

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Entire Computer Science

Name of the Course: B.Sc. II (Sem-III & IV)

(Syllabus to be implemented from w.e.f. June 2020)

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

Subject/ Core Course	Name and Type of the Section		No. of Papers/ Practical	Hrs/week			Total Marks Per Section	UA	CA	Credits
	Type	Name		L	T	P				
Class :	B.Sc(Entire Computer Science)- II Semester – III									
Core	DSC 1C	Data Structure using C++ -I		3	-	--	50	40	10	4
		Data Structure using C++ -II		3	-	--	50	40	10	
	DSC 2C	Software Engineering		3	-	--	50	40	10	4
		Software Testing		3	-	--	50	40	10	
	DSC 3C (GE-3)	Probability Theory –I		3	-	--	50	40	10	4
		Probability Theory-II		3	-	--	50	40	10	
	SEC-I	Introduction to Python programming		3	-	--	50	40	10	2
Total				21	-	--	350	280	70	14
Class :	B.Sc(Entire Computer Science)- II Semester – IV									
Core	DSC 1D	Database Management System		3	-	--	50	40	10	4
		MYSQL		3	-	--	50	40	10	
	DSC 2D	Operating System		3	-	--	50	40	10	4
		Linux OS and Shell Scripting		3	-	--	50	40	10	
	DSC 3D (GE-4)	Statistics for Data Science		3	-	--	50	40	10	4
		Optimization techniques		3	-	--	50	40	10	
	SEC-II	Web Development using PHP		3	-	--	50	40	10	2
	AECC	Environmental studies		3	-	--	50	40	10	NC
	Total (Theory)			24	-	--	400	320	80	14
Practical's on		DSC 1C , DSC 1D and SEC-I	Practical I & II	--	-	8	100	80	20	4
		DSC 2C , DSC 2D and SEC-II	Practical I & II	--	-	8	100	80	20	4
		DSC 3C & DSC 3D	Practical I & II	--	-	8	100	80	20	4
	Total (Practical)					24	300	240	60	12
	Grand Total			45	-	24	1150	920	230	44

***Core Subjects: Chemistry/Physics/Electronics/Computer**

Science/Mathematics/Statistics/Botany/Zoology/ Microbiology/Geology/ Geography/Psychology

Abbreviations:L: Lectures, T: Tutorials, P: Practical's, UA:University Assessment, CA: College

Assessment, DSC / CC: Core Course, AEC : Ability Enhancement Course, DSE : Discipline Specific

Elective Section, SEC : Skill Enhancement Course, GE : Generic Elective, CA: Continuous Assessment,

ESE: End Semester Examination

Course Code: _____ (Section-I)**Total Contact Hours:** Hrs.**Teaching Scheme:** Theory 3 Lect./Week**Course Title: Data structures- I****Total Marks: 50(40 Lectures)****Total Credits: 02**

Unit No	Content	No. of Lectures
1	An Introduction to Data Structures: Introduction, Definition and types of Data structure. Abstract Data Type (ADT)- ADT for array, ADT for stack, ADT for queue. Algorithm: Definition, characteristics of algorithm. Complexity of algorithm- Space complexity, time complexity, Big-O Notation Design strategies of Algorithm- Divide and Conquer, Greedy Algorithm, branch & bound, backtracking, and dynamic programming.	8
2	Array: Introduction to Array, types of array- one dimensional, two dimensional and multidimensional, Operations of array- insert, delete, traverse, count, display, reverse	4
3	Stack: Introduction to Stack, Operations of stack- Create, isempty, isfull, push, pop, display, Implementation of stack using array (Static Implementation) Applications of Stack-Conversion of infix expression to postfix expression, Conversion of infix expression to prefix expression, Matching parenthesis in an expression (Checking expression is valid or invalid), Evaluation of postfix expression, Stack in recursion, Implementation of applications of stack.	8
4	Queue: Introduction to Queue, Operations of 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 array (Static Implementation), Difference between stack and queue, Applications of Queue	8
5	Linked Lists: 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)	12

Books Recommended:

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

Course Code: _____(Section-I)**Course Title: Data structures- II****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
1	<p>Trees: 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 tree, Height balanced tree/Balanced Binary Tree/AVL tree, Application of tree</p>	10
2	<p>Graph: Concept & terminologies used in graph, Graph Representation using- Array and linked list, Graph traversals – BFS & DFS, Dijkstra's shortest path algorithm, and application of graph.</p>	10
3	<p>Sorting: 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>	10
4	<p>Searching: Introduction and definition of Searching, Types of searching-Linear (Sequential) Search, Binary Search, Indexed sequential search, Hashing and different Hash functions.</p>	10

Books Recommended:

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.

Course Code: _____ (Section-I)

Course Title: Software Engineering

Total Contact Hours: Hrs.

