

**PUNYASHLOK AHILYADEVJI HOLKAR  
SOLAPUR UNIVERSITY, SOLAPUR**



**Name of the Faculty: Science and Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: Entire Computer Science**

**Name of the Programme: B.Sc.[ECS]-II (Sem.–III and IV)**

**(Syllabus to be implemented w.e.f. June 2023)**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

**B. Sc.[ECS] - II year (Entire Computer Science)**

**Syllabus (Semester – III and IV)**

**(Choice Based Credit System)**

**With Effect from June 2023**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**  
**Faculty of Science and Technology**

**Choice Based Credit System (CBCS),(w.e.f. 2023-24) Revised Structure for B.Sc.(Entire Computer Science)-II**

Subject/ Core Course	Type	Name and Type of the Paper		Paper / Practical No	Hrs./week			Total Marks Per Paper	UA	CA	Credits	
		Name			L	T	P					
<b>B.Sc.(Entire Computer Science)-II Sem-III</b>												
****Core Courses  DSC 1C and DSC 2C are compulsory while student can select either # DSC 3C/GE-3C or AIC-1A as a third subject.	DSC 1C	Data Structure using C++-I		Paper- V	3	-	--	50	40	10	4.0	
		Linux OS and Shell Scripting		Paper-VI	3	-	--	50	40	10		
	DSC 2C	Software Engineering		Paper- V	3	-	--	50	40	10	4.0	
		Database Management System-I		Paper-VI	3	-	--	50	40	10		
	#DSC 3C	#DSC 3C	Probability Theory	AIC- 1A	Paper- V	3	-	--	50	40	10	4.0
			Data Science with Python		Paper-VI	3	-	--	50	40	10	
<b>Total</b>					<b>18</b>	<b>-</b>	<b>--</b>	<b>300</b>	<b>240</b>	<b>60</b>	<b>12</b>	
\$SEC-1		Web Development using PHP			4			100	80	20	4	
<b>B.Sc.(Entire Computer Science)-II Sem-IV</b>												
****Core Courses	DSC 1D	Data Structure using C++ -II		Paper-VII	3	-	--	50	40	10	4.0	
	Core Java		Paper- VIII	3	-	--	50	40	10			

DSC 1D and DSC 2D are compulsory while student can select either # DSC 3D/GE-3D or AIC-1B as a third subject.	DSC 2D	Software Testing		Paper-VII	3	-	--	50	40	10	4.0
		Database Management System-II		Paper-VIII	3	-	--	50	40	10	
	#DSC 3D	Descriptive Statistics	AIC-1A	Paper-VII	3	-	--	50	40	10	4.0
		Data Visualization		Paper-VIII	3	-	--	50	40	10	
<b>Total</b>					<b>18</b>			<b>300</b>	<b>240</b>	<b>60</b>	<b>12</b>
Environmental Studies					3			50	40	10	NC
<b>Total (Theory)</b>					<b>36</b>	-	--	<b>600</b>	<b>480</b>	<b>120</b>	<b>24</b>
Core Practical	DSC 1C and 1D	Practical I			--	-	8	200	160	40	8.0
	DSC 2C and 2D	Practical II			--	-	8	200	160	40	8.0
	DSC 3C and 3D	Practical III			--	-	8	200	160	40	8.0
<b>Total (Pract.)</b>							<b>24</b>	<b>600</b>	<b>480</b>	<b>120</b>	<b>24</b>
<b>Grand Total</b>					<b>36</b>		<b>24</b>	<b>1200</b>	<b>960</b>	<b>240</b>	<b>48</b>
SEC					<b>4</b>			<b>100</b>	<b>80</b>	<b>20</b>	<b>4</b>

\*\*\*\*Core Courses: DSC 1C, DSC 2C, DSC 1D and DSC 2D (Core computer science courses)

# Generic Electives: DSC 3C and DSC 3D : Statistics

Additional Interdisciplinary Courses - Bio informatics Optimization techniques/Computational

Geometry/Data Analytics /NCC etc.

\$The students can choose MOOCs/ NPTEL/SWAYAM/Pathshala/Add-on / Skill based courses of University/college initiated courses of same credits.

\$ These courses are not compulsory, but after completion students get additional credits on their mark lists.

\$ SEC courses run by colleges should be communicated to University for information and necessary action.

**Abbreviations:**

L: Lectures T: Tutorials P: Practical UA : University Assessment CA : College Assessment CC: Core Course  
AEC : Ability Enhancement Course DSC : Discipline Specific Course Paper SEC : Skill Enhancement Course,  
AIC: Additional Interdisciplinary Courses GE: Generic Electives

**Type: DSC 1C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Data Structure using C++-I**

**(Paper Code:V)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Understand basic data structures such as arrays, linked lists, stacks, and queues.
2. To be familiar with fundamental data structures and with the manner in which these data structures can best be implemented; become accustomed to the description of algorithms in both functional and procedural styles.
3. To have a knowledge of the complexity of basic operations like insert, delete, and search on these data structures.
4. Ability to choose a data structure to suitably model any data used in computer applications.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>An Introduction to Data Structures:</b> Introduction, Definition and Types of Data Structure. Abstract Data Type (ADT)- ADT for array, ADT for the stack, ADT for the queue. Algorithm: Definition, characteristics of the algorithm.</p> <p>The complexity of algorithm- Space complexity, time complexity, Big-O Notation Design strategies of Algorithm- Divide and Conquer, Greedy Algorithm, branch and bound, backtracking, and dynamic programming.</p> <p><b>Array:</b> Introduction to Array, types of array- one dimensional, two dimensional, and multidimensional, Operations of array- insert, delete, traverse, count, display, reverse.</p> <p><b>Stack:</b> Introduction to Stack, Operations of stack- Create, isempty, isfull, push, pop, display, Implementation of stack using an array (Static Implementation)</p> <p>Applications of Stack-Conversion of infix expression to postfix expression, Conversion of infix expression to prefix expression, Matching parenthesis in an expression (Checking</p>	<b>20</b>

	expression is valid or invalid), Evaluation of postfix expression, Stack in recursion, Implementation of applications of stack.	
<b>II</b>	<p><b>Queue:</b> Introduction to Queue, Operations of the queue- Create, isempty, isfull, insert, remove, display, Types of Queue- Linear Queue, Circular Queue, Deque (Double Ended Queue), Priority queue. Implementation of all types of queue using the array (Static Implementation), Difference between stack and queue, Applications of Queue.</p> <p><b>I. Linked Lists:</b> Introduction to Linked Lists, Difference between Array and Linked list. Types of linked list- 1) Linear linked list- Singly (Single) linear linked list and Doubly (Double) linear linked list. 2) Circular linked list- Singly (Single) circular linked list and Doubly (Double) circular linked list, Operations of linked list, Creation, Insertion, Deletion, Traversing, Searching, Display, count, reverse, Implementation of all types of linked list, Implementation of stack using linked list (Dynamic stack), Implementation of queue using linked list (Dynamic queue)</p>	<b>20</b>
<b>Books Recommended:</b>		
1.	Tanenbaum: Data structures using C and C++	
2.	Data Structures Through C in Depth- S.K.Srivastava,D.Srivastava	
3.	Fundamentals of Data Structures in C by Sahni	

**Type: DSC 1C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Linux OS and Shell Scripting**

**(Paper Code:VI)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Understand the basic commands of the linux operating system and can write shell scripts.
2. Create file systems and directories and operate those using programs.
3. Understand the process's background and foreground by process and signals system calls.
4. Create shared memory segments, pipes, and message queues and can exercise-processes communication.
5. Create sockets and semaphores to interact between processes of different system.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Introduction of Linux:</b> History of Linux, Architecture of Linux system and features, Shell and its type, Difference between Windows and Linux. Linux Distributions, Working environments: KDE, GNOME, Xface4, Installing and Configuring Linux OS.</p> <p><b>Linux File System:</b> Hierarchy of File system, File System parts-Boot Block, Super Block, Inode Block, Data Block, File types, Mounting devices (CD/DVD, USB, hard drive partition).</p> <p><b>Users and Groups Management:</b> Create and manage Users or groups, Assigning permissions to users and Groups, File and Directory permissions, chmod, chown, chgrp.</p> <p><b>Linux commands:</b></p> <p><b>File and directory Management Commands:-</b>mkdir, rmdir, cd ,pwd, file, ls, cat, more, less.</p> <p><b>File and Directory Operations:</b> find, cp, mv, rm, ln, Printing the files lpr, lpq, lprm</p> <p><b>Filter Commands and Editor:-</b>Filters: head, tail, pr, cut, paste, sort, uniq, tr, grep, egrep, fgrep, sed.</p>	<b>20</b>



