FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS FOR THE

SUBJECT: COMPUTER APPLICATIONS (VOCATIONAL)

for the award of the Degree in

BACHELOR OF ARTS/ BACHELOR OF SCIENCE/ HONOURS

(Offered under 4-year UG Degree Programme)

(Credit Based Grading System)
under NEP 2020

Batch: 2025–29

(SEMESTER I-VIII)

GURU NANAK DEV UNIVERSITY AMRITSAR

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Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester System)*
(Faculty of Engineering & Technology)

SCHEME
COMPUTER APPLICATIONS (VOCATIONAL)

S. No.	Course Code	Course Title	Credits L-T-P	Marks
		SEMESTER - I		
1.		Computer Fundamentals & PC Software (Theory)	3-0-0	75
2.		Computer Fundamentals & PC Software (Practical)	0-0-1	25
		Total Semester credits	**04**	
		SEMESTER – II		
1.		Introduction to Programming using Python (Theory)	3-0-0	75
2.		Introduction to Programming using Python (Practical)	0-0-1	25
		Total Semester credits	**04**	
		SEMESTER-III		
1.		Operating System (Theory)	3-0-0	75
2.		Operating System (Practical)	0-0-1	25
		Total Semester credits	**04**	
		SEMESTER-IV		
1.		Web Designing & Development (Theory)	3-0-0	75
2.		Web Designing & Development (Practical)	0-0-1	25
		Total Semester credits	**04**	
		SEMESTER-V		
1.		Database Management (Theory)	3-0-0	75
2.		Database Management with MySQL (Practical)	0-0-1	25
3.		Internship with local public/private industry/ business /organization Field Practice – 1	0-0-2	50
		Total Semester credits	**06**	
		SEMESTER-VI		
1.		E-Business (Theory)	3-0-0	75
2.		Digital Marketing (Practical)	0-0-1	25
		Total Semester credits	**04**	
		SEMESTER-VII		
1.		Computer Networks (Theory)	4-0-0	100
2.		Data & File Structures (Theory)	4-0-0	100
3.		Software Engineering (Theory)	4-0-0	100
4.		Object-Oriented Programming in C++ (Theory)	3-0-0	75
5.		Data & File Structures with C++ (Practical)	0-0-1	25
6.		Data Analytics **(Minor-1)** (Theory)	3-0-0	75
7.		Data Analytics **(Minor-1)** (Practical)	0-0-1	25
8.		Internship with local public/private industry/ business /organization Field Practice – 2	0-0-2	50
		Total Semester credits	**22**	

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SEMESTER-VIII				
Sr. No.	**Course Code**	**Course Title**	**Credits L-T-P**	**Marks**
1.		Cloud computing (Theory)	4-0-0	100
2.		Technology and Ethics (Theory)	4-0-0	100
3.		Artificial Intelligence (Theory)	4-0-0	100
4.		Machine Learning (Theory)	3-0-0	75
5.		Machine Learning (Practical)	0-0-1	25
6.		Data Visualization **(Minor-2)** (Theory)	3-0-0	75
7.		Data Visualization **(Minor-2)** (Practical)	0-0-1	25
		Total Semester credits	**20**	

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester-I)*
(Faculty of Engineering & Technology)

SEMESTER-I

COMPUTER APPLICATIONS (VOCATIONAL)

COMPUTER FUNDAMENTALS & PC SOFTWARE
(THEORY)

M. Marks: 75

Credits

Time: 3 Hours **L-T-P**

3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcomes:

- learn the functioning of various components of a computer system.
- identify input and output devices and storage devices.
- getting familiar with software.
- create documents, spreadsheets, and presentations

SECTION–A (12 Hrs.)

Introduction to Computer, Generations of Computers, Classification of Computers, Computer Applications:
Computer as a system, basic concepts – hardware and software, functional units, and their interrelation. Block diagram showing Central Processing Unit, Memory, and Input/Output Devices. Communication devices.

SECTION–B (11 Hrs.)

Software: System software and Application software. Programming languages.
Hardware: Input Devices- Keyboard, mouse, pens, touch screens, Bar Code reader, joystick, source data automation, (MICR, OMR, OCR), screen assisted data entry: portable/handheld terminals for data collection, voice recognition systems
Output Devices: Display Monitors, Printers, Impact Printers, Non-impact Printers, Plotters, Voice Output Systems, Projectors, Terminals.
Storage Devices: Concept of storage units(bit, byte, KB, MB etc.), Primary storage, Secondary storage, Magnetic storage devices, and Optical Storage Devices.

SECTION–C (11 Hrs.)