Total Marks: 50(40 Lectures)

Teaching Scheme: Theory 3 Lect./Week

Total Credits: 02

Unit No	Content	No. of Lectures
Unit-1	<p>System concepts: Introduction system, characteristics, Elements of system, Types of system, System Analysis, Role of System Analyst.</p> <p>Software Engineering: Definition, Characteristics of software, Qualities of software.</p> <p>System Development life cycle- Waterfall model, V-shape model, Spiral model, Prototyping, incremental, RAD, Agile.</p>	10
Unit-2	<p>Software requirements: Functional, Non-functional requirements, User requirement, System requirements, Fact finding techniques: Interviews, Questionnaire, Record reviews, Observation</p> <p>Analysis and Design Tools: Flow charting, Decision tables, Decision Trees, Structured English, Structure charting Techniques (HIPO).</p> <p>System Design: Data flow Diagram (Physical, Logical), Entity relation diagram, structured chart, Data Dictionary, Input and output design, Types of Dependencies, Normalization(1NF,2NF,3NF,BCNF,4NF,5NF)</p>	10
Unit-3	<p>Coding: Verification, size measures, complexity analysis, coding standards, Effort Estimation, Cost Estimation, Testing fundamentals</p> <p>Construction of the system: traditional and incremental approaches, conversion methods, Software Implementation, Overview of maintenance process, types of maintenance.</p>	10
Unit-4	<p>Software Quality Assurance: 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>	10

Books Recommended:

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 Parthasarty

Course Code: (Section-II)**Course Title: Software Testing****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
Unit-1	Introduction To Software Testing: <ul style="list-style-type: none"> • Importance or need of software testing • Differences between Manual and Automation Testing Introduction to White Box Testing: <ul style="list-style-type: none"> • Advantages and Disadvantages of White box testing • Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection • Dynamic Techniques or Structural Techniques <ul style="list-style-type: none"> ▪ Statement Coverage Testing, Branch Coverage Testing ▪ Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing 	10
Unit-2	Introduction to Black Box Testing: <ul style="list-style-type: none"> • Advantages and Disadvantages of black box testing • Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, State Transition Technique, Cause Effective Graph, Decision Table, Use Case Testing • Experienced Based Techniques: Error guessing, Exploratory testing Levels of Testing <ul style="list-style-type: none"> • Functional Testing <ul style="list-style-type: none"> ▪ Integration Testing and types - Top Down , Bottom Up , Non Incremental ▪ System Testing ▪ Acceptance Testing- Alpha and Beta ▪ Smoke Testing ▪ Regression Testing- Unit , Regional, Full • Non Functional Testing <ul style="list-style-type: none"> ▪ Adhoc Testing ▪ Performance Testing : Load Testing, Stress Testing, Volume Testing, Soak Testing ▪ Recovery Testing 	10
Unit-3	Test cases design Techniques: <ul style="list-style-type: none"> • Introduction to Test Case and types. • Test Case Template • How to write a test case and examples • Preparing Review Report Software Test Life cycle <ul style="list-style-type: none"> • Software Test Life Cycle- <ul style="list-style-type: none"> ▪ Writing Test Plan ▪ Preparing Traceability Matrix ▪ Writing Test Execution Report and Summary Report 	10
Unit-4	Defect Life Cycle: <ul style="list-style-type: none"> • Bug/Defect Life Cycle- Difference between Bug, Defect, Failure, Error <ul style="list-style-type: none"> ▪ Defect Tracking and Reporting ▪ Types of Bugs, Identifying the Bugs, Reporting the Bugs Introduction to automated testing- Install and configure selenium testing tool, Case study: Design test case for login page, Internet Banking Login, Online shopping.	10

Books Recommended:

- 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
- 4) Software Testing Techniques, 2ndedition- Boris Beizer

Course Code: (Section-I)**Course Title: Probability Theory-I****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
1	1. Permutations and Combinations: 1.1 Principles of counting 1.2 Permutations of 'n' dissimilar objects taken 'r' at a time (with and without replacement) 1.3 Permutations of 'n' objects not all different 1.4 Combinations of 'r' objects taken from 'n' objects 1.5 Numerical problems	10
2	2. Probability: 2.1 Idea of deterministic and non-deterministic models 2.2 Sample space – types of sample space 2.3 Event- types of events 2.4 Classical definition of probability and its limitations 2.5 Axioms of probability- proofs of results: $P(\phi)=0$, $P(A^c)=1-P(A)$, $P(A \cup B)=P(A)+P(B)-P(A \cap B)$, $P(A) \leq P(B)$ if A is subset of B 2.6 Conditional probability: concept and definition, multiplication law of probability (statement only) 2.7 Independence of events: concept and definition, pair wise and complete independence (for 3 events), 2.8 Partition of sample space and Baye's theorem (statement only) 2.9 Numerical problems	12
3	3. Discrete random variable: 3.1 Definition of r.v and discrete r.v. 3.2 Definition of p.m.f. , c.d.f., properties of c.d.f. 3.3 Expectation and variance of r.v.: definition, proof of the results $E(c)=c$, $E(aX \pm b)=aE(X) \pm b$, $V(c)=0$, $V(aX \pm b)=a^2V(X)$ 3.4 Numerical problems	8
4	4. Special prob. Distributions: 4.1 Binomial distribution: definition, mean and variance (only state), additive property (only state), illustrations of real life situations, recurrence relation for probabilities. 4.2 Poisson distribution: definition, mean and variance (only state), additive property (only state), illustrations of real life situations, recurrence relation for probabilities. 4.3 Hypergeometric distribution: definition, mean and variance (only state), illustrations of real life situations, recurrence relation for probabilities. 4.4 Numerical problems	10

