.	2
10	**Dreamweaver** ii. Create a website using Dreamweaver MX	2
TOTAL NO. OF LECTURES		20

BOS	Bachelor of Computer Application
Class	F.Y.B.C.A
Semester	I
Subject Name	I.T. Fundamentals and Problem solving
Type of course	SEC (Flipped Classroom)
Level of the Subject	Basic
Credit Points	2

Course Objectives:

1. To gain insights into Problem and building blocks of solution
2. To obtain deep insight into computer organization and architecture

Unit No.	Name of Unit	Topic No.	Content	Hours
1	Introduction to Problem Solving	1.1	Fundamentals of Problem Solving: What is a problem? Problem with problem Solving, Strategy for problem solving. Linking Problem Solving concept with Programming: coding versus problem solving	7
		1.2	Why do we write Programs? and What are they? How to think like a programmer? Defining the Problem and finding the solution: define the problem, Find the solution, Evaluate alternative solutions	
2	Building blocks of Solution Representation	2.1	Primitives: Input, Process, and Output, Variables and Constants, Data Types, Using Operators. Algorithm: Algorithm Definition, Types of Algorithm, Properties of Algorithm and Structure	8
		2.2	Flowchart: symbols used in flowcharts, sequencing the task, Representing Decisions in a Flowchart,Represent the solution as an	

			algorithm,Convert Algorithm into flowchart.	
		2.3	Converting Algorithm to Program: Understanding the program execution process, Types errors and debugging, Programming style and Quality	
3	Introduction to IT Fundamentals	3.1	Basic Computer Architecture and Design: Instruction codes, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit, Instruction Formats, , Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC	7
		3.2	Number Systems: Binary, Decimal, Octal, Hexadecimal and their interconversions. Computer Arithmetic: Binary addition and subtraction using signedMagnitude, 1's complement and 2's complement	
4	Digital logic circuits	4.1	Boolean algebra: Basic identities of Boolean Algebra, Boolean function (b) Logic Gates: AND, OR, NOT, NOR, NAND, EX-OR EX-NOR operations and their truth table, Simplification of boolean expression, K-maps	8
		4.2	Digital Circuits: Half Adder, Full Adder, Binary adder-subtractor, Multiplexers, Encoder and decoder. Flip Flops: Concept of sequential circuits, concept of clock and synchronization, Types of Flip flops, concept of counters and registers	
TOTAL NO. OF VIDEOS				**30**

Course Outcomes:

1. Examine a problem and find a logical solution for the same.
2 Apply logic building techniques to write actual programs.
3 . Evaluate the concept of writing a good program.
4**.** Describe the Number system and memory hierarchy
5. Discuss the boolean algebra with basic identities and logic gates
6. Classify different types of digital circuits including concept of sequential circuits

References:

1. Computer organization and architecture: William Stallings, PHI, Sixth edition
2. Computer System architecture: M. Morris Mano, PHI,
3. http://kc.niitstaff.com/NIITStaffUpgrade/CG/IEC%20Track%203%20-Information%20System/CFS/04_PLT/02_SM1_PLT_CG.pdf - UNIT II (Flowchart)
4. https://www.freecodecamp.org/news/how-to-think-like-a-programmer-lessons-in-problem-solving-d1d8bf1de7d2/ UNIT I (Problem Solving)
5. https://www.studocu.com/en-au/document/monash-university/computer-programming/lecture-notes/guide-to-problem-solving-and-program-design/1290996/view UNIT III (Solution Representation)

SEMESTER II

BOS	Computer Science
Class	F.Y.B.C.A
Semester	II
Course Name	Core Java
Course Code	PUSCA201
Type of course	Discipline Specific Core
Level of the Subject	Medium
Credit Points	2

Course Objectives:

1. To understand the basic concepts and fundamentals of platform independent object oriented language.
2. To understand basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.