	<p><b>Communication commands:</b>-mesg, talk, write, wall, mail.</p> <p><b>Text Editors:</b> vi, vim, Archive and File compression commands</p> <p><b>Shell Programming:</b> Shell Variables, Meta characters, Shell Scripts – Control and Loop structure, I/O and Redirection, Piping</p>	
<b>II</b>	<p><b>Process Management:</b> Shell process, System process, background and foreground process, Changing process priority with nice. Listing processes-jobs, ps, kill, premature termination of process.</p> <p><b>Disk Management Tools:</b> Fdisk, Parted, Boot Loaders- GRUB, LILO , Role of system administrator,</p> <p><b>Networking:</b> services and Configuration files, starting services, Network tools, ping, finger, traceroute, who, host, Protocols and Services- SMB, FTP, DHCP, LDAP, NFS and NIS.</p>	<b>20</b>
<b>Books Recommended:</b>		
1.	Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India	
2.	UNIX for programmers and users by Graham Glass and King Ables, Pearson Education	
3.	UNIX concepts and applications by sumitabha das, mcgraw hill publication	

**Type: DSC 2C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Software Engineering**

**(Paper Code:V)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Basic knowledge and understanding of the analysis and design of complex systems.
2. Ability to apply software engineering principles and techniques.
3. To produce efficient, reliable, robust and cost-effective software solutions.
4. Ability to work as an effective member or leader of software engineering teams
5. To manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals Identify and analyze the common threats in each domain.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>System concepts:</b> Introduction system, characteristics, Elements of system, Types of system, System Analysis, Role of System Analyst.</p> <p><b>Software Engineering:</b> Definition, Characteristics of software, Qualities of software.</p> <p><b>System Development life cycle:</b> Waterfall model, V-shape model, Spiral model, Prototyping, incremental, RAD, Agile.</p> <p><b>Software requirements:</b> Functional, Non-functional requirements, User requirement, System requirements, Fact finding techniques: Interviews, Questionnaire, Record reviews, Observation</p> <p><b>Analysis and Design Tools:</b> Flow charting, Decision tables, Decision Trees, Structured English, Structure charting Techniques (HIPO).</p> <p><b>System Design:</b> Data flow Diagram (Physical, Logical), Entity relation diagram, structured chart, Data Dictionary, Input and output design, Types of Dependencies,</p>	<b>20</b>

	Normalization(1NF,2NF,3NF,BCNF,4NF,5NF)	
<b>II</b>	<p><b>Coding:</b> Verification, size measures, complexity analysis, coding standards, Effort Estimation, Cost Estimation, Testing fundamentals</p> <p><b>Construction of the system:</b> traditional and incremental approaches, conversion methods, Software Implementation, Overview of maintenance process, types of maintenance.</p> <p><b>Software Quality Assurance:</b> SQA Tasks, Goals and Metrics, Software Review Techniques: Informal reviews, Formal Technical Reviews, Software Reliability. Software risk management: definition, types of risk, risk identification-risk monitoring and management.</p>	<b>20</b>
<b>Books Recommended:</b>		
1.	Analysis and Design of Information Systems By James Senn.	
2.	Practical guide to structure System Design By Miller/Page/jones.	
3.	Software Engineering By Pressman. 4. System Analysis and Design By Parthsarty	

**Type: DSC 2C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Database Management System-I**

**(Paper Code:VI)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Gain knowledge of database systems and database management systems software.
2. Ability to model data in applications using conceptual modelling tools such as ER Diagrams and design data base schema based on the model.
3. Formulate, using SQL, solutions to a broad range of query and data update problems.
4. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
5. Be acquainted with the basics of transaction processing and concurrency control.
6. Familiarity with database storage structures and access techniques.
7. Analyse strengths and weaknesses of the applications of database technologies to various subject areas.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Introduction to database management system:</b> definition, limitations of traditional file system, advantages of dbms, components of dbms, database users, database structure database architecture- 2-tier and 3 level (schema) tier architecture, instances and schemas, database languages, data independence, types of data models(hierarchical, network, relational, hybrid).</p> <p><b>Conceptual design:</b> ER-model: entities, attributes and its types, relationship, relationship sets, generalization, specialization, aggregation</p> <p><b>Relational database concepts:</b> introduction and features of RDBMS, difference between DBMS and RDBMS, 12 codd's rules.</p>	<b>20</b>

	<p><b>DDL commands:</b> create, alter, rename, truncate, drop. dml-insert, update, delete. DQL-select statements using where clause. DCL- grant, revoke, user creation: creating users granting and revoking permissions on database objects, rollback, commit and savepoint datatypes, operators: comparison, conditional, arithmetic, logical, set and special operators – in (not in), between (not between), like (not like), is null (is not null)</p> <p><b>Built-in functions:</b> arithmetic, string, date and time, conversion, aggregate, OLAP, and general. common clause: order by, group by, having.</p> <p><b>integrity constraints:</b> importance of data integrity, not null, unique, foreign key constraint with on delete, on delete cascade, check, default constraints.</p> <p><b>Relational algebra operations:</b> select, project, Cartesian product, union, set difference.</p> <p><b>Joins:</b> equi join/inner join/simple join, Cartesian, outer joins, self-join and lossless join.</p>	
<p><b>II</b></p>	<p><b>View:</b> types of views, relational views, object views, using views for DML operations, putting check constraint upon views, creation of read only views, materialized views, synonym.</p> <p><b>Queries and nested sub queries:</b> purpose and usage of a sub query, type of sub queries-single row, multiple row, multiple column, applying group functions in sub queries, in, any, some, all operators in sub queries. correlated sub queries: handling data retrieval with exists and not exists operators</p> <p><b>Sequences:</b> creating, retrieving data, modifying, dropping sequences, synonyms, index-what is index, advantages types of indexes, creating index, retrieving data using index, pseudo columns: types of pseudo columns, currval and nextval, level, rowid, rownum.</p>	<p><b>20</b></p>
<p><b>Books Recommended:</b></p>		
<p>1.</p>	<p>Database System Concepts by Korth Silberschetz</p>	
<p>2.</p>	<p>Fundamentals of Database Systems by Elmsari, Navathe</p>	

**Type: DSC 3C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Probability Theory (AIC-1A)**

**(Paper Code:V)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Permutations and Combinations:</b></p> <p>Principles of counting, Permutations of 'n' dissimilar objects taken 'r' at a time (with and without replacement), Permutations of 'n' objects not all different, Combinations of 'r' objects taken from 'n' objects, Numerical problems.</p> <p><b>Probability:</b></p> <p>Idea of deterministic and non-deterministic models, Sample space: types of sample space, Event: types of events, Classical definition of probability and its limitations, Axiomatic definition of probability,</p> <p><b>Proofs of results:</b> <math>P(\phi) = 0</math>, <math>P(A^c) = 1 - P(A)</math>, <math>P(A \cup B) = P(A) + P(B) - P(A \cap B)</math>, <math>P(A) \leq P(B)</math> if A is subset of B.</p> <p><b>Conditional probability:</b> concept and definition, multiplication law of probability (statement only).</p> <p><b>Independence of events:</b> concept and definition, pair wise and complete independence (for 3 events), Partition of sample space and Baye's theorem (statement only), Numerical problems.</p>	<b>20</b>
<b>II</b>	<p><b>Discrete Random Variable and standard distributions:</b></p> <p>Definition of discrete random variable(r.v.), Definition of Probability mass function(p.m.f.) , cumulative distribution function(c.d.f.), properties of c.d.f</p> <p><b>Mathematical Expectation and variance of r.v.:</b> definition, Numerical problems.</p> <p><b>I. Standard Discrete Distribution:</b></p> <p>a) Binomial Distribution: Definition, mean and variance (Statement only), real life situations, adaptive property and numerical examples.</p>	<b>20</b>

