Shri Vaishnav Vidyapeeth Vishwavidyalaya
Shri Vaishnav Institute Of Information Technology
B.Tech. (CSE-Generative AI-IBM)
Choice Based Credit System (CBCS)-2025-29
SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCSH107	**BS**	**Linear Algebra**	**60**	**20**	**20**	**0**	**0**	**3**	**1**	**0**	**4**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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COURSE OBJECTIVES:
The student will have ability to:
1. Know the fundamental principles of the Linear algebra.
2. Understand and apply the basics of the Matrices and Vector Space.

Course Outcomes (COs):
After Upon completion of the subject, students will be able to:
1. Apply the techniques to find the Solution of Linear equations.
2. Apply the basics of the calculus of the Determinants.
3. Apply the basics of the calculus of the Matrices.
4. Apply the concept of Singular value decomposition and Principal component analysis in Image Processing and Machine Learning.
Syllabus:

UNIT I
10HRS
Introduction to Matrices and Determinants: Solution of Linear Equations; Cramer's rule; Inverse of a Matrix.
UNIT II **9HRS**
Ordinary Vectors and linear combinations: Rank of a matrix; Gaussian elimination; LU Decomposition; Solving Systems of Linear Equations using the tools of Matrices.
UNIT III **8HRS**
Vector space: Dimension; Basis; Orthogonally; Projections; Gram-Schmidt orthogonalization and QR decomposition
UNIT IV **7HRS**
Eigen values and Eigen vectors; Positive definite matrices; Linear transformations; Hermitian and unitary matrices
UNIT V **8HRS**
Singular value decomposition and Principal component analysis; Introduction to their applications in Image Processing and Machine Learning.
Text Books:
1. **Higher Engineering Mathematics, B. S. Grewal.**

References:
1. **Advanced Engineering Mathematics, 7th Edition, Peter V. O'Neil.**
2. **Advanced Engineering Mathematics, 2nd Edition, Michael. D. Greenberg.**

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3. **Introduction to linear algebra, 5th Edition, Gilbert Strang.**
4. **Applied Mathematics (Vol. I & II), by P. N. Wartikar & J. N. Wartikar.**
5. **Digital Image Processing, R C Gonzalez and R E Woods**
6. **https://machinelearningmastery.com/introduction-matrices-machine-learningCourse**

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BTPH101	**BS**	**Applied Physics**	**60**	**20**	**20**	**30**	**20**	**3**	**1**	**2**	**5**

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Course Educational Objectives (CEOs):

1. To develop a comprehensive understanding of the laws of physics.
2. To develop the ability to apply laws of physics for various engineering applications.
3. To develop experimental skills, ability to analyze the data obtained experimentally to reach substantiated conclusions.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The students will be able to

1. comprehend laws of physics.
2. apply laws of physics for various engineering applications.
3. determine physical parameter experimentally and will be able to analyze the data obtained experimentally to draw substantiate conclusions.

Syllabus:

UNIT I 10 HRS

Quantum Physics: Introduction to Quantum hypothesis, Matter wave concept, Wave Group and Particle velocity and their relations, Uncertainty principle with elementary proof and applications to microscope and single slit, Compton Effect, Wave function and its physical significance. Development of time dependent and time independent Schrodinger wave equation, Applications of time independent Schrodinger wave equation.

UNIT II 9 HRS

Solid State Physics: Free electron model, Qualitative Analysis of Kronig Penney Model, Effective mass, Fermi level for Intrinsic and Extrinsic semiconductors, P-N junction diode, Zener diode, Tunnel diode, Photodiode, Solar- cells, Hall Effect, Introduction to Superconductivity, Meissner effect, Type I & II Superconductors

UNIT III 8 HRS

Nuclear Physics: Nuclear Structure & Properties Nuclear models: Liquid drop with semi-empirical mass formula & shell model. Particle accelerators: Cyclotron, Synchrotron, Betatron.

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Counters and Detectors: Giger-Muller counters, Bainbridge Mass Spectrograph and Auston Mass Spectrograph.

UNIT IV 7 HRS

Laser & Fiber Optics: Stimulated and Spontaneous Emission, Einstein‟s A&B Coefficients, Population Inversion, Pumping, Techniques of Pumping, Optical Resonator, Properties and Applications of Laser, Ruby, Nd:YAG, He-Ne lasers.
Introduction to Optical fibre, Acceptance angle and cone, Numerical Aperture, V- Number, Ray theory of propagation through optical fibre, Pulse dispersion, applications of optical fibre.