Unit No.	Name of Unit	Topic No.	Content	Hours
1	**Fundamentals of Oops Programming**	1.1	**Introduction to Oops** : What is Object Oriented? Basic Concepts of OOPS: Objects, Classes, Data Abstraction and Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding. **Configuration of Java** : How to install java, java development kit (JDK, JRE, JVM, JIT), Features of java. How to set a path in java? Setting the path environment variable.	10
	Introduction to Java Programming Environment	1.2	**Introduction to Java**: Java Compiler and Interpreter, java programs, structure of java program, keywords, Comments, Data types, variables (declaration, types, naming	

			convention rules) and Constants, operators, Type casting. Input from keyboard.	
2	**Selection statements, Looping Statements & Jumping Statements**	2.1	**Control Flow Statements**: if, if...else Statement, The switch...case Statement **Iterative Statement**: The while Loop, The do ... while Loop, The for Loop, The for each Loop, nested loops. **Branching Statements**: The break and continue & return statement. Arrays.	10
	Classes & Objects	2.2	**Classes & Object**: Defining a class, Instantiating Objects from a class, methods, accessing a method, method returning a value, method's arguments, method overloading, variable arguments[Var args], static field and static methods.	
3	**Constructor**	3.1	**Constructor:** Constructor and its types, constructor overloading, this keyword, String and StringBuffer class, Creating Packages, Default Package, Importing Package.	10
	Inheritance	3.2	**Inheritance:** Inheritance and Access Control, Types of inheritance, super keyword, Method Overriding.	
4	**Abstraction**	4.1	**Abstract Classes**: Abstract Classes, Abstract methods, **Interfaces**: Interfaces, What is an Interface? How is an Interface different from an Abstract class? Multiple Inheritance, Lambda Expressions.	10
	Exception Handling	4.2	**Exception Handling :** What is Exception in Java? What is Exception Handling? Hierarchy of Java Exception classes, Types of Java Exceptions, Difference between Checked and Unchecked Exceptions, Java Exception	

			Keywords (try , catch , finally, throw & throws) , Examples	
TOTAL NO OF LECTURES				**40**

Course Outcomes:

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Understand the basic concept of string handling and control flow statements.
3. Explain the concepts of classes, objects , methods & constructors.
4. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
5. Apply the concepts of Exception handling to develop efficient and error free codes.
6. Design simple command line applications which mimic real world scenarios.

References:

1. Core Java 8 for Beginners- vaishali Shah,SharanamShah,publisher- SPD,1st Edition.
2. Java :The Complete Reference -Herbert Schildt, Publisher -Tata McGraw Hill ,9th Edition.
3. Murach's Beginning Java with Netbeans -Joel Murach , Michael Urban,Publisher- SPD,1st Edition
4. Core Java, Volume I:Fundamentals-Horstmann,Publisher- Pearson ,9th Edition.
5. "Java: A Beginner's Guide" by Herbert Schildt

CASE STUDY	
1	A-Z company is a perfect service provider for all the IT and software development requirements. The team leverages their knowledge in completing the projected goals and makes it possible to build the ideas as per the market demands. Apart from focusing on just making a website, the team of experts always focus on designing a platform that can take the client's business to another level.They always blend expertise, innovation & technology to design innovative masterpieces. Client satisfaction is what matters the most for the people at the A-Z company. The company is going to develop a Java project on the Student Management System . ● How to define a class student with attributes roll no and name. ● How to define the default constructor of a student class. ● What will be methods that can be implemented in all required classes? ● Create an interface of the student class defining all the methods. ● Can the count of Objects created. ● How to create a parameterized constructor of student class and use this keyword in it.

2	RBI bank declares to give interest to all the bank's customers. Now each nationalized bank will give different rates of interest to its customers. Nationalized bank are SBI,PNB,BOB,IOB ● Which concept will be best suitable to achieve the result and why ● Write the program to achieve the goal ● RBI wants to see the rate of interest given by all the banks

BOS	Computer Science
Class	F.Y.B.C.A
Semester	II
Course Name	Core Java Practical
Course Code	PUSCA206P
Level of the Subject	Medium
Credit Points	2

Practical No	**Details**	**Hours**
1	a. Write a Java program that takes a number as input and prints its multiplication table upto 10. b. Write a Java program to print the area and perimeter of a circle.	2
2	Write a program to perform following tasks : a) Factorial b) Armstrong c) Prime Number d) Fibonacci series e) Palindrome	2