	<p>b) Poisson Distribution: Definition, mean and variance (Statement only), real life situations, adaptive property and numerical examples.</p> <p><b>II. Contentions Random variable and Distributions:</b>  Definition of Contentions random variable(r.v.), Definition of Probability density function(p.d.f.) , cumulative distribution function(c.d.f.), properties of c.d.f  <b>Mathematical Expectation and variance of r.v.:</b> definition, Numerical problems.</p> <p><b>Standard Contentious Distributions:</b></p> <p>a) <b>Uniform distribution:</b> definition, mean and variance (Statement only), c.d.f., probability curve and numerical examples.</p> <p>b) <b>Normal distribution:</b> definition, mean and variance (Statement only), probability curve, Standard Normal Variable(S.N.V.), properties of normal distribution, distribution of <math>(aX + b)</math>, <math>(aX + bY + c)</math> when X and Y are independent variables, computations of probabilities using normal tables.</p>	
<p><b>* Note: Question paper should have minimum 50% theory questions and 50% numerical problems.</b></p>		
<p><b>Books Recommended:</b></p>		
1.	Fundamentals of Statistics by Goon Gupta, Das Gupta.	
2.	Statistical Methods by S. P. Gupta	
3.	Business Statistics by S. Shaha	
4.	Fundamentals of Mathematical Statistics by Kapoor and Gupta	
5.	Programmed Statistics by B. L. Agarwal	
6.	Statistical Methods by P. N. Arora, Summeet Arora, S. Arora	
7.	Introduction to discrete probability and probability distributions by Madhav B. kulkarni, Surendra B. Ghatpande.	

**Type: DSC 3C**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Data Science with Python (AIC-1A)**

**(Paper Code:VI)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Know basic data types in Python.
2. Know operators, and how to clean and merge datasets.
3. Know pandas library, the main methods for DataFrames.
4. Know how to import data in Python.
5. Know how to work in Spyder.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Introduction to Data Science:</b> Evolution of Data Science – Data Science life cycle, Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.</p> <p><b>Data Collection Strategies</b> – Introduction to Collection of Data, Primary and Secondary Data, Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data.</p> <p><b>Data Pre-Processing Overview</b> – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization, Outlier analysis, Testing and Training</p> <p><b>Model design and Development:</b> Model Evaluation using Visualization – Residual Plot – Distribution Plot –, Measures for In-sample Evaluation – Prediction and Decision Making. Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.</p>	<b>20</b>



<p><b>II</b></p>	<p><b>Introduction to NumPy:</b> Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes.</p> <p><b>Universal Functions:</b> Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.</p> <p><b>Introduction to pandas:</b> Series, DataFrame, Creating Data Frame from an Excel, .csv file, python Dictionary, python List and Tuples, Operations on Data Frames: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.</p> <p><b>Data visualization using Matplotlib and Seaborn:</b> Basic plot-Line, Bar, scatter, subplot, Statistics plots-Box, Histogram, errorbar and pie, 3D plots-scatter, surface, triangular, Heatmap, Density Plots, CatPlot (Categorical Plot), Joint Distribution Plot</p>	<p><b>20</b></p>
<p><b>Books Recommended:</b></p>		
<p>1.</p>	<p>Python Data Analytics, Fabio Nelli, Apress</p>	
<p>2.</p>	<p>Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly, 2nd Edition,2018. Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, and Wiley</p>	
<p>3.</p>	<p>Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, 2017.</p>	
<p>4.</p>	<p>Programming through Python, M. T. Savaliya, R. K. Maurya, G. M. Magar, STAREDU Solutions</p>	
<p>5.</p>	<p>Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, Arno D.B. Meysman, et al., Manning</p>	

**Type: SEC-I**

**B.Sc(ECS)-II ( Semester III )**

**Course Title: Web Development using PHP**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

- |    |   |
|----|---|
| 1. | Analyze PHP scripts and determine their behavior.                                     |
| 2. | Construct PHP scripts to create dynamic web content.                                  |
| 3. | Create PHP scripts capable of inserting and modifying data in a MySQL database.       |
| 4. | Design web pages with the ability to retrieve and present data from a MySQL database. |

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
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<b>I</b>	<p><b>Introduction:</b> Introduction to web applications, Client Side Vs Server Side Scripting <b>WebServers:</b> Local Servers and Remote Servers, Installing Web servers, Internet Information Server (IIS) and Personal Web Server (PWS). Static website vs Dynamic website development. Introduction to PHP and PHP Framework, Basic PHP syntax, Data types in PHP, Variables, Constants, operators and Expressions, printing data on PHP page, <b>Control statements:</b> if, switch case, for, while, do while. <b>Arrays:</b> Initialization of an array, Iterating through an array, Sorting arrays, Array Functions, <b>Functions:</b> Defining and Calling Functions, Passing by Value and passing by references, Inbuilt Functions. <b>String:</b> Formatting String for Presentation and Storage, Joining and Splitting String, Comparing String, Matching and replace Substring, patterns, basic regular expressions.  <b>Working With Forms:</b> Forms controls properties, methods and events, Retrieving form data with \$_POST, \$_GET and \$_REQUEST arrays, Validating retrieved data, Strategies for handling invalid input, Super global variables, Super global array,</p>	<b>20</b>
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	Importing user input, Accessing user input, Combine HTML and PHP code, Using hidden fields, Redirecting the user, File upload and scripts, Validation- Serverside validation, Client side validation	
<b>II</b>	<p><b>Database Connectivity with MYSQL:</b> Connection with MySQL Database, Creating database and Tables, Performing DML operations(Insert, Delete, Update, Select), MySQL operator and various clauses, Aggregate and Scalar Functions, MySQL Queries, Constraints, views</p> <p><b>Working with file and Directories:</b> Understanding fileand directory, Opening and closing a file, Coping ,renaming and deleting a file Working with directories, Building a text editor, File Uploading and Downloading.</p> <p><b>Generating Images with PHP-</b> Basics of computer Graphics Creating Image, Manipulating Image, Using text in Image</p> <p><b>State Management:</b></p> <p><b>Cookies:</b> Setting time in a cookie with PHP, Deleting a cookie, Creating session cookie, Working with the query string</p> <p><b>Session:</b> Starting a session, Registering Session variables, working with session variables, destroying session, passing session Ids, encoding and decoding session variables</p>	<b>20</b>
<b>Books Recommended:</b>		
1.	PHP: The Complete Reference-Steven Holzner.	
2.	Programming PHP- Rasmusler dorf, Kevin Tatroe.	

**Type: DSC 1D**

**B.Sc(ECS)-II ( Semester IV )**

**Course Title: Data Structure using C++ -II**

**(Paper Code:VII)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Solve problems involving graphs, trees and heaps.
2. Algorithms for solving problems like sorting, searching, insertion and deletion of data.
3. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc.
4. Ability to assess efficiency tradeoffs among different data structure implementations.
5. Implement and know the applications of algorithms for sorting, pattern matching etc.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Sorting:</b> Introduction and definition of Sorting, Types of Sorting-Bubble sort, Quick sort, Shell sort, Selection sort, Insertion sort, Heap Sort, Merge sort, Radix Sort, Tree Sort techniques</p> <p><b>Searching:</b> Introduction and definition of Searching, Types of searching-Linear (Sequential) Search, Binary Search, Indexed sequential search, Hashing and different Hash functions.</p>	<b>20</b>
<b>II</b>	<p><b>Trees:</b> Introduction to Tree, Introduction to Binary Trees, Types of Binary tree- Strictly Binary tree, Complete Binary tree, Extended (2-Tree) Binary tree, Binary expression tree, Binary Search tree, Heap Tree- Min heap tree, Max heap tree, Representation of Binary tree using- Array, Linked list</p> <p>Operations of Binary search tree-Creating and inserting node, Searching node, Counting total nodes, Counting and displaying leaf nodes, Tree Traversal methods Preorder, Inorder, Postorder, Deletion of Nodes, Implementation of binary search</p>	<b>20</b>

	<p>tree, Height balanced tree/Balanced Binary Tree/AVL tree, Application of tree.</p> <p><b>Graph:</b>          Concept and terminologies used in graph, Graph Representation using- Array and linked list, Graph traversals – BFS and DFS, Dijkstra’s shortest path algorithm, and application of graph</p>	
<b>Books Recommended:</b>		
1.	Tanenbaum: Data structures using C and C++	
2.	Data Structures Through C in Depth- S.K.Srivastava,D.Srivastava	
3.	Fundamentals of Data Structures in C by Sahni	
4.	Ulman: Data structures and Algorithms	
5.	Niklaus Wirth: Algorithms, data structures, Programs.	