Book Recommended:

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

Course Code: (Section-II)**Course Title: Probability Theory-II****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
1	1. Continuous random variable: 1.1 Definition of continuous r.v. 1.2 Definition of p.d.f. , c.d.f., properties of c.d.f 1.3 Expectation and variance of r.v.: definition 1.4 Numerical problems	8
2	2. Special prob. Distribution: 2.1 Uniform distribution: definition, mean and variance (only state), c.d.f., probability curve 2.2 Exponential distribution: definition, mean and variance (only state), c.d.f., lack of memory property, probability curve 2.3 Normal distribution: definition, mean and variance (only state), probability curve, S.N.V., properties of normal distribution, distribution of $(aX+b)$, $(aX+bY+c)$ when X and Y are independent, computations of probabilities using normal tables 2.4 Chi-square distribution: definition of chi-square variate as a sum of squares of n iids.n.vs., statement of p.d.f., Use of chi-square table for computing probabilities, mean and variance (only state)	10
3	3. Tests of hypothesis: 3.1 Definition – random sample, parameter, statistic, sampling distribution of statistic, standard error of statistic 3.2 Concept of null and alternative hypothesis, level of significance, types of error, critical region, concept of tests of hypothesis, one sided and two sided tests.	8
4	4. Large sample tests: 4.1 $H_0: \mu=\mu_0$ against $H_1 : \mu\neq\mu_0$ 4.2 $H_0: \mu_1=\mu_2$ against $H_1 : \mu_1\neq\mu_2$ 4.3 $H_0: p=p_0$ against $H_1 : p\neq p_0$ 4.4 $H_0: p_1=p_2$ against $H_1 : p_1\neq p_2$	8
5	5. Tests based on chi-square distribution: 5.1 Test for goodness of fit. 5.2 Test for independence of attributes.	6

Book Recommended:

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

Course Code: (SEC-I)**Course Title: Introduction to Python
Programming****Total Contact Hours: Hrs.****Total Marks: 50 (40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
1	Introduction to Python: Features/Characteristics of Python, Installation and Working with Python, Structure of a Python Program, Writing simple python program, Executing python program using command line window and IDLE graphics window, Python Virtual Machine, Identifiers and Keywords, Operators (Arithmetic operators, Relational operators, Logical or Boolean operators, Assignment Operators, Bit wise operators, Membership operators, Identity operators), Operator Precedence and Associativity	4
2	Python Data Types: Python Variables, Data types in python, Built-in Datatypes, Bool datatype , Sequences in python, Sets, Literals in python, User Defined Datatypes, Constants in python, Type conversion, Input and Output Statements, Command line arguments Control Statements: Conditional Statements: if, if-else, nested if –else, Looping: for, while, nested loops, Loop manipulation using pass, continue, break, assert and else suite	6
3	Strings, Collection Lists, Tuples and Dictionaries: Strings: Introduction to String, String Manipulation. Collection List: Introduction to List, Manipulating list. Tuples: Introduction to Tuples, Manipulating Tuples. Dictionaries: Concept of Dictionary, Techniques to create, update & delete dictionary items.	6
4	Functions, Modules : Difference between a Function and a Method, Functions:- Defining a function, Calling a function, Advantages of functions, Types of functions, Function parameters:-Formal parameters, Actual parameters, Anonymous functions, Global and Local variables, Modules:- Importing module, Creating & exploring modules, Math module, Random module, Time module	4
5	Object Oriented Programming: Features, Concept of Class & Objects, Constructor, Types of Variables, Namespaces, Types of Methods, Inner Classes, Constructors in Inheritance, Overriding Super Class Constructors and Methods, Types of Inheritance, Abstract Classes and Interfaces, The Super() Method, Operator Overloading, Method Overloading, Method Overriding	8
6	Regular Expressions: Introduction to Regular Expression, Advantages & Operations, Sequence characters in Regular Expression, Powerful pattern matching and searching, Password, email, url validation using regular expression, Pattern finding programs using regular expression Exception Handling: Errors in a Program, Exceptions, Exception handling, Types of Exceptions, User-defined Exceptions	8
7	Python File Operation: Types of File, Opening and Closing a File, Reading and writing to files, Manipulating directories	4

Reference Books

1. Python Cookbook: Recipes for Mastering Python 3 by Brian Kenneth Jones and David M. Beazley O'Reilly
2. Beginning Python by Magnus Lie Hetland-Apress
3. Python Programming for the Absolute Beginner by Michael Dawson-Cengage Learning
4. Python for Everybody: Exploring Data in Python 3 by Charles Severance-Create Space Independent Publishing Platform

B.Sc (Entire Computer Science)-II Semester- IV**Course Code: _____(Section-I)****Course Title: Database Management System****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
Unit-1	Introduction to Database Management System: <ul style="list-style-type: none"> • 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(Relational, Network, Hierarchical, hybrid) 	8
Unit-2	Conceptual Design <ul style="list-style-type: none"> • E-R model: entities, attributes and its types, Relationship, Relationship sets, Generalization, Specialization, Aggregation • Relational Model: Relation, Domain, Tuple, Degree, cardinality • Relational Algebra operations: Select, Project, Cartesian Product, Union, Set difference, join 	8
Unit-3	Transaction Management & Concurrency Control: <ul style="list-style-type: none"> • Introduction of Transaction, ACID properties, transaction states, scheduling, conflict and view serializability, • Introduction of Concurrency Control, problems of concurrency control, lock based protocols, timestamp based protocol, deadlock, deadlock handling methods. 	14
Unit-4	Database recovery and Atomicity: <ul style="list-style-type: none"> • Introduction, recovery algorithms, log base recovery, shadow paging, recovery with concurrent transaction, checkpoints or syncpoints or savepoints. • Query Optimization: Overview Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization. 	10