3	Write a Java program to print following patterns
	a)
	*
	**
	***
	b)
	  *
	 * *
	* * *
	c)
	* * *
	 * *
	  *
		2

4	a. Write a Java program to perform assending order on given 1-Dimension array. b. Working with 2-D arrays.	2
5	a. Write a Java program to implement methods, method overloading . b. Write a Java program to work with constructors, constructor overloading.	2
6	a. Write a Java program to reverse a string and also check whether it is a palindrome or not. b. Write a java program to working with string functions.	2
7	a. Write a Java program to implement differents types of Inheritance. b. Write a Java program to implement method overriding, super keyword & this keyword.	2
8	a. Write a Java program to demonstrate the implementation of abstractration(abstract class & inheritance) b. Write a Java program to work with lambda expression.	2
9	a. Write a Java program to implement exception handling by using try...catch & finally block.	2

10	Write a Java Order driven application which contains following operation: Enter Your Name : Enter Your Address : Select option : 1. Misal Pav : Rs. 50/- 2. Pizza : Rs. 250/- 3. Samosa : Rs. 15/- After confirm order : Show all the details with appropriate bill amount.	2
Total No of Lectures		20

BOS	Mathematics & Statistics
Class	F.Y.B.C.A
Semester	II
Course Name	Statistical Methods & Testing of Hypothesis
Course Code	PUSCA202
Type of Course	Core
Level of the Subject	Basic
Credit Points	2

Course Objectives:

1. To provide students with a solid understanding of fundamental statistical concepts such as probability, random variables, probability distributions, and descriptive statistics.
2. Exploring Inferential Statistics: To introduce students to inferential statistics and teach them how to make inferences about populations based on sample data, including estimation and hypothesis testing.

Unit No.	Name of the Unit	Topic No.	Name of Topic	Hours
1	IKS	1.1	Squares and square roots , Cubes and cube roots	10
		1.2	Divisibility	
		1.3	Strategies for Enhanced Mental Calculations- Nikhilam Sutra Nikhilam Sutra,Urdhva Tiryak Sutra,Ekadhikena Purvena Sutra, Anurupye Sutra, Yavadunam Tavadunikritya Varga Samam	
2	Sampling Distributions & Non parametric test	2.1	Introduction, Factors that influence sampling distribution,Types of distributions- Sampling distribution of mean/ proportion	10
		2.2	Binomial Distribution- Properties and problems based on Binomial distribution	

			Poisson Distribution- Properties and problems based on Poisson distribution	
		2.3	Normal distribution-properties and problems based on Normal distribution, Central limit theorem, Chi square distribution -definition and properties, t distribution - definition and properties , F distribution -definition and properties	
		3.1	Need of non-parametric tests, difference between parametric and non-parametric test	
		3.2	Sign test for one sample and two sample,Run test for one sample and two sample	
		3.3	Wilcoxon test, Mann-Whitney test	
		3.4	Kruskal-Wallis test, Friedman test	
3	Testing of Hypothesis (Parametric test)	3.1	Hypothesis- Null and Alternative, Types of error in hypothesis testing, level of significance,One tailed two-tailed test, critical region, p-value, Confidence interval for mean and proportion	10
		3.2	Large sample test (z test)-single mean, two means, single proportion, two proportions	
		3.3	Small sample test(t test) one sample mean, paired t test, unpaired t test	
4	ANOVA and Chi-Square test	4.1	Application and importance of ANOVA	10
		4.2	One Way ANOVA - procedure and examples	
		4.3	Chi-square test of goodness of fit , Chi-square test for association, Chi square test for independence of attributes, Yates correction	
TOTAL NUMBER OF LECTURES				**40**

Course Outcomes:

1. Identify when to use a parametric method. Different parametric methods in estimation, testing, model fitting, and in analyses.
2. Develops the ability to analyze a problem and understand the appropriate statistical technique to analyze it.

3. Develops the use of the inferential statistical tools to analyze a problem.
4. Apply Parametric statistical hypothesis testing to make a decision.
5. Explain the results obtained using statistical tools based on a problem scenario. and introduces ANOVA for analyzing a problem in higher level .
6. Understands the tricks to do the mathematical calculations with ease.