<b>Type: DSC 1D</b> <b>B.Sc(ECS)-II ( Semester IV )</b> <b>Course Title: Core Java</b> <b>(Paper Code:VIII)</b>		
<b>Credits: Theory – (2)</b>		<b>Practical's – (2)</b>
<b>Total Lectures: 40 Hrs.</b>		<b>Contact Hrs. (L) : 3</b>
<b>University Evaluation: 40 Marks</b>		<b>Internal Evaluation: 10 Marks</b>
<b>Course Outcomes:</b>		
1.	Knowledge of the structure and model of the Java programming language.	
2.	Use the Java programming language for various programming technologies.	
3.	Develop software in the Java programming language.	
4.	Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.	
<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<b>Introduction to Java :</b> Object Oriented Concepts, C++ Vs Java, Java API, Features of Java, Introduction to Java Environment, JVM architecture, Structure of java program, Class concept and molecularity, Data members, methods, constructor syntax, "this" References, Static and non-static data members and methods, Static block, Parameter passing in Java, Array, Garbage collection, Scope specifies public, private and package  <b>Inheritance:</b> Super, Access/Scope specifies protected, Method overriding, Abstract classes, Final keyword, Object class and methods in Object class.  <b>Interfaces:</b> Comparison with inheritance, Interfaces and runtime polymorphism, Wrapper classes	<b>20</b>
<b>II</b>	<b>Exception handling:</b> Try catch finally-flow, Throw and throws keywords, User defined exceptions.  <b>Multithreading:</b> Concept, Life cycle of a thread, Thread class, Runnable interface, Methods in thread class-sleep, interrupt, join, priority etc., Sharing data,	<b>20</b>

	<p>Synchronization, Usage of wait and notify()</p> <p><b>IO programming:</b> Concept, Binary and text IO, IO streams and Reader / Writers, Console I/O, Data input and data Output usage File I/O, Object Stream and Serializable interface</p> <p><b>Event Handling:</b> Event Model, Event Classes, Event Listener Interfaces, Adapter and anonymous Classes.</p> <p><b>Swing Technology:</b> AWT vs Swing, hierarchy of swing, Swing controls-JTextBox, JRadio, JCheckBox, JComboBox, JList, JTree, JOptionPane, JscrollBar, etc. Layout managers and menus.</p> <p><b>Introduction to Collection Framework:</b> Set, list, Map interfaces, Collection Classes.</p>	
<b>Books Recommended:</b>		
1.	Core Java by Dr. R. Nageshwar Rao.	
2.	James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley The Java Language Specification, Java SE 8 Edition (Java Series), Published by Addison Wesley, 2014.	
3.	Joshua Bloch, Effective Java 2nd Edition, Publisher: Addison-Wesley, 2008.	
4.	Cay S. Horstmann, Gary Cornell, Core Java 2 Volume 1, 9th Edition, Printice Hall. 2012	
5.	Cay S. Horstmann, Gary Cornell, Core Java 2 Volume 2 - Advanced Features, 9th Edition, Printice Hall. 2013.	
6.	Bruce Eckel, Thinking in Java, 3rd Edition, PHI, 2002.	
7.	E. Balaguruswamy, Programming with Java, 4th Edition, McGraw Hill. 2009.	
8.	Paul Deitel, Harvey Deitel, Java: How to Program, 10th Edition, Prentice Hall, 2011.	
9.	David J. Eck, Introduction to Programming Using Java, Published by CreateSpace Independent Publishing Platform, 2009.	
10.	John R. Hubbard, Programming with Java, Schaum's Series, 2nd Edition, 2004.	

<b>Type: DSC 2D</b> <b>B.Sc(ECS)-II ( Semester IV )</b> <b>Course Title: Software Testing</b> <b>(Paper Code:VII)</b>		
<b>Credits: Theory – (2)</b>		<b>Practical – (2)</b>
<b>Total Lectures: 40 Hrs.</b>		<b>Contact Hrs. (L) : 3</b>
<b>University Evaluation: 40 Marks</b>		<b>Internal Evaluation: 10 Marks</b>
<b>Course Outcomes:</b>		
1.	List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.	
2.	Distinguish characteristics of structural testing methods.	
3.	Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.	
4.	Discuss about the functional and system testing methods.	
5.	Demonstrate various issues for object oriented testing.	
<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<b>Introduction To Software Testing:</b> <ul style="list-style-type: none"> <li>• Importance or need of software testing</li> <li>• Differences between Manual and Automation Testing</li> </ul> <b>Introduction to White Box Testing:</b> <ul style="list-style-type: none"> <li>• Advantages and Disadvantages of White box testing</li> <li>• Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection</li> <li>• Dynamic Techniques or Structural Techniques</li> <li>• Statement Coverage Testing, Branch Coverage Testing</li> <li>• Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing</li> </ul> <b>Introduction to Black Box Testing:</b> <ul style="list-style-type: none"> <li>• Advantages and Disadvantages of black box testing</li> </ul>	<b>20</b>



	<ul style="list-style-type: none"> <li>• Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, State Transition Technique, Cause Effective Graph, Decision Table, Use Case Testing</li> <li>• Experienced Based Techniques: Error guessing, Exploratory testing Levels of Testing</li> <li>• Functional Testing</li> <li>• Integration Testing and types - Top Down , Bottom Up , Non Incremental</li> <li>• System Testing</li> <li>• Acceptance Testing- Alpha and Beta</li> <li>• Smoke Testing</li> <li>• Regression Tesng- Unit , Regional, Full Non Functional Testing</li> <li>• Adhoc Testing</li> <li>• Performance Testing : Load Testing, Stress Testing, Volume Testing, Soak Testing</li> <li>• Recovery Testing</li> </ul>	
II	<p><b>Test cases design Techniques:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Test Case and types.</li> <li>• Test Case Template</li> <li>• How to write a test case and examples</li> <li>• Preparing Review Report Software Test Life cycle</li> <li>• Software Test Life Cycle-</li> <li>• Writing Test Plan</li> <li>• Preparing Traceability Matrix</li> <li>• Writing Test Execution Report and Summary Report</li> </ul> <p><b>Defect Life Cycle:</b></p> <ul style="list-style-type: none"> <li>• Bug/Defect Life Cycle- Difference between Bug, Defect, Failure, Error</li> <li>• Defect Tracking and Reporting</li> <li>• Types of Bugs, Identifying the Bugs, Reporting the Bugs</li> </ul> <p>Introduction to automated testing- Install and configure selenium testing tool, Case study: Design test case for login page, Internet Banking Login, Online shopping.</p>	20

<b>Books Recommended:</b>	
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1.	The art of Software Testing–Glenford J. Myers
2.	Lessons learned in Software Testing– Cem Kaner, James Bach, Bret Pettichord
3.	A Practitioner’s Guide to Software Test Design- Lee Copeland

**Type: DSC 2D**

**B.Sc(ECS)-II ( Semester IV )**

**Course Title: Database Management System-II**

**(Paper Code:VIII)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1.	Implement Basic DDL, DML and DCL commands .
2.	Understand Data selection and operators used in queries and restrict data retrieval and control the display order.
3.	Write sub queries and understand their purpose .
4.	Use Aggregate and group functions to summarize data.
5.	Join multiple tables using different types of joins.
6.	Understand the PL/SQL architecture and write PL/SQL code for procedures, triggers, cursors, exception handling etc.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Introduction of Transaction:</b> ACID properties, transaction states, scheduling and its types, conflict and view serializability.</p> <p><b>Introduction of Concurrency Control:</b> Problems of concurrency control, lock based protocols, timestamp based protocol, deadlock, deadlock handling methods.</p> <p><b>Introduction, recovery algorithms:</b> log base recovery, shadow paging, recovery with concurrent transaction, checkpoints or syncpoints or savepoints.</p> <p><b>Query Optimization:</b> Overview Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization.</p>	<b>20</b>