UNIT V 8 HRS

Wave Optics: Introduction to Interference, Fresnel's Bi-prism, Interference in Thin films, Newton's rings experiment, Michelson‟s interferometer and its application, Introduction to Diffraction and its Types, Diffraction at single slit, double slit, resolving power, Rayleigh criterion, Resolving power of grating, Concept of polarized light, Double refraction, quarter and half wave plate, circularly & elliptically polarized light.

TEXTBOOKS: -

1. Engineering Physics by Dr. S. L. Gupta and Sanjeev Gupta, DhanpatRai Publication, NewDelhi.
2. Engineering Physics by Navneet Gupta, DhanpatRai Publication, NewDelhi.
3. Engineering Physics by H. J. Sawant, Technical Publications, Pune,Maharastra.
4. Engg Physics by M.N. Avdhanulu& P.G. Kshirsagar, S.Chand&Co.Edition(2010).
5. Fundamentals of Physics by Halliday, Wiley,India.

REFERENCES: -

1. Concepts of Modern Physics by Beiser, TMH, New Delhi.
2. Solid State Physics by Kittel, Wiley India.
3. Atomic and Nuclear physics by Brijlal and Subraminiyan.
4. LASERSs and Electro Optics by Christopher C. Davis, Cambridge Univ. Press (1996).
5. Optroelectronics an Introduction by J. Wilson & J. F. B. Hawkes, Prentice-Hall II Edition.
6. LASER theory and applications by A. K. Ghatak&Tyagarajan, TMH (1984). Optics by Ghatak, TMH.

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PRACTICAL LIST: -

1. Measurement of radius of curvature “R” of convex lens by Newton‟s ringexperiment.
2. Measurement of Numerical aperture of fiber by LASER.
3. Determination of Energy band gap “E_g” of Ge using Four Probemethod.
4. Measurement of Frequency of A.C. mains by electrically maintained vibratingrod.
5. Measurement of Resolving Power of Telescope.
6. Measurement of “λ” of LASER light source using Diffraction Grating.
7. Determination of Planck‟s constant by using photocell.
8. Determination of Energy band gap (E_g) using PN Junction Diode.
9. To determine the mass of cane sugar dissolved in water using half shade polarimeter.
10. To study forward and reverse characteristics of Zener diode.
11. To study forward and reverse characteristics of P-N diode.
12. To study characteristics of Photodiode.
13. To study characteristics of LDR.
14. μ and ω of given prism using spectrometer.
15. Measuring height of a given object using a Sextant.

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BTIBM205N	**DCC**	**Software Foundation and Programming 2 (with C++)**	**60**	**20**	**20**	**30**	**20**	**3**	0	**2**	4

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Course Educational Objectives (CEOs):

To introduce the basic concepts of Object-Oriented Programming using C++.
To analyse and handle runtime errors effectively using exception handling mechanisms.
To develop problem-solving skills using object-oriented approaches in C++
To design and implement real-world applications using object-oriented programming principles.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The students will be able to:

Distinguish between procedural and object-oriented programming and translate C logic into C++ classes.
Manage object lifecycles and dynamic memory effectively using constructors, destructors, and memory management operators.
Implement code reusability and extensibility through Inheritance and Polymorphism.
Develop generic, type-independent code using Templates and handle runtime anomalies via Exception Handling.
Design robust applications that interact with the file system for data persistence.

Syllabus

Unit-I **10HRS**

The Bridge from C to C++:
Evolution: Limitations of Procedural Programming, the OOP paradigm (Encapsulation, Abstraction, Polymorphism, Inheritance). **The Basics:** iostream, Namespaces, cin/cout. **Enhanced Features:** Inline functions, Default arguments, Reference variables, and Function Overloading. **Classes & Objects:** Defining classes, data members, and member functions (inside vs outside), Access Specifiers (public, private, protected).

Unit-II **9HRS**

Object Lifecycle & Memory Management:
Constructors: Default, Parameterized, and Copy Constructors.

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Destructors: Cleaning up resources and the order of destruction. **Dynamic Memory:** The new and delete operators**. Static keyword:** Static data members and static member functions, The 'this' Pointer.