References:

1. Ross, S.M. (2006): A First course in probability. 6th Ed^{n} Pearson
2. Kulkarni, M.B., Ghatpande, S.B. and Gore, S.D. (1999): Common statistical tests. Satyajeet Prakashan, Pune
3. Gupta, S.C. and Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi
4. Gupta, S.C. and Kapoor, V.K. (4th Edition): Applied Statistics, S. Chand and Sons, New Delhi
5. Trivedi, K.S.(2009) : Probability, Statistics, Design of Experiments and Queuing theory, with applications of Computer Science, Prentice Hall of India, New Delhi

CASE STUDY	
1	**Testing the Mean Lifetime of Fluorescent Light Bulbs** A company manufactures fluorescent light bulbs and claims that the mean lifetime of their bulbs is 1600 hours. However, there are concerns about the actual mean lifetime being less than the claimed value. As a data analyst, you have been tasked with conducting a hypothesis test to determine whether there is sufficient evidence to support the claim that the mean lifetime of the company's bulbs is indeed 1600 hours. A sample of 400 fluorescent light bulbs produced by the company has been selected for analysis. The sample has a mean lifetime of 1570 hours with a standard deviation of 150 hours.
2	**Analyzing Customer Satisfaction Levels in a Restaurant Chain** A restaurant chain wants to assess the satisfaction levels of its customers across different locations. They have collected data on customer feedback regarding their dining experience, categorized into three satisfaction levels: "Satisfied," "Neutral," and "Dissatisfied." The restaurant chain aims to determine if there is a significant difference in customer satisfaction levels among its various locations. As a data analyst, you are tasked with conducting a Chi-square test to analyze the data and provide insights to the management.

The dataset consists of customer feedback collected from five different restaurant locations. For each location, the number of customers falling into each satisfaction category (Satisfied, Neutral, Dissatisfied) is recorded.

Location	Satisfied	Neutral	Dissatisfied
A	60	30	10
B	50	35	15
C	70	25	5
D	55	20	25
E	45	40	15

BOS	Mathematics and Statistics
Programme	F.Y.B.C.A
Semester	II
Course Name	Statistical Methods and Testing of Hypothesis using R tool (Practical)
Course Code	PUSCA206P
Type of Course	Discipline Specific Core
Level of the Course	Medium

S.N.	Topic	Hours
1	Basic inbuilt commands in R for testing of hypothesis	2
2	R program on Binomial distribution	2
3	R program on Poisson distribution	2
4	R program on Normal distribution	2
5	R program on one sample and two sample mean Z test	2
6	R program on one sample and two sample proportion Z test	2
7	R program on unpaired t test	2
8	R program on paired t test	2
9	R program on Chi square test	2
10	R program on ANOVA	2
TOTAL NO OF LECTURES		20

BOS	Computer Science
Class	F.Y. B.C.A
Semester	II
Course Name	Web Programming
Course Code	PUSCA203
Type of Course	Discipline Specific Core
Level of the Subject	Basic
Credit points	2

Course Objectives:

1.To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting, and database connectivity.

2.To provide insights of the internet programming and how to design and implement applications over the web

Unit No.	Name of Unit	Topic No.	Content	Hours
1	HTML5 , CSS	1.1	**HTML5:** Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, using lists and backgrounds, Tables in HTML,Creating navigational aids: planning site organization, creating text based navigation bar, creating graphics based navigation bar, Images on a Web Page, Image Formats, Image Maps,Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page.	10

		1.3	**CSS:** Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element	
2	JavaScript	2.1	JavaScript: Using JavaScript in an HTML Document, Programming Fundamentals of JavaScript – Variables, Operators, Control Flow Statements, Jumping Statements Functions – Defining and Invoking a Function,	10
		2.2	JavaScript Objects -Form Validation using JavaScript . Events and Event Handlers : General Information about Events, Defining Event Handlers, event : onClick, onDblClick, onBlur, onFocus, onSubmit.Popup Boxes : Alert, Confirm, Prompt.	
3	Introduction to PHP	3.1	PHP: Variables and Operators, comment type, Program Flow, Working with Files and Directories, Working with arrays, functions : with argument and return statement, passing information with PHP using GET, POST.	10
		3.2	Formatting form variables, strings and string functions, regular expressions, number handling.Working with Databases,working with Cookies, session .	
4	Introduction to Bootstrap	4.1	JSON– Introduction,Overview,Syntax,Data Types,Objects,Comparison JSON with PHP Introduction to Bootstrap :What is	10