Books Recommended:

- 1) Database System Concepts by Korth Silberschetz
- 2) Fundamentals of Database Systems by Elmsari, Navathe

Course Code: _____ (Section-II)**Course Title: MYSQL****Total Contact Hours: Hrs.****Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
1	Introduction to MySQL <ul style="list-style-type: none"> ▪ Installing MySQL and starting MySQL instance. ▪ History of MySQL ▪ Components of MySQL -DML,DDL,DCL,DQL ▪ Data types in MySQL ▪ Creating databases and show databases 	5
2	Performing Operation on Table Data <ul style="list-style-type: none"> ▪ Populating tables with data , ▪ Retrieving data from tables, Sorting data in a table, Deleting data from table ▪ Updating data in tables, Adding new columns , Dropping columns ▪ Modifying existing columns, Rename existing column ▪ Renaming table using alter table, Changing a table type ▪ Finding out the tables created by user, Displaying a table structure ▪ Creating a table from a table , Inserting data into a table from another table 	8
3	MySQL clauses, Function, Operators <ul style="list-style-type: none"> ▪ MySQL clause-where distinct, from, order by, group by, having, rollup ▪ MySQL Function-Aggregate functions, Math functions, String functions, Date and Time functions, control flow functions and expressions, comparison functions, Window functions ▪ MySQL operators:- and, or ,and or, like, in, not, is null, is not null, between, comparison operator 	8
4	MySQL constraints <ul style="list-style-type: none"> ▪ Applying data constraints- column level and table level ▪ Types of Data constraints- I/O constraints ,Business rule constraints <ul style="list-style-type: none"> • NOT NULL constraint , UNIQUE constraint , CHECK constraint • Primary key and Foreign key constraint • Disable foreign key checks ▪ Adding, Modify and drop constraints using alter table command 	6
5	SubQueries, Join and Indexing <ul style="list-style-type: none"> ▪ sub queries:- use, example ▪ Set Operations- Union, Union all, Minus and Intersect ▪ MySQL join:- Advantages and disadvantages of Join, Types of Joins ▪ Indexing:- Advantages and disadvantages of Indexing, creating index(simple, composite, unique),multiple indexing, drop index ▪ MySQL View:- why view, Create, Alter and Drop view 	6
6	Stored Procedures, Transaction and cursor, Trigger <ul style="list-style-type: none"> ▪ Stored Procedure:- use of stored procedure ,structure of stored procedure, Supported SQL statements in Procedures, creating dynamic procedure, Adding record to the table using procedure, procedure with IN,OUT,INOUT parameter, dropping procedure ▪ Triggers- use, example ▪ Transaction :MySQL transactions, open and closing transaction, commit, rollback, savepoint in transaction, table lock ▪ Cursor:-use of cursor, types of cursor ,opening a cursor, fetching a record from the cursor, cursor fetch statement, closing cursor ▪ MySQL import & export- Import CSV File into MySQL Table, Export MySQL Table to CSV 	6

Reference books:

1. MySQL(TM): The Complete Reference by Vikram Vaswani
2. MySQL Cookbook by Paul DuBois

Course Code: (Section-I)**Course Title: Operating System****Total Contact Hours:** Hrs.**Total Marks: 50(40 Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
Unit-1	<p>Introduction Operating System: Definition, Types of OS-Batch, Multiprogramming, Time-Sharing, Real-Time, Distributed, Parallel, OS Services, System components, System Calls.</p> <p>Process and Thread Management Concept of Process, Process states, Process Control Block, Context switching, Operations on Process, Co-operating Process, Threads and its types, Benefits of threads.</p> <p>Process Scheduling- Types of Schedulers, Scheduling criteria, Scheduling algorithms-Preemptive and Non-preemptive, FCFS, SJF, Round Robin, Priority, Multilevel Queue, Multilevel-feedback Queue.</p>	
Unit-2	<p>Process Synchronization(Concurrency Control): The Producer Consumer Problem, Race Conditions, Critical Section Problem, Semaphores, and Classical problems of Synchronization-Reader-Writer Problem, Dining Philosopher Problem, Critical Regions.</p> <p>Deadlocks: Definition, Characteristics, Resource Allocation Graph, Methods of Handling Dead Locks- Deadlock Prevention, Deadlock Avoidance, Deadlock detection and Recovery.</p>	
Unit-3	<p>Memory Management: Basic, Address Binding, Logical &Physical address Space, Dynamic Loading, Overlays, Memory partitioning: Fixed and Variable, Contiguous Memory allocation, Allocation Strategies(First Fit, Best Fit, Worst Fit),Swapping, fragmentation, compaction, Paging and Segmentation.</p> <p>Virtual Memory: demand paging, Page fault, Page Replacement policies: Optimal(OPT), First in First Out(FIFO),Least Recently used(LRU), Thrashing.</p>	
Unit-4	<p>Storage Management: File concept, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping).</p> <p>Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, CSCAN), disk reliability, disk Formatting, boot block, bad blocks.</p>	