<p><b>II</b></p>	<p><b>Introduction to PL/SQL:</b>  Advantages, Architecture, Datatypes, Variable and Constants, Using Built_in Functions, Conditional, Looping and Iterations Statements, Selection Case, Simple Case, GOTO Label and EXIT, SQL within PL/SQL.</p> <p><b>Procedures in PL/SQL:</b> STORED PROCEDURES, PROCEDURE with Parameters (IN,OUT and IN OUT), POSITIONAL Notation and NAMED Notation, Dropping a Procedure.</p> <p><b>Functions in PL/SQL:</b> Difference between Procedures and Functions, types of functions and parameter modes,</p> <p><b>Packages in PL/SQL:</b> importance, advantages Implementing packages, Private and Public Objects in PACKAGE</p> <p><b>Cursor in PL/SQL:</b> Types of Cursors, Cursor Attributes, Cursor with Parameters, Cursors with LOOPS Nested Cursors, Cursors with Sub Queries and procedure.</p> <p><b>Exceptions in PL/SQL:</b> Types of exceptions, RAISE_APPLICATION_ERROR, PRAGMA_AUTONOMOUS_TRANSACTION</p> <p><b>Database Triggers in PL/SQL:</b> Types of Triggers, Row Level Triggers, Statement Level Triggers, Implementing triggers for various DML operations (insert, delete, update), DDL Triggers, Trigger Auditing.</p>	<p><b>20</b></p>
<p><b>Books Recommended:</b></p>		
<p>1.</p>	<p>Database System Concepts by Korth Silberschetz</p>	
<p>2.</p>	<p>Fundamentals of Database Systems by Elmsari, Navathe</p>	

**Type: DSC 3D**

**B.Sc(ECS)-II ( Semester IV )**

**Course Title: Descriptive Statistics(AIC1A)**

**(Paper Code:VII)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Students will demonstrate proficiency with statistical analysis of data.
2. Students will develop the ability to build and assess data-based models.
3. Students will execute statistical analyses with professional statistical software.
4. Students will demonstrate skill in data management.
5. Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Population and sample:</b> Concept of population with illustration, Concept of sample with illustration. Sampling methods: Simple Random Sample(SRS), Simple Random Sample With Replacement (SRSWR), Simple Random Sample Without Replacement (SRSWOR), stratified and systematic random sampling.</p> <p><b>Data condensation and graphical methods:</b> Raw data- attribute, variable- discrete and continuous, constant. Classification- definition, objectives, principles of classification. Construction of frequency distribution, cumulative frequency distribution.</p> <p><b>Graphical representation:</b> histogram, frequency polygon, frequency curve, ogives.</p> <p><b>Measures of Central Tendency:</b> Concept of central tendency, criterion for good measures of central tendency. <b>Arithmetic Mean(A.M.):</b> definition computation for ungrouped and grouped data, combined mean, weighted mean, effect of change of origin and scale, numerical</p>	<b>20</b>

	<p>examples, merits and demerits.</p> <p><b>Median:</b> definition, computation for ungrouped and grouped data, graphical determination, numerical examples, merits and demerits,</p> <p><b>Mode:</b> definition, computation for ungrouped and grouped data, graphical determination, numerical examples, merits and demerits.</p> <p><b>Quartiles:</b> definition, computation for ungrouped and grouped data, graphical determination, Numerical problems.</p> <p><b>Measures of Dispersion:</b> Concept of dispersion, absolute and relative measures,</p> <p><b>Range:</b> definition, computation for ungrouped and grouped data, Coefficient of range, numerical examples, merits and demerits.</p> <p><b>Standard Deviation(S.D.) and Variance:</b> definition, computation for ungrouped data and grouped data.</p> <p><b>Coefficient of Variation(C.V.):</b> definition, computation for ungrouped data and grouped data, combined S.D. effect of change of origin and scale, merits and demerits, Numerical problems.</p>	
<p><b>II</b></p>	<p><b>Correlation and Regression:</b></p> <p>Bivariate data, Concept of correlation, types of correlation, cause and effect relation.</p> <p><b>Methods of Studying Correlation:</b></p> <p><b>a) Scatter Diagram Method:</b> definition, interpretation.</p> <p><b>b) Karl Pearson's coefficient of correlation (r)</b> definition, limits for 'r', interpretation of r, effect of change of origin and scale, numerical examples.</p> <p><b>Regression:</b> concept, definition, lines of regression, Derivation of lines of regression by least square method, properties of regression coefficients, interpretation of regression coefficients.</p> <p><b>Non-linear regression:</b> fitting of lines of regression, fitting of second degree curve (<math>Y = A + BX + CX^2</math>), fitting of exponential curve (<math>Y = A B^x</math>), Numerical problems.</p>	<p><b>20</b></p>
<p><b>Books Recommended:</b></p>		
<p>1.</p>	<p>Fundamentals of Statistics by Goon Gupta, Das Gupta.</p>	
<p>2.</p>	<p>Statistical Methods by S. P. Gupta</p>	
<p>3.</p>	<p>Business Statistics by S. Shaha</p>	

4.	Fundamentals of Mathematical Statistics by Kapoor and Gupta
5.	Programmed Statistics by B. L. Agarwal
6.	Statistical Methods by P. N. Arora, Summeet Arora, S. Arora
7.	Introduction to discrete probability and probability distributions by Madhav B. kulkarni, Surendra B. Ghatpande

**Type: DSC 3D**

**B.Sc(ECS)-II ( Semester IV )**

**Course Title: Data Visualization (AIC1A)**

**(Paper Code:VIII)**

**Credits: Theory – (2)**

**Practical's – (2)**

**Total Lectures: 40 Hrs.**

**Contact Hrs. (L) : 3**

**University Evaluation: 40 Marks**

**Internal Evaluation: 10 Marks**

**Course Outcomes:**

1. Analyze data using exploratory visualization.
2. Build commonly requested types of visualizations as well as more advanced visualizations using ground-up customization.
3. Constructively critique existing visualizations, identifying issues of integrity as well as excellence.
4. Create useful, performant visualizations from real-world data sources, including large and complex datasets.
5. Design aesthetically pleasing static and interactive visualizations with perceptually appropriate forms and encoding.
6. Improve your own work through usability testing and iteration, with attention to context.

<b>Unit</b>	<b>Content</b>	<b>No. of Lectures</b>
<b>I</b>	<p><b>Introduction to Power BI:</b> What is Business Intelligence, BI Uses and Users, Various BI Tools, Why Power BI, Introduction to Power BI, Features of Power BI, Power BI Components, Building Blocks of Power BI, Architecture of Power BI, Power BI Desktop Installation,</p> <p><b>Loading and Transforming dataset:</b> Data Sources-File Sources, Databases, Azure, Other Sources, Loading Data-Web Pages, CSV Files, Text Files, XML Files, Excel, Microsoft Access Databases, SQL Server and other databases, Refreshing Data.</p> <p><b>Creating a Data Model:</b> Data Modeling in the Power BI Desktop Environment-The Power BI Desktop Data View, Data Models, Managing Power BI Desktop Data- Manipulating Tables, Manipulating Columns, Power BI Desktop Data Types, Formatting Power BI Desktop</p>	<b>20</b>