			Bootstrap , Advantages of Bootstrap Framework	
		4.2	Using Dalle 3 for designing web page elements (logo, assets, etc.) Using chatgpt to understand the structure and code of existing web pages. (Type any web page Url in chatgpt and ask to give its code) Uploading existing code base on chat gpt to optimize it and improve Create an end to end functional webpage completely using A.I (use chat gpt, Dalle 3, mid journey, and pika labs for video).	
TOTAL NUMBER OF LECTURES				40

Course Outcomes:

1. Identify basic HTML tags to write HTML programs and use concepts such as Table, Forms, Navigation etc..
2. To understand the basic concept of Cascading Style Sheets(CSS).
3. Examine the factors of Javascript code And determine the concept of Event Handling, popup boxes..
4. Analyzing the change in Validating a Form through Javascript.
5. Evaluate the role of PHP in Web Programming and apply PHP code on web pages to handle backend of any Web page.
6. To learn and create advanced standalone GUI concepts using bootstrap.

References:

1. Jon Duckett’s HTML and CSS:
2. A beginner’s guide to HTML, CSS, Javascript, and Web Graphics, by Jennifer Niederst Robbins
3. Marijn Haverbake’s Eloquent Javascript:
4. Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML by Robin Nixon

CASE STUDY	
1	Jane, an aspiring web developer, aims to create a personal portfolio website to showcase her skills and projects.Jane needs to master HTML5, CSS, JavaScript, PHP, and Bootstrap to structure content, style elements, add interactivity, and ensure responsiveness.Jane;s website will feature her bio, portfolio projects, contact form, and social media links, demonstrating her web development skills and facilitating communication.By building her portfolio website, Jane gains practical experience and establishes an online presence, laying a foundation for her future career.
2	Web development is the same as society. Just like we require a plan, society permit and license from the city , web development also requires documents, appropriate server , designing and a programming language. Since the standards of web designing are always increasing and so is the complexity of the technology required, frameworks have now become a crucial part of developing websites or web applications. It is absolutely unreasonable to reinvent the wheel, thus for designing rich and attractive websites , it is very much sensible to use frameworks endorsed by developers all over the world.Django,Angular, Spring, React, Vue, Express are some of the well- known web development frameworks.

BOS	Computer Science
Class	F.Y. B.C.A
Semester	II
Course Name	Web Programming Practical
Course Code	PUSCA206P
Level of the Subject	Basic
Credit points	2

Practical No.	**Details**	**Hours**
1	Design a Web Page in HTML That Makes a Use of Following Concepts: i) Text Formatting Tags ii) List Elements iii) Image Tag iii) Image Mapping	2
2	Design a Web Page in HTML That Makes a Use of Table Tag: i) Simple Table ii) Rowspan iii) Colspan	2
3	Design a Web Page in HTML to perform i) Hyperlink ii) Navigation. iii) Multimedia iv) Form	2
4	Design a Web Page to Perform CSS Properties: i) Inline CSS ii) Internal CSS iii) External CSS	2

5	Write a Javascript Code to perform i) Operators, ii) Control Flow Statements and iii) Functions.	2
6	Write a Javascript Code to perform i) Popup Boxes, ii) Events and iii) form validation.	2
7	Write a HTML Code with Bootstrap Classes to perform following programs.(Buttons,Table,Images,Typography)	2
8	Write a HTML Code with Bootstrap Classes to perform following programs.(Basic Form, Navigation, Icons)	2
9	Write a HTML Code with Bootstrap Classes to perform following programs: i) Bootstrap ProgressBar ii) Panel iii) Alerts iv) Well v) Carousel	2
10	Write a PHP Code to perform Following Programs : i) If-else ii) Array iii) Functions iv) String Functions v) Cookies vi) Get and Post	2
Total No of Lectures		20

BOS	BCA
Class	F.Y.B.C.A
Semester	II
Course Name	Computer Networks
Course Code	PUSCA204
Type of course	SEC (Flipped Classroom)
Level of the Subject	Medium
Credit points	2

Course Objectives:

1. The course introduces main concepts of networking ; application areas; layers of TCP/IP
2. To develop an understanding of computer networking basics.