Unit-III **8HRS**

Inheritance and Polymorphism:

Inheritance: Base and Derived classes, visibility modes, Single, Multiple, Multilevel, Hierarchical, and Hybrid inheritance. **Virtual Base Classes:** Solving the "Diamond Problem". **Runtime Polymorphism:** Virtual Functions, Pure Virtual Functions, and Abstract Classes.
Compile-time Polymorphism: Operator Overloading (Unary and Binary), Overloading using Friend functions.

Unit-IV **7HRS**

Templates and the STL:

Templates: Function Templates and Class Templates for generic programming. **Standard Template Library (STL):** Introduction to Containers (Vector, List, Stack), Algorithms (Sort, Search), and Iterators. **Strings**: The std::string class.

Unit-V **8HRS**

Exception Handling and File I/O:

Exception Handling: try, throw, catch blocks, catching multiple exceptions, re- throwing. **File Streams:** ifstream, ofstream, and fstream. **File Operations:** Opening/closing files, sequential and random access.

Text Books:

1. IBM Course Material.
2. Object-Oriented Programming with C++ – E. Balagurusamy.

References:

1. The C++ Programming Language – Bjarne Stroustrup.
2. C++ Primer – Stanley B. Lippman, Josée Lajoie, Barbara E. Moo.

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List of Experiments:

1. Function Overloading: Create a program to calculate the area of a circle, rectangle, and triangle using the same function name
2. Classes & Objects: Design a Student class with attributes and methods to calculate grades; implement an array of objects
3. Constructors: Build a Complex number class that uses parameterized and copy constructors to initialize values
4. Friend Functions: Create two classes, DistanceM (meters) and DistanceF (feet), and use a friend function to add them
5. Dynamic Memory: Implement a program that allocates an array of integers dynamically, fills it, sorts it, and deletes the memory
6. Operator Overloading (Binary): Overload the + operator to concatenate two custom string objects
7. Operator Overloading (Unary): Overload the ++ operator to increment time (HH:MM:SS) by one second
8. Single Inheritance: Create a Payroll system where a Derived class Employee inherits from a Base class Person
9. Multiple Inheritance: Implement a SmartPhone class inheriting features from both Camera and MusicPlayer classes
10. Virtual Functions: Demonstrate runtime polymorphism using a Shape base class and Circle/Square derived classes
11. Templates: Create a generic Swap function and a generic Sort function that works for int, float, and char
12. STL Vectors: Write a program to manage a dynamic shopping list using std::vector (add, remove, search)
13. Exception Handling: Create a program for division that catches a "Divide by Zero" exception and "Out of Range" array indices
14. File I/O: Write a program that reads a C++ source file and counts the number of characters, words, and lines
15. Binary Files: Create a small "Address Book" application that saves and retrieves contact objects to/from a binary file

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BTIT201M	**DCC**	**Data Communication**	**60**	**20**	**20**	**0**	**0**	**3**	0	**0**	3

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Course Educational Objectives (CEOs):

The student will have ability to:
1. To understand the concepts of data communications.
2. To be familiar with the Transmission media and Tools.
3. To study the functions of OSI layers.
4. To learn about IEEE standards in computer networking.
5. To get familiarized with different protocols and network components.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The students will be able to:
1. Understand the Process and functions of data communications
2. Understand Transmission media and Tools
3. Understand the functions of OSI layers
4. Understand IEEE standards in computer networking
5. Understand different protocols and network components

Syllabus

UNIT–I 10HRS

Introduction: Data Communication Components, Types of Connections, Transmission Modes, Network Devices, Topologies, Protocols and Standards, OSI Model, Transmission Media, Bandwidth, Bit Rate, Bit Length, Baseband and Broadband Transmission, Attenuation, Distortion, Noise, Throughout, Delay and Jitter.

UNIT–II 9HRS

Data Encoding: Unipolar, Polar, Bipolar, Line and Block Codes. Multiplexing: Introduction and History, FDM, TDM, WDM, Synchronous and Statistical TDM. Synchronous and Asynchronous transmission, Serial and Parallel Transmission.

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UNIT–III 8HRS

Error Detection & Correction: Correction, Introduction–Block Coding–Hamming Distance, CRC, Flow Control and Error Control, Stop and Wait, Error Detection and Error Go Back– N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, CSMA/CD, CDMA/CA

UNIT–IV 7HRS

Network Switching Techniques: Circuit, Message, Packet and Hybrid Switching Techniques.X.25, ISDN.Logical Addressing, Ipv4, Ipv6, Address Mapping, ARP, RARP, BOOTP and DHCP, User Datagram Protocol, Transmission Control Protocol, SCTP.