	<p>Data, Currency Formats, Preparing Data for Dashboards, Categorize Data, Apply a Summarization, Define Sort by Columns, Sorting Data in Power BI Desktop Tables, Adding Hierarchies, Designing a Power BI Desktop Data Model- Data View and Relationship View, Creating and Deleting Relationships Manually and Automatically</p> <p><b>Transforming Datasets:</b></p> <p>Editing Data After a Data Load, Transforming Data Before Loading, Dataset Shaping- Renaming Columns, Reordering Columns, Removing Columns, Merging Columns, Duplicating Columns, Splitting Columns, Removing Records, Removing Duplicate Records, Sorting Data, Reversing the Row Order, Filtering Data-Selecting Specific Values, Finding Elements in the Filter List, Filtering Text Ranges, Filtering Numeric Ranges, Filtering Date and Time Ranges</p>	
<p><b>II</b></p>	<p><b>Data Cleansing:</b></p> <p>Viewing a Full Record, Changing Data Type , Detecting Data Types, Replacing Values, Transforming Column Contents, Filling Down, Using the First Row As Headers, Grouping Records, Extending Data, Appending Data, Merging Data- Adding Data, Aggregating Data During a Merge Operation, Extending the Data Model with Calculated Columns, Creating Custom Columns, Index Columns, Types of Join- Joining on Multiple Columns, Preparing Datasets for Joins, Correct and Incorrect Joins, Examining Joined Data, The Expand and Aggregate Buttons.</p> <p><b>Power Query Editor</b> - What is DAX, Different type of DAX functions-Aggregate functions, Date functions, Logical functions, Math functions, String functions, Trigonometric functions and other functions.</p> <p><b>Adding Measures to the Data Model</b></p> <p>Basic Aggregations in Measures, Using Multiple Measures, Cross-Table Measures, More Advanced Aggregations, Filtering Data in Measures, Analyzing Data over Time.</p> <p><b>Data Visualizations</b></p> <p>Charts in Power BI-Types of charts, Maps in Power BI, Table and Matrix in Power BI, Subtotal and Total in Matrix, Cards and Filters in Power BI, Conditional Formatting, Slicers in Power BI- slicers, adding a Slicer, Applying Slicers, clearing a Slicer, deleting</p>	<p><b>20</b></p>

	<p>a Slicer, modifying a Slicer, Formatting Slicers-Slicer Orientation, Modifying the Outline, Adjusting Selection Controls, Setting the Exact Size and X and Y coordinates of a Slicer, Slicer Header, Slicer Items</p> <p><b>Designing Power BI Dashboards and Reports</b></p> <p>Dashboards, reports, Dashboards versus reports, Dashboard design- What is KPI, When to use KPI, Requirements for KPI, KPI Visualizations, Visual selection, Layout, Navigation pane, Full screen mode, Supporting tiles, Custom date filters, Single-dashboard, Multiple-dashboard, Organizational dashboards, Multiple datasets</p> <p><b>Dashboard tiles-</b> Tile details and custom links, Images and text boxes, SQL Server Reporting Services.</p> <p><b>Deploying the Power BI Report Server</b></p> <p>Live Dashboard pages, Live report pages, Mobile-optimized dashboards</p> <p>Case study – Superstore, IPL Analysis, Product Sales Data Analysis, Marketing Campaign Insights Analysis, Financial Performance Analysis, Loan Application Analysis</p>	
<b>Books Recommended:</b>		
1.	Pro Power BI Desktop-Free interactive data analysis with Microsoft Power BI by Adam Aspin, Apress	
2.	Introducing Microsoft Power BI by Alberto Ferrari and Marco Russo, Microsoft Press	
3.	Mastering Microsoft Power BI by Brett Powell, Packt BIRMINGHAM – MUMBAI	
4.	Microsoft Power BI Complete Reference by Devin Knight, Brian Knight, Mitchell Pearson, Manuel Quintana, Brett Powell, Packt	
5.	Learn Power BI by Greg Deckler, Packt	
6.	Pro Power BI Desktop-Free interactive data analysis with Microsoft Power BI by Adam Aspin, Apress	

<b>Type: Core Practical</b>	
<b>B.Sc(ECS)-II ( Semester IV )</b>	
<b>Course Title: DSC1C and 1D(Paper Code: Practical-I)</b>	
<b>Total Lectures: 40 Hrs.</b>	<b>Contact Hrs. (L) : 8</b>
<b>University Evaluation: 80 Marks</b>	<b>Internal Evaluation: 20 Marks</b>
<b>Data Structure using C++</b>	<b>Software/Tools: Turboc3</b>
<b>Array:</b>	
1.	Write a program to implement array with following operations: a) Insert Element b) Delete element from entered position c) Traverse array element. d) Count e) Search element
2.	Write a programs that prints array elements in reverse order.
3.	Write a program that finds only even elements in an array.
4.	Write a program that finds only odd elements in an array.
5.	Write a program that finds addition of matrices.
6.	Write a program that finds multiplication of matrices.
<b>Stack:</b>	
1.	Write a program to implement stack by using array. (Static Implementation of stack)
2.	Write a program, which reverses the string by using stack.
3.	Write a program to check entered string is palindrome or not by using stack.
4.	Write a program to convert decimal number into binary number by using stack.
5.	Write a program to count total number of vowels present in string by using stack.
6.	Write a program which convert infix expression into prefix expression.
7.	Write a program which convert infix expression into Postfix expression.
8.	Write a program which check entered expression is valid or not.
9.	Write a program for evaluation of postfix expression.
10.	Write a program to calculate factorial of entered number by using recursion.
11.	Write a program to calculate digit sum of entered number by using recursion.
12.	Write a program to find face value of entered number by using recursion.



	IV. Insert Edge V. Find adjacent vertices VI. Display Graph
4.	Write a program to implement breadth first search (BFS) traversal of graph.
5.	Write a program to implement depth first search (DFS) traversal of graph.
<b>Sorting and Searching</b>	
1.	Write a program to implement simple exchange sort method.
2.	Write a program to implement bubble sort method.
3.	Write a program to implement insertion sort method.
4.	Write a program to implement selection sort method.
5.	Write a program to implement Shell sort method.
6.	Write a program to implement linear searching technique for unsorted data.
7.	Write a program to implement linear searching technique for sorted data.
8.	Write a program to implement Binary search technique.
<b>Linux OS and Shell Scripting: <span style="float: right;">Software/Tools: Linux Text Editor</span></b>	
1.	Write a shell script to find out the greatest among three inputs.
2.	Write a shell script to calculate the net salary of an employee in a particular month considering various allowances (TA, DA, HRA) and deductions (INCOME TAX, PROVIDEND FUND) as: TA=15 percent of basic salary DA=2 percent of basic salary HRA=10 percent of basic salary INCOME TAX=5 percent of salary PROVIDEND FUND=10 percent of salary
3.	A departmental store announces its festival scheme to customers on cash payment. The scheme is as follows If purchase amount is less than 1000 then Tax=2% and discount=10%. If purchase amount is greater than 1000 then Tax=5 % and discount=20%
4.	Write a shell script to find out the "n to the power y"(Square), where n and y must be input by the user.
5.	Write a shell script to check whether an input is a prime or not.
6.	Write a shell script to find out the sum of series
7.	Write a shell script to generate the series 1, 5, 2, 10, 3, 15,.....50.

8.	The XYZ construction company plans to give a 5% year-end bonus to each of its employees earning Rs. 5,000 or more per year and a fixed bonus of Rs 250 to all other employees. Print the bonus of any Employee.
9.	Write a shell script to read an integer and print its digits in reverse order.
10.	Write a shell script to print Fibonacci series.
11.	The marks obtained by a student in five different subjects are input through the keyboard. The student gets a division as per the following rules. if percentage greater than or equal to 60 get First division if percentage greater than or equal to 50 or less than 60 get Second division if percentage greater than or equal to 40 or less than 50 get Third division if percentage less than 40 Fail
12.	Write a shell script for Swapping of Two Numbers.
13.	Write a shell script to calculate the area and perimeter of the rectangle, and the area and circumference of the circle.
14.	Write a shell script to calculate overtime pay of employees. Overtime is paid at the rate of Rs. 12.00 per hour for every hour worked above 40 hours. Assume that employees do not work for fractional part of an hour.
15.	Write a shell script to convert this temperature into Centigrade degrees.
16.	In a town, the percentage of men is 52. Rest all are women. The percentage of total educated is 48. If total percentage of educated men is 35 of the total population, Write a shell script to find the total number of uneducated men and women. The population of the town is 80,000.
17.	Write a shell script to print following pattern.
18.	Write a menu driven shell Script I. Change the group and owner of a directory II. Set permission read, write and remove execute of a file III. To check a file is sorted.
19.	Write a menu driven shell Script I. Change directory II. Display first 15 lines only III. To remove repeated data from a file.
20.	Write a menu driven shell Script