Unit No.	Name of Unit	Topic No.	Content	Hours
1	Introduction	1.1	Definition of Computer Network, Nodes,Communication Link, Data Flow, Network Topology, Network types.	10
		1.2	Protocol Layering: Network Models: OSLayered Architecture, TCP/IP Protocol Suite,	
		1.3	Signals: Data and Signals, Analog and Digital Data, Analog and Digital Signals, Sine Wave Phase, Wavelength, Time and Frequency Domains, Bandwidth, Digital Signal, Bit Rate, Bit Length	

		1.4	Transmission of Digital Signals, Transmission Impairments, Attenuation, Distortion, Noise, Data Rate Limits, Performance, Bandwidth, Throughput, Latency (Delay)	
2	Introduction to Physical Layer	2.1	Introduction: Digital Transmission, digital-to- digital conversion, Line, Coding,Line Coding Schemes, analog-to-digital conversion	10
		2.2	Transmission modes and Modulation: Transmission Modes,Parallel Transmission, Serial Transmission.	
		2.3	Multiplexing:Multiplexing, frequency-Division Multiplexing, Wavelength-Division Multiplexing Time-Division Multiplexing.	
		2.4	Transmission Media, Guided Media, Twisted- Pair Cable, Coaxial Cable, Fiber-Optic Cable. Switching, Three Methods of Switching , Circuit Switched Networks, Packet Switching	
3	Introduction to Data- Link Layer	3.1	Introduction to Data-Link Layer: Services, Two Sub-layers: MAC, LLC Three Types of addresses, Address Resolution Protocol(ARP)	10
		3.2	Error Detection and Correction: Introduction, Types of Errors, Redundancy, Detection versus Correction, Simple parity check code, Hamming distance, Hamming code, CRC, Checksum	

		3.3	Media Access Control (MAC), random access, CSMA, CSMA/CD, CSMA/CA	
4	CSMA , Addressing and Routing	4.1	Connecting Devices and Addressing: Virtual LANs, connecting devices, Hubs, Link-Layer Switches, Routers,	10
		4.2	Introduction to Network Layer, Routing and Forwarding, IPv4 addresses, Address Space, Classful Addressing	
		4.3	Routing : Unicast Routing, Least-Cost Routing, Routing Algorithms: Distance Vector Routing, Link-State Routing, Path Vector Routing	
		4.4	Introduction to Transport Layer, Transport- Layer Services, Connectionless and Connection- Oriented Protocols. UDP: Service, Port Numbers, User Datagram Protocol User Datagram TCP: Service, Port Numbers, TCP Features, Segment format, TCP connections,	
TOTAL NO. OF LECTURES				30

Course Outcomes:

1. Identify basic computer network technology.
2. Explain Data Communications System and its components.
3. Compare the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5. Apply different types of network devices and their functions within a network .
6. Build the skills of subnetting and routing mechanisms.

References:

1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2013.
2. Computer Network, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, Pearson Education, 2011.
3. Computer Network, Bhushan Trivedi, Oxford University Press
4. Data and Computer Communication, William Stallings, PHI
5. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ros

Course Name	Computer Networks Practical
Type of course	SEC
Level of the Subject	Medium
Credit points	2

Practical No	**Details**
1.	Understanding the working of NIC cards, Switches, Hub, Gateway router
2.	Crimping of Twisted-Pair Cable with RJ45 connector for Straight Through and Cross-Over, Roll-Over.
3.	Using Packet Tracer, Create a basic network of different devices(Router, Switch,PC) using appropriate network wire.
4.	Problem solving with IPv4, which will include concept of Classful addressing.
5.	Using linux-terminal or Windows-cmd, execute the following networking commands and note the output: ping, traceroute, netstat, arp, ipconfig.
6.	Using Packet Tracer, Configure the network with static routing using protocol.
7.	Using Packet Tracer, Configure the network with dynamic routing using RIP,OSPF protocol.
8.	Using Packet Tracer, connect a network with three layer two switches and every switch will have four computers. Verify their connectivity with each other
9	Using Packet Tracer, create a wireless network of multiple PCs using appropriate access point to block/unblock wireless connection
10.	Using Wireshark, network analyzer, set the filter for ICMP, TCP, HTTP, UDP, FTP and perform respective protocol transactions to show/prove that the network analyzer is working.