UNIT–V 8HRS

Application Layer Protocols: Domain Name Service Protocol, File Transfer Protocol, TELNET, WWW and Hyper Text Transfer Protocol, Simple Network Management Protocol, Simple Mail Transfer Protocol, Post Office Protocol v3.

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Fifth Edition,Elsevier, 2012.
2. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education,2007.
3. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring theInternet”, Pearson Education, 2005.

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BTIBM207N	DCC	Introduction to Python and Role and ML	60	20	20	30	20	2	0	2	3

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Course Objectives (COs):

The student will have ability to:

1. **To introduce students to Python programming and its role in Machine Learning.**
2. **To develop strong foundational skills in NumPy and Pandas for data manipulation and analysis.**
3. **To understand data visualization techniques using Matplotlib and Seaborn.**
4. **To provide knowledge of supervised and unsupervised machine learning algorithms.**
5. **To enable students to build an end-to-end machine learning model using Python.**

1.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The students will be able to

1. **Understand and apply Python programming concepts in data science and machine learning.**
2. Use NumPy for numerical computations and array operations.
3. Perform data manipulation and preprocessing using Pandas.
4. Create meaningful visualizations using Matplotlib and Seaborn.
5. Implement basic supervised and unsupervised machine learning algorithms and develop a mini ML project.

2.

Syllabus:

UNIT I 10 HRS

Introduction of Python:

What is Python?, History and evolution of Python, Features of Python, Advantages and Disadvantages of Python, Installing Python and Setting Up Environment (Anaconda, Jupyter

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Notebook, VS Code), Python Syntax and Indentation, Variables and Data Types (int, float, string, boolean), Type Casting, Basic Input and Output Functions, Operators in Python (Arithmetic, Relational, Logical, Assignment), Conditional Statements (if, elif, else), Loops (for loop, while loop), Break and Continue Statements.

UNIT II 9 HRS

Introduction To Numpy

What is NumPy?, History and importance of NumPy in Data Science and Machine Learning, Why NumPy is faster than Python Lists, Installation and Importing NumPy, Understanding Dimensions in NumPy, Array Indexing and Slicing, Array Operations : Broadcasting Concept, Element-wise Operations, Comparison Operations, Reshaping and Manipulating Arrays.

UNIT III 8 HRS

Data Manipulation using Pandas

What is Pandas?, History and importance of Pandas in Data Science and Machine Learning, Why Pandas is used for Data Analysis, Installation and Importing Pandas (import pandas as pd), Understanding Series and DataFrame, Difference between NumPy Array and Pandas DataFrame, Loading and Saving Data, Data Selection and Filtering: Selecting Columns, Selecting Rows (loc[], iloc[]), Boolean Indexing, Data Cleaning and Preprocessing, Aggregation Functions

UNIT IV **7 HRS**
Data Visualization using Matplotlib and Seaborn

Introduction to Matplotlib, Installing and Importing Matplotlib, Understanding Figure and Axes, Basic Plot Structure, Basic Plots in Matplotlib: Line Plot, Bar Plot, Horizontal Bar Plot, Scatter Plot, Pie Chart, Histogram, Box Plot. Customizing Plots in Matplotlib: Titles and Labels, Legends, Colors and Styles, Markers and Line Styles, Grid, Figure Size, Subplots (subplot(), subplots()), Saving Figures, Introduction to Seaborn, Why Seaborn is used along with Matplotlib, Comparing Matplotlib and Seaborn, When to Use Matplotlib vs Seaborn

UNIT V **8 HRS**

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BTIBM207N	DCC	Introduction to Python and Role and ML	60	20	20	30	20	2	0	2	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Supervised And Unsupervised Learning
What is linear regression? Logistic Regression, what is classification? Decision Tree, Confusion Matrix, Random Forest, Naïve Bayes classifier, support vector machine, use cases of unsupervised learning, what is clustering and Types of clustering. What is K-means clustering and Hierarchical Clustering? Step by step calculation of k-means algorithm. Mini Project: End-to-End ML Model using Python.

Text Books:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly.
2. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*, O'Reilly.