Books Recommended:

1. Operating System Concepts By Siberchatz and Galvin.
2. Modern O.S. By Andrews Tanenbaum.

Course Code: (Section-II)**Course Title: Linux OS and Shell Scripting****Total Contact Hours: Hrs.****Total Marks: 50(____Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 02**

Unit No	Content	No. of Lectures
Unit-1	<p>Introduction of Linux: History of Linux, Architecture of Linux system & features, Shell & its type, Difference between Windows and Linux. Linux Distributions, Working environments: KDE, GNOME, Xface4, Installing and Configuring Linux OS.</p> <p>Linux File System: 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>Users & Groups Management: Create and manage Users or groups, Assigning permissions to users and Groups, File and Directory permissions- chmod, chown, chgrp.</p>	10
Unit-2	<p>Linux commands: File and directory Management Commands:-mkdir, rmdir, cd ,pwd, file, ls, cat, more, less. File and Directory Operations: find, cp, mv, rm, ln, Printing the files lpr, lpq, lprm Filter Commands & Editor:-Filters: head, tail, pr, cut, paste, sort, uniq, tr, grep, egrep, fgrep, sed. Communication commands:-mesg, talk, write, wall, mail. Text Editors: vi, vim, Archive and File compression commands Shell Programming: Shell Variables, Metacharacters, Shell Scripts – Control and Loop structure, I/O and Redirection, Piping,</p>	15
Unit-3	<p>Process Management: Shell process, System process, background and foreground process, Changing process priority with nice. Listing processes-jobs, ps, kill, premature termination of process.</p> <p>Disk Management Tools: Fdisk, Parted, Boot Loaders- GRUB, LILO Role of system administrator,</p> <p>Networking: services and Configuration files, starting services, Network tools-ping, finger, traceroute, who, host, Protocols and Services- SMB, FTP, DHCP, LDAP, NFS and NIS.</p>	15

Books Recommended:

1. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
2. UNIX for programmers and users by Graham Glass & King Ables, Pearson Education
3. UNIX concepts and applications by sumitabha das, mcgraw hill publication

Course Code: (Section-I)
Total Contact Hours: Hrs.
Teaching Scheme: Theory 3 Lect./Week

Course Title: Statistics for Data Science
Total Marks: 50(40 Lectures)
Total Credits: 02

Unit No	Content	No. of Lectures
1	Population and sample: 1.1 Concept of population with illustration. 1.2 Concept of sample with illustration. 1.3 Sampling methods: SRS (SRSWR, SRSWOR), stratified, systematic(description only)	4
2	Data condensation and graphical methods: 2.1 Raw data- attribute, variable- discrete and continuous, constant. 2.2 Classification- def, objectives, principles of classification. 2.3 Construction of frequency distribution, cumulative frequency distribution, relative frequency distribution. 2.4 Graphical representation: histogram, frequency polygon, frequency curve, ogives.	6
3	Measures of central tendency: 3.1 Concept of central tendency, criterion for good measures of central tendency. 3.2 A.M. – def. computation for ungrouped and grouped data, combined mean, weighted mean, effect of change in origin and scale, merits and demerits. 3.3 Median- def. computation for ungrouped and grouped data, graphical determination, merits and demerits. 3.4 Mode- def. computation for ungrouped and grouped data, graphical determination, merits and demerits. 3.5 Quartiles- def. computation for ungrouped and grouped data, graphical determination. 3.6 Numerical problems.	10
4	Measures of dispersion: 4.1 concept of dispersion, absolute and relatives measures. 4.2 Range- def. computation for ungrouped and grouped data, Coefficient of range, merits and demerits. 4.3 S.D. and Variance-def. computation for ungrouped and grouped data, C.v., combined S.D. effect of change of origin and scale, merits and demerits. 4.4 Numerical problems.	10
5	Correlation and regression 5.1 Bivariate data 5.2 Concept of correlation, types of correlation, cause and effect relation. 5.3 Karl Pearson’s coefficient of correlation (r)- def., limit for ‘r’, interpretation of r, effect of change of origin and scale. 5.4 Regression – concept, def., lines of regression 5.5 Derivation of line of regression by least square method 5.6 Properties of regression coefficient (only state), interpretation of regression coefficients. 5.7 Non-linear regression- fitting of second degree curve ($Y = A + BX + Cx^2$), exponential curve ($Y = A Bx$) 5.8 Numerical problems.	10

Book Recommended:

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,
Surenra B. Ghatpande

Course Code: (Section-II)

Course Title: Optimization Techniques

Total Contact Hours: Hrs.