	<p>I. To locate all files named by BSc</p> <p>II. User of system</p> <p>III. Merge two files</p>
21.	<p>Write a menu driven shell Script</p> <p>I. To find out Factorial.</p> <p>II. To find out given no is perfect or not.</p> <p>III. To find out Armstrong or not</p>
22.	Write a Shell Script to check if a file is readable, writable and executable
<b>Core Java:</b>	
1.	To find the sum of any number of integers entered as command line arguments
2.	To find the factorial of a given number
3.	To learn use of single dimensional array by defining the array dynamically.
4.	To learn use of length in case of a two-dimensional array
5.	To convert a decimal to binary number
6.	To check if a number is prime or not, by taking the number as input from the keyboard
7.	To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument.
8.	Write a program that show working of different functions of String and String Buffer classs like setCharAt(), setLength(), append(), insert(), concat()and equals().
9.	Write a program to create a —distance class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer.
10.	Modify the distance class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
11.	Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions (from lower to higher data type).
12.	Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword .
13.	Write a program to show the use of static functions and to pass variable length arguments in a function.
14.	Write a program to demonstrate the concept of boxing and unboxing.
15.	Write a program —Divide by Zero that takes two numbers a and b as input, computes a/b,

	and invokes Arithmetic Exception to generate a message when the denominator is zero.																																												
<b>Type: Core Practical</b> <b>B.Sc(ECS)-II ( Semester IV )</b> <b>Course Title: DSC2C and 2D(Paper Code: Practical-II)</b>																																													
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1.	Display List of all Salesmen.																																												
2.	Display List of all Salesmen who have salary greater than 5000.																																												



3.	Display List of all Salesmen by salary.
4.	Display List of all Salesmen whose address located in pune.
5.	Change the salary of Salesmen whose sno is 's00009' by 10000.
6.	Modify the name Raj to Rajkumar.
7.	Delete the records whose state is Andhrapradesh.
8.	Delete the salary that have salary small than 1000.
9.	Add the column mobile_no to salesmen.
10.	Change the size of salesmen s_name column by 30.
11.	List of all salesmen whoes address start with 'N'.
12.	List of salesmen whose Department is not Computer and HR.
13.	List of salesmen whose Mobile_no is 9423376798 or 9763658485.
14.	List of salesmen whose is join in month 'june'.
15.	List of salesmen whose salary is >5000 and <10000.
16.	Change the column name address1 t0 permanent address.
17.	List of salesmen whose salary in order of Highest and lowest.
18.	Display average salary of salesmen.
19.	Display List of salesmen whose salary is maximum,minimum and average salary by department wise.
20.	Display how many salesmen are working on computer department.
21.	Allocate 25 charters for name if remaining charters than charter are Right padded with ' * ' .
22.	Display the list of salesmen whose middle is sanjay;
23.	Display average salary of salesmen by computer department.
24.	Display list of salesmen who joined in 12-dec-2009 .
25.	How many salesmen working whose name is 'Dipak'.
26.	Display the state which contain 6 charter.
27.	Display all the salesmen whose salary is either 5000 or 10000.
28.	Display all salesmen whose s_name contain third letter ' n ' .
29.	Delete the record whose pincode is NULL values.
30.	Remove all the constraints from salesmen.
31.	Change the table name salesmen to Salesmen_master.
32.	Display Total Amount of salary of salesmen.
33.	Display the list of salesmen with exprience year;
34.	Display the User name in which salesmen_master is created.
35.	Find out the Total salary of salesmen who have joined in month 'March'.

36. Rename the column pincode to ZIP.

**A] Table Structure of Account\_Master**

Field Name	Datatype	Size	Description
Accent	Varchar2	6	Primary Key
Acc_name	Varchar2	6	Account Holders name
Gender	Char	1	Either M or F
Op_date	Date		Date on which Account is opened
Chq_fac	Char	1	Cheque facility statue set Default 'N'
Cl_date	Date		

**B] Table Structure of Account\_Transaction**

Field Name	Datatype	Size	Description
Accent	Varchar2	6	Foreign Key
Tr_amount	Number	7,2	Transaction Amount
Tr_date	Date	1	Transaction Date
Chq_no	Varchar2	10	Cheque Number
Tr_type	Char	1	Receipt or Withdrawal

1. Display all the details of account holders in ascending order of Op\_date.
2. Display the details of account holders who are having cheque facility and balance >4000.
3. Display the details of account holders whose balance is between 4000 and 9000.
4. Display the name and number of female account holder.
5. Display the details of account holders whose 2nd char of name 'a'.
6. Display the account of those who have deposited.
7. Display the details of account holders those who have opened account in 2012.
8. Display the no of female account holders having cheque facility.
9. Display the details of 2nd min balance of account holder.
10. Display the account\_no, account\_nm, transaction amount, transaction\_type of all account holders.
11. Display the details of account holders who is having maximum balance.
12. Display the details of account holders whose month of opening the account and transaction are same.
13. Display the details of account holders who have not made any transaction and whose name is starts with 'R'.

**Synonam, Index, View:**

1. Create a synonym for table student.

2.	Apply DML command on synonym.
3.	Destroy synonym.
4.	Create a view read only view.
5.	Create updateable view.
6.	Apply DML commands on updatable view.
7.	Create read only view for single table.
8.	Destroy view.
9.	Create a sequence for roll_no field in student table.
10.	Insert sequence into table.
11.	Create a cyclic sequence.
12.	Destroy sequence.
13.	Create a cluster table.
14.	Apply DML command on cluster table.
15.	Destroy cluster table.
16.	Create a simple index.
17.	Display an index.
18.	Create composite index.
19.	Create reverse index.
20.	Rebuild reverse index to normal index.
21.	Destroy index.
22.	Create type.
23.	Use type in table.
24.	Insert value for type in table.
25.	Display the table.
26.	Create array for name.
27.	Use array as data type in table.
28.	Insert value for array in table.
29.	Display table.
30.	Create user.
31.	Give grants to the user.
32.	Give grants to the user from own database.
33.	Give grant to user from another user.
34.	Withdraw once given grant.

35.	Commit work done.
36.	Rollback to commit.
37.	Create savepoint.
38.	Rollback to the particular savepoint.
<b>Simple PL/SQL Block</b>	
1.	Write a PL/SQL block to display Best of Luck Message.
2.	Write a PL/SQL to calculate simple interest.
3.	Write a PL/SQL to calculate Compound interest.
4.	Write a PL/SQL to calculate Area ,circumference and perimeter of circle.
5.	Write a PL/SQL to calculate Area andperimeter of rectangle.
6.	Write a PL/SQL to calculate Area and perimeter of Triangle.
7.	Write a PL/SQL to calculate Area and perimeter of Square.
8.	Write a PL/SQL to find out maximum no between two no's.
9.	Write a PL/SQL to find out maximum no between three no's.
10.	Write a PL/SQL to find out minimum no between two no's.
11.	Write a PL/SQL to find out minimum no between three no's.
12.	Write a PL/SQL to find out given no is even or odd.
13.	Write a PL/SQL to find out given no is Positive, Negative or Zero.
14.	Write a PL/SQL to display the message when user entering no then display appropriate no in word (eg.1-one).
15.	Write a PL/SQL to display for month name.
16.	Write a PL/SQL to display for week day name.
17.	Write a PL/SQL to display for grade of student.
18.	Write a PL/SQL to display for 1-10 numbers.
19.	Write a PL/SQL to display for 1-10 numbers in descending order.
20.	Write a PL/SQL to calculate factorial of any no.
21.	Write a PL/SQL to calculate sum of digits.
22.	Write a PL/SQL to find given no is prime or not.
23.	Write a PL/SQL to find given no is palindrome or not.
24.	Write a PL/SQL to find given no is Armstrong or not.
25.	Write a PL/SQL to find given no is composite or not.
26.	Write a PL/SQL to find given no is strong or not.
27.	Write a PL/SQL to find given no is perfect or not.