Reference Books:

1. Jake VanderPlas, *Python Data Science Handbook*, O'Reilly.
2. Joel Grus, *Data Science from Scratch*, O'Reilly.

List of Practical:

1. Installation and setup of Python, Anaconda, Jupyter Notebook, and VS Code.
2. Basic Python programs using variables, loops, and conditional statements.
3. NumPy array creation, indexing, slicing, and broadcasting operations.
4. Pandas Series and DataFrame creation and manipulation.
5. Data cleaning and preprocessing using Pandas.
6. Creating basic plots using Matplotlib.
7. Visualization using Seaborn.
8. Implementation of Linear Regression and Logistic Regression.
9. Implementation of K-Means Clustering.
10. Mini Project: End-to-End Machine Learning Model using Python.

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SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTIT208M	**SEC**	**Unix Programming**	**0**	**0**	**0**	**30**	**20**	**0**	0	**2**	1

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Course Educational Objectives (CEOs):
The student will have ability to:-

1. Provide introduction to UNIX Operating System and its File System.
2. Gain an understanding of important aspects related to the SHELL and the process
3. Develop the ability to formulate regular expressions and use them for pattern matching.
4. Provide a comprehensive introduction to SHELL programming, services and utilities.
5. Develop the ability to perform different networking tasks.

COURSE OUTCOMES:
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The students will be able to:-
1. Describe the architecture and features of UNIX Operating System .
2. Distinguish UNIX Operating System from other Operating Systems.
3. Demonstrate UNIX commands for file handling and process control.
4. Show the working of vi editor in all its modes using various commands.
5. Write Regular expressions for pattern matching and apply them to various filters for a specific task.
6. Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem.
7. Diagnose network using different networking utilities of UNIX.

SYLLABUS:

UNIT I: 10HRS
Introduction to UNIX - The UNIX Operating System, The UNIX Architecture, Features of UNIX, Internal and External Commands, Command Structure.
General purpose utilities: cal, date, echo, printf, bc, script, passwd, path, who, uname, tty, pwd, cd, mkdir, rmdir.

UNIT II: 9 HRS
Handling Files - The File System,touch, cat, cp, rm, mv, more, file, ls, wc, pg, comm, gzip, tar, zip, df, du, The vi editor.

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Security by file Permissions: chmod, umask .
Networking commands: ping, telnet, ftp, finger, arp, rlogin.

UNIT III: 8 HRS

Shell Basics - Types of shells, Shell Functionality, Work Environment, Writing script & executing basic script, Debugging script, Making interactive scripts, Variables (default variables), Mathematical expressions. Conditional statements: If-else-elif, Test command, Logical operators - AND, OR, NOT, Case –esac. Loops: While, For, Until, Break & continue.

UNIT IV: 7HRS

Command Line Arguments & Regular Expression - Command line arguments: Positional parameters, Set & shift, IFS. Functions & file manipulations: Processing file line by line, Functions. Regular Expression & Filters: Regular expression, grep, cut , paste, sort , head , tail , nl , pipe ,tr, tree , meta characters.

UNIT V: 8HRS

SED and AWK - SED: Scripts, Operation, Addresses, commands, Applications.

AWK: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications awk .

TEXT BOOKS:

1. Sumitabha Das: “YOUR UNIX – The Ultimate Guide”, Tata McGraw Hill.

REFERENCES:

1. Behrouz A. Forouzan, Richard F. Gilbery, “Unix and Shell Programming”,Cengage Learning India.
2. Graham Glass, King Ables, “Unix for programmers and users”, Pearson Education.
3. N.B. Venkateswarlu, “Advanced Unix programming”, B S Publications.
4. Yashavant Kanetkar, “Unix Shell programming”, 1st Edition, BPB Publisher.
5. Stephen Prata “Advanced UNIX: A Programming's Guide”, BPB Publications.
6. Maurice J. Bach “Design of UNIX O.S. “, PHI Learning.
7. Brian W. Kernighan & Robe Pike, “The UNIX Programming Environment”, PHI Learning.

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LIST OF EXPERIMENTS:

1. Perform installation of UNIX/LINUX operating system.
2. Study of UNIX general purpose utility commands.
3. Execution of various file/directory handling commands.
4. Working with the vi editor: Creating and editing a text file with the vi text editor using the standard vi editor commands.
5. Write a shell script for calculator (to perform basic arithmetic and logical calculations).
6. Write a shell script that will take an input file and remove identical lines (or duplicate lines from the file).
7. Shell scripts to explore system variables such as PATH, HOME etc.
8. Execution of various system administrative commands.
9. Write awk script that uses all its features.
10. Write a shell script to display list of users currently logged in.
11. Write a shell script to delete all the temporary files.
12. Write shell script to perform different string operations of arrays.