Total Marks: 50(40 Lectures)

Teaching Scheme: Theory 3 Lect./Week

Total Credits: 02

Unit No	Content	No. of Lectures
1	Introduction to O.R. <ul style="list-style-type: none"> ▪ History, ▪ Evolution, ▪ Scope and limitations 	4
2	Linear programming problems (LPP): <ul style="list-style-type: none"> ▪ Statement of LPP, Formulation of problem as LPP, ▪ General form of LPP, canonical form of LPP, standard form of LPP, ▪ Definitions – decision variable, slack and surplus variables, artificial variable, solution, feasible solution, basic feasible solution, optimal solution, alternate solution. ▪ Solution of LPP: ▪ Graphical method, simplex method, big-M method ▪ Duality Theory – writing dual of primal LPP 	12
3	Transportation problem (TP): <ul style="list-style-type: none"> ▪ Statement of TP, mathematical model of TP, balanced and unbalanced TP, ▪ methods of obtaining initial basic feasible solution of TP- north-west corner method, matrix minima method, Vogel's approximation method, ▪ Modified Distribution method (MODI) of obtaining optimal solution of TP 	12
4	Assignment problem (AP): <ul style="list-style-type: none"> ▪ Statement of AP, mathematical model of AP, balanced and unbalanced AP, AP with restriction, ▪ Optimal solution of AP by Hungarian method, alternative solution, maximization in AP 	12

Books Recommended:

1. Operation Research an introduction – by Hamdy A Taha
2. Operation Research Theory and applications – by J. K. Sharma
3. Operation research – by Premkumar Gupta, D. S. Hira
4. Operation Research – by KantiSwarup Gupta, Man Mohan

Course Code: SEC-II**Course Title: Web Development using PHP****Total Contact Hours: Hrs.****Total Marks: 100(____ Lectures)****Teaching Scheme: Theory 3 Lect./Week****Total Credits: 04**

Unit No	Content	No. of Lectures
1	<p>Introduction:</p> <ul style="list-style-type: none"> • Introduction to web applications, Client Side Vs Server Side Scripting • WebServers: 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, • Control statements–if, switch case, for, while, do while. • Arrays: Initialization of an array, Iterating through an array, Sorting arrays, Array Functions, • Functions: Defining and Calling Functions, Passing by Value and passing by references, Inbuilt Functions. 	10
2	<ul style="list-style-type: none"> • String: Formatting String for Presentation and Storage, Joining and Splitting String, Comparing String, Matching and replace Substring, patterns, basic regular expressions. • Working With Forms: 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, 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. 	10
3	<ul style="list-style-type: none"> • Database Connectivity with MYSQL: 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 • Working with file and Directories: Understanding file& directory, Opening and closing a file, Coping ,renaming and deleting a file Working with directories, Building a text editor, File Uploading & Downloading, Generating Images with PHP- Basics of computer Graphics Creating Image, Manipulating Image, Using text in Image 	14
4	<p>State Management:</p> <ul style="list-style-type: none"> • Cookies: Setting time in a cookie with PHP, Deleting a cookie, Creating session cookie, Working with the query string • Session: Starting a session, Registering Session variables, working with session variables, destroying session, passing session Ids, encoding and decoding session variables 	6

Books Recommended: 1)PHP: The Complete Reference-Steven Holzner.
2)Programming PHP- Rasmusler dorf, Kevin Tatroe.

Lab Course on Data Structure I and II**Array**

- 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.

Stack

- 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.

Queue

- 1) Write a program to implement linear queue by using array. (Static Implementation of queue)
- 2) Write a program to implement Circular queue.
- 3) Write a program to implement Priority queue.
- 4) Write a program to implement IRD (Input Restricted Deque)
- 5) Write a program to implement ORD (Output Restricted Deque)

Linked List

- 1) Write a program to implement singly linear linked list with its basic operations.
- 2) Write a program to implement stack by using linked list. (Dynamic implementation)
- 3) Write a program to implement queue by using linked list. (Dynamic implementation)
- 4) Write a program to implement doubly linear linked list with its basic operations.
- 5) Write a program to implement singly circular linked list with its basic operations.
- 6) Write a program to implement doubly circular linked list with its basic operations.

Tree

- 1) Write a program to implement binary search tree with tree traversal methods.
- 2) Write a program to implement BST with following operations:
 - I) Insert Node
 - II) Count Leaf nodes
 - III) Count Non-Leaf nodes
 - IV) Count Total nodes
- 3) Write a program to implement BST with following operations:
 - I) Insert Node
 - II) Find Maximum node
 - III) Find Minimum Node
 - IV) Search node
 - V) Display only odd nodes
 - VI) Display only even nodes
 - VII) Display leaf nodes
 - VIII) Find level of node
 - IX) Find degree of node
 - X) Delete Node

Graph

- 1) Write a program to represent undirected and directed graph by using Adjacency matrix.
- 2) Write a program to represent weighted graph by using Adjacency matrix.
- 3) Write a program to implement graph by using linked list and perform following operations:
 - 1) Insert Vertex (Node)
 - 2) Display Vertices
 - 3) Search Vertex
 - 4) Insert Edge
 - 5) Find adjacent vertices
 - 6) 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.

Sorting and Searching

- 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.