28.	Write a PL/SQL to find face value of given no.
29.	Write a PL/SQL to find area of circle and insert this area in to table. (Take radius from table)
30.	Write a PL/SQL to calculate addition, subtraction, division, multiplication of any two no's.
31.	Write a PL/SQL to find prim no bet 1 to 1000.
32.	Write a PL/SQL to find perfect no bet 1 to 1000.
33.	Write a PL/SQL to find strong no bet 1 to 1000.
34.	Write a PL/SQL to find palindrome no bet 1 to 1000.
35.	Write a PL/SQL to find Armstrong no bet 1 to 1000.
36.	Write a PL/SQL to find composite no bet 1 to 1000.
37.	Write a PL/SQL to find 1st 10 palindrome no's.
38.	Write a PL/SQL to find 1st 10 composite no's.
39.	Write a PL/SQL to print multiplication table.
40.	Write a PL/SQL to find given string palindrome or not.
	Write a program to print following patterns: <pre> 1 2 3 4 5           a   b   c   d   e 1 2 3 4           a   b   c   d 1 2 3             a   b   c 1 2               a   b 1                 a </pre>
<b>Functions and Procedures:</b>	
1.	W.A.P for calculate factorial by using function.
2.	W.A.P for calculate Armstrong by using function.
3.	W.A.P for calculate palindrome by using function.
4.	W.A.P for calculate reverse no by using function.
5.	W.A.P for calculate face value by using function.
6.	W.A.P for calculate perfect no by using function.
7.	W.A.P for calculate prime by using function.
8.	W.A.P for calculate strong no by using procedure.
9.	W.A.P for calculate Armstrong by using procedure.
10.	W.A.P for calculate palindrome by using procedure.
11.	W.A.P for calculate perfect no by using procedure.
12.	W.A.P for calculate prime by using procedure.

13.	W.A.P for calculate reverse no by using procedure.
14.	W.A.P for calculate factorial by using function.
<b>Cursor:</b>	
1.	Create a cursor for updating salary of employee by 5%.
2.	Create a cursor for display 5 highest earners.
3.	Create a cursor for display 5 lowest earners.
4.	Create a cursor for calculation of area of circle and insert in to table. (Take radius from table)
5.	Create a cursor for transaction balance becomes less than 500 or the day is Sunday of transaction then display message transaction is not allowed.
6.	For display user defined message when cursor not fetching row.
7.	For display user message when cursor fetching more than one row or one value.
<b>Trigger</b>	
1.	Create a trigger for generating primary key.
2.	Create a trigger for generating primary key when some data is already present.
3.	Create a trigger for backup.
4.	Create a trigger for display message when user enters <0 value in students roll_no column.
5.	Create a trigger for transaction if transaction balance becomes <500 or transaction day is Sunday then reject the transaction.
<b>Exception Handling and package :</b>	
1.	To generate the exception when Data is not found in the table.
2.	To generate the exception Too many Rows are found in the table.
3.	To generate the exception for Duplicate index.
4.	To generate the exception for display value_Error.
5.	To generate user defined exception for divide by zero value.
6.	W.A.PL/SQL block to generate your own exception for more amounts withdrawing than balance.
7.	Create a package for combine function and procedure.
8.	Modify the package.

<b>Type: Core Practical</b>	
<b>B.Sc(ECS)-II ( Semester IV )</b>	
<b>Course Title: DSC3C and 3D(Paper Code: Practical-III)</b>	
<b>Total Lectures: 40 Hrs.</b>	<b>Contact Hrs. (L) : 8</b>
<b>University Evaluation: 80 Marks</b>	<b>Internal Evaluation: 20 Marks</b>
<b>Software/Tools: spyder / Power BI</b>	
<b>Practical Component of Numpy:</b>	
5.	Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
6.	Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
7.	Computation on NumPy arrays using Universal Functions and Mathematical methods.
8.	Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
9.	Load an image file and do crop and flip operation using NumPy Indexing.
<b>Practical Component of Pandas:</b>	
1.	Create Pandas Series and DataFrame from various inputs.
2.	Import any CSV file to Pandas DataFrame and perform the following:
3.	Visualize the first and last 10 records
4.	Get the shape, index and column details
5.	Select/Delete the records(rows)/columns based on conditions.
6.	Perform ranking and sorting operations.
7.	Do required statistical operations on the given columns.
<b>Practical Component:</b>	
1.	Import any CSV file to Pandas DataFrame and perform the following:
2.	Handle missing data by detecting and dropping/ filling missing values.
3.	Transform data using apply() and map() method.
4.	Detect and filter outliers.
5.	Perform Vectorized String operations on Pandas Series.
6.	Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
1.	Import the legacy data from different sources such as (CSV, Text, Excel, SqlServer, Oracle etc.) and load in the target system.
2.	Perform the different Transformation process to construct the database.
3.	Create calculated tables, calculated columns, and simple measures using Data Analysis Expressions (DAX)

4.	Design Data Modeling on dataset.
5.	Create measures with DAX expressions involving filter context manipulation
6.	Demonstrate DAX functions
7.	Design and generate necessary reports based on the data
8.	Demonstrate slicer in Power BI
9.	Creating a Power BI Dashboard
10.	Publishing and Sharing Dashboard and reports Power BI
11.	Demonstrate different charts
12.	Demonstrate at list 5 Maps
13.	Demonstrate Table and Matrix
14.	Demonstrate total and Subtotal in matrix
15.	Deploying the Power BI Dashboard and Report on Server



**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

Faculty of Science and Technology

Equivalent Subject for Old Syllabus B.Sc. (ECS) - II (Semester–III and IV)

<b>Semester-I</b>		
<b>Sr. No.</b>	<b>Name of the Old Paper (w.e.f. 2020-2021)</b>	<b>Name of the New Paper (w.e.f. 2023-2024)</b>
1	Data Structure using C++ -I	Data Structure using C++ -I (Sem-III)
2	Data Structure using C++ -II	Data Structure using C++ -II (Sem-IV)
3	Software Engineering	Software Engineering(Sem-III)
4	Software Testing	Software Testing(Sem-IV)
5	Probability Theory –I	-
6	Probability Theory-II	Probability Theory (Sem-I)
7	Introduction to Python programming	-
<b>Semester-II</b>		
<b>Sr. No.</b>	<b>Name of the Old Paper (w.e.f. 2020-2021)</b>	<b>Name of the New Paper (w.e.f. 2023-2024)</b>
1	Database Management System	Database Management System-I(Sem-III)
2	MYSQL	Database Management System-II(Sem-IV)
3	Operating System	-
4	Linux OS and Shell Scripting	Linux OS and Shell Scripting (Sem-III)
5	Statistics for Data Science	Descriptive Statistics (Sem-IV)
6	Optimization techniques	-
7	Web Development using PHP	Web Development using PHP (Sem-III)

## Nature of Question Paper

### Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Nature of Question Paper for Choice Based Credit System(CBCS) Semester Pattern

Faculty of Science (w.e.f. June 2023 for B.Sc[ECS]-II)

Time: 2 Hrs.

Total Marks:40

**Instructions:** (Instructions may differ from subject to subject)

1. All questions are compulsory.
2. Draw **net diagrams** and give equation whenever necessary.
3. Figure to the right indicates **full marks**.
4. Use of a logarithmic table and calculator is allowed.

**Q.No.1) Multiple choice questions.**

**(8)**

1. \_\_\_\_\_  
a) \_\_\_\_\_ b) \_\_\_\_\_ c) \_\_\_\_\_ d) \_\_\_\_\_
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**Q.No.2) Answer any four of the following.**

**(8)**

- I.
- II.
- III.
- IV.

**Q.No.3) Write a short note on any two of the following.**

**(8)**

- I.
- II.
- III.

**Q.No.4) Answer any two of the following.**

**(8)**

- I.
- II.
- III.

**Q.No.5) Answer any one of the following.**

**(8)**

I.

II.

**For Science faculty: CA- Continuous Assessment (Internal Examinations) of Total Marks: 10**

Pattern / Examination nature may be as follows:

One internal examination of 10 marks or two examinations of 5 marks each.

Open book examination / Home Assignment / Classroom test / Seminar / Field Work report / Project Report etc.