Lab Course on Software Testing:

- 1) Design test case for Internet Banking Application
- 2) Design test case for Gmail Login Functionality
- 3) Design test case for college admission Application
- 4) Design test case for online order processing.
- 5) Design test case for social networking sites.
- 6) Design test case for MS-word application
- 7) Design test case for simple calculator
- 8) Design test case for ball pen.
- 9) Design test case for Paint application.
- 10) Design test case for Online Flight Booking

Lab Course on Python

- 1) Installing Python and setting up Python environment.
- 2) Write a program to print strings, numbers and perform simple mathematical calculations.
- 3) Write a program to implement command line arguments.
- 4) Write a program to implements conditional statements -if, if-else, nested if.
- 5) Write a program to implement loops.
- 6) Write a program to manipulate strings like string copy, string concatenation, string comparison, string length, string reverse etc.
- 7) Write program to show use of Lists and Tuples.
- 8) Write program which uses dictionaries
- 9) Write program to implement functions & Modules
- 10) Write program to implement Package.
- 11) Write a program to implement Constructors.
- 12) Write a program to implement types of Inheritance and Interfaces.
- 13) Write a program to implement Method Overloading and Method Overriding.
- 14) Write a program to implement Operator Overloading.
- 15) Write a program in to read and write contents in a file.
- 16) Write a program to demonstrate Exception handling
- 17) Write a program to demonstrate user defined exception.
- 18) Write a program to demonstrate the use of regular expressions
- 19) Write a program to draw different shapes

Lab Course on DBMS using MYSQL:

1. Create the following Databases.

Salesmen

SNUM	SNAME	CITY	COMMISSION
1001	Prashnat	Mumbai	12
1002	Rajesh	Surat	13
1004	Anandi	Mumbai	11
1007	Priya	Delhi	15
1003	Suchita	Pune	10
1005	Nayan	Baroda	14

Customers

CNUM	CNAME	CITY	RATING	SNUM
2001	Harsh	Baroda	100	1001
2002	Gita	Pune	200	1003
2003	Lalit	Mumbai	200	1002
2004	Govind	Delhi	300	1002
2006	Chirag	Surat	100	1001
2008	Prajakta	Delhi	300	1007
2007	Sushma	Mumbai	100	1004

Orders

ONUM	AMOUNT	ODATE	CNUM	SNUM
3001	18	10/3/2019	2008	1007
3003	767	15/3/2019	2001	1001
3002	1900	10/3/2019	2007	1004
3005	5160	20/4/2019	2003	1002
3006	1098	20/4/2019	2008	1007
3007	1713	10/5/2019	2002	1003
3008	75	10/5/2019	2004	1002
3010	4723	15/6/2019	2006	1001
3011	1309	18/3/2019	2004	1002

Solve the following queries using above databases and where clause range searching and pattern matching.

1. Produce the order no, amount and date of all orders.
2. Give all the information about all the customers with salesman number 1001.
3. Display the following information in the order of city, sname, snumand commission.
4. List of rating followed by the name of each customer in Surat.
5. List of snum of all salesmen with orders in order table without any duplicates.

Solve the following queries using above databases and group by clause.

1. Find out the largest orders of salesman 1002 and 1007.
2. Count all orders of October 3, 1997.
3. Calculate the total amount ordered.
4. Calculate the average amount ordered.
5. Count the no. of salesmen currently having orders.

Solve the following queries using above databases and formatted output and order by clause.

1. List all salesmen with their % of commission.
2. Display the no. of orders for each day in the descending order of the no. of orders in the following format.
FOR dd-mon-yy, there are __ Orders.
3. Assume each salesperson has a 12% commission. Write a query on the order table that will produce the order number, salesman no and the amount of commission for that order.

4. Find the highest rating in each city in the form :

For the city (city), the highest rating is : (rating)

5. List all in descending order of rating.

6. Calculate the total of orders for each day and place the result in descending order.

Solve the following queries using above databases and join.

1. Show the name of all customers with their salesman's name.

2. List all customers and salesmen who shared a same city.

3. List all orders with the names of their customer and salesman.

4. List all orders by the customers not located in the same city as their salesman.

5. List all customers serviced by salespeople with commission above 12%.

Solve the following queries using above databases and join and subquery.

1. Find all orders attributed to salesmen in 'London'.

2. List the commission of all salesmen serving customers in 'London'.

3. Find all customers whose cnum is 1000 above than the snum of Sejal.

4. Count the no. of customers with the rating above than the average of 'Surat'.

5. List all orders of the customer 'Chirag'.

Solve the following queries using above databases and delete and update.

1. Remove all orders from customer Chirag from the orders table.

2. set the ratings of all the customers of Piyush to 400.

3. Increase the rating of all customers in Rome by 100.

4. Salesman Sejal has left the company. Assign her customers to Miti.

5. Salesman Miti has resigned. Reassign her number to a new salesman Gopal whose city is Bombay and commission is 10%.

Solve the following queries using above databases and alter table and table constraints..

1. How the onum field is forced to be an unique?

2. Create an index to permit each salesman to find out his orders by date quickly.

3. Write a command to enforce that each salesman is to have only one customer of a given rating.

4. Write a command to add the item-name column to the order table.

5. Write a command to create the salesmen table so that the default commission is 10% with no NULLs permitted, snum is the primary key and all names contain alphabetical only.

6. Give the commands to create our sample tables (salesmen, customer, orders) with all the necessary constraints like PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY.

Solve the following queries using above databases and view.

1. Create a view called Big orders which stores all orders larger than Rs. 4000.

2. Create a view Rate count that gives the count of no. of customers a teach rating.

3. Create a view that shows all the customers who have the highest ratings.

4. Create a view that shows all the number of salesmen in each city.

5. Create a view that shows the average and total orders for each salesmen after his name and number.

6. Create a cursor emp_cur, fetch record from emp table and check whether sal > 10000 then update Grade = 'A' else if sal >= 5000 and sal <= 10000 then update Grade = 'B'

7. Write a procedure to find the table structure of a given number

8. Write a procedure on software table to calculate selling cost of all software of a specified person

Lab Course on Linux OS and Shell Scripting-

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 & perimeter of the rectangle, and the area & 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
 - 1) Change the group & owner of a directory
 - 2) Set permission read, write & remove execute of a file
 - 3) To check a file is sorted.
- 19) Write a menu driven shell Script
 - 1) Change directory
 - 2) Display first 15 lines only
 - 3) To remove repeated data from a file.
- 20) Write a menu driven shell Script
 - 1) To locate all files named by bsc
 - 2) User of system
 - 3) Merge two files
- 21) Write a menu driven shell Script
 - 1) To create hard link a file bsc to bcs file
 - 2) Cut fields 2 & 3 from a bsc file
 - 3) Create a new file
- 22) Write a shell Script to calculate simple interest and compound interest
- 23) Write a menu driven shell Script
 - 1) To find out Factorial.
 - 2) To find out given no is perfect or not.
 - 3) To find out Armstrong or not.
- 24) Write a menu driven Script to make File and Directory Management Operations:

- 1) Display Current directory
 - 2) Make Directory
 - 3) Edit a file
 - 4) Copy a file
 - 5) Remove a file
 - 6) Move a file.
- 25) Write a Shell Script to find profit or loss given the Cost price and Selling price
 - 26) Write a Shell Script to check if a file is readable, writable and executable
 - 27) Write a shell script to concatenate files.
 - 28) Write a Shell Script to convert Decimal number into Binary
 - 29) Write a shell script to display series: 1+4+27+256...
 - 30) Write a shell script to display series: 0 1 1 2 3 5 8

<pre> 0 1 0 2 1 0 3 2 1 0 4 3 2 1 0 5 4 3 2 1 0 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 </pre>		<pre> 1 2 3 4 5 1 2 3 4 1 2 3 1 2 1 1 2 1 2 3 1 2 3 4 1 2 3 4 1 2 3 4 5 </pre>
<pre> 5 4 3 2 1 5 4 3 2 5 4 3 5 4 5 </pre>	<pre> 1 2 3 4 5 6 7 8 9 10 </pre>	<pre> 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5 </pre>
<pre> 1 0 1 0 1 0 1 0 1 0 </pre>	<pre> 2 4 6 8 10 12 14 16 18 20 </pre>	<pre> 0 1 0 1 2 1 0 1 2 3 2 1 0 1 2 3 4 3 2 1 0 1 2 3 4 </pre>

Lab Course on Web Technology using PHP

- 1) Write PHP code to check entered number is Armstrong or Not.
- 2) Write a menu driven program to perform following operations:
 - a) Check Number is Palindrome or not.
 - b) Check Number is Perfect or not.
 - c) Find face value of Entered number.
 - d) Check Number is Prime or not.
 - e) Check Number is Strong or not.
- 3) Write a PHP code to perform following operations:
 - a) Sort array element
 - b) Find Maximum and Minimum number in array

- c) Merge two arrays in third array.
- d) Swap two array elements
- 4) Write a program to overload the constructor.
- 5) Write a program which uses the static methods and static variables.
- 6) Write a program to implement different types of inheritance.
- 7) Write a program to implement interface.
- 8) Write a program to handle different types of exceptions.
- 9) Write a program which shows the use of 'final' keyword.
- 10) Write a program to copy the content of one file into another.
- 11) Write a program to merge two files into third file.
- 12) Design a web application to perform following task on employee table.
I) Add New II) Save III) Delete IV) Update V) Move First VI) Move Last
- 13) Design a web application that uses cookies and session object.

Lab Course on Probability Theory-I and II, Statistics for Data Science and Optimization Techniques (Practical's)

- 1. Fitting of Binomial distribution
- 2. Fitting of Poisson distribution
- 3. Fitting of Hypergeometric distribution
- 4. Model sampling from uniform and exponential distribution
- 5. Fitting of normal distribution
- 6. Large sample tests
- 7. Tests based on chi-square distribution
- 8. Construction of frequency distribution and graphical representations
- 9. Measures of central tendency (ungrouped data)
- 10. Measures of central tendency (grouped data)
- 11. Measures of dispersion
- 12. Computation of correlation coefficient
- 13. Fitting of lines of regression
- 14. Fitting of second degree and exponential curves
- 15. Solution of LPP by graphical method
- 16. Solution of LPP by simplex method
- 17. Transportation problem
- 18. Assignment problem
- 19. Perform following operations on XLS or CSV data(files) by using Python(Use any library Pandas/Numpy/Scipy/Matplotlib)
 - I)Data processing(columns,rows,statistical information,Max value ,min value etc)
 - II)Data visualization(Bar graph/Histogram/Pie Chart/Line Graph)
 - III)Data Analysis(central tendency, dispersion, Binomial distribution ,normal distribution)