Operating System: meaning, purpose, Windows GUI, Command-line, Powershell overview. File Explorer.
Microsoft (MS) Office: download and install; different components
Word Processing using Microsoft (MS) Word: Overview, creating, saving, opening, importing, exporting and inserting files, formatting pages, paragraphs and sections, indents and outdents, creating lists and numbering. headings, styles, fonts and font size; editing, positioning, and viewing texts; finding and replacing text; inserting page breaks, page numbers, bookmarks, symbols, and dates; using tables, header, footer, macros, mail-merge; printing setup

SECTION–D (11 Hrs.)

Presentations using MS Powerpoint: Presentation overview, entering information, presentation creation, opening and saving presentation; inserting audio and video, shapes, different views, formatting; playing slides. Spreadsheets using MS Excel: Spreadsheet overview, Editing, Formatting, freeze panes, using formulas and functions, sorting and filtering, pivot tables, charts and Graphs.

Recommended Books:

1. P. K. Sinha, Computer Fundamentals : concepts, systems and applications, BPB Publications
2. E Balagurusamy, FUNDAMENTALS OF COMPUTERS Tata McGraw Hill Education Private Limited NEW DELHI
3. Peter Norton, Introduction to Computers, McGraw Hill Education
4. MS–Office _ BPB Publications.
5. Gurvinder Singh & Rachpal Singh, Windows-Based Computer Courses.
6. E-books at OpenOffice.org
7. A Conceptual Guide to OpenOffice.org3, 2nd Edition, R. Gabriel Gurley

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester-I)*
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SEMESTER-I

COMPUTER APPLICATIONS (VOCATIONAL)

COMPUTER FUNDAMENTALS & PC SOFTWARE

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva should also be conducted alongside, and the student is asked viva questions related to the question and the solution he/she is working on during the exam.

Students will prepare a report after analyzing print and social media advertisements along with the local market survey to understand the desktop/laptop vendors and prices. Arrange the options available as per price/performance preferences

Lab exercises based on:

- Practice the Windows Operating System command line and the GUI for user interaction, personalization, and file management
- Document preparation with Word using the features mentioned in the syllabus
- Spreadsheet processing with Excel using the features mentioned in the syllabus
- Presentation preparation with PowerPoint using the features mentioned in the syllabus

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester-II)*
(Faculty of Engineering & Technology)

SEMESTER-II

COMPUTER APPLICATIONS (VOCATIONAL)

INTRODUCTION TO PROGRAMMING USING PYTHON

(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- Understand the strengths of the Python language.
- Gain proficiency in string handling, functions, and n control flow statements.
- Create and manipulate Python programs by using different data structures and object-oriented concepts.
- Understand the operations involved in creating and manipulating file systems and databases.

SECTION–A (12 Hrs.)

Problem Solving, Problem Analysis, Concept of writing an algorithm, drawing a flowchart, developing a program.; Introduction to Python: Python's features, Story behind the name, Python versions, Execution environments: the Python Interpreter and IDEs (e.g. PyCharm or VSCode), Getting and Setting up Python.
Python program structure; writing your first "Hello World" program; creating, saving and executing a program; comments, Indentation.

SECTION–B (11 Hrs.)

Data and Expressions: Literal Constants, numbers, strings – immutable strings, quotes, the escape sequence, the format methos; Variables and Identifiers, data types, object, Operators & Expressions – short cuts, evaluation order, Boolean Expressions (Conditions), Logical Operators. User Input/output
Control Flow: Selection Control, Nested conditions, Loops, break and Continue Statements,
Data Structures: list, tuple, dictionary and set; basic operations e.g. creating, indexing, slicing, membership

SECTION–C (11 Hrs.)

Functions: defining and calling functions, passing and returning values, local and global variables, recursive functions, Iteration vs. Recursion
Modules: purpose and usage, the import statement, from – import statement, the __main__ attribute, creating a module and importing, the dir() function
Handling Exceptions – try..catch and with statements, errors, debugging

SECTION–D (11 Hrs.)

Files and Strings: Opening Files, Using Text Files, Reading files, Writing files, Understanding read functions, Understanding write functions
Introduction to numpy and pandas for data processing

Recommended Books and Materials:

1. Yashavant Kanetkar, Aditya Kanetkar, Let Us Python- 6th Edition, BPB Publications.
2. Charles Dierbach, Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Wiley Publications.
3. Martin C. Brown, Python: The Complete Reference, Indian Edition, McGraw Hill Education (India) Private Limited
4. Mark J. Guzdial, Introduction to Computing and Programming in Python, Pearson Education.
5. https://www.python.org/about/
6. Swaroop C.H., A Byte of Python available at https://python.swaroopch.com/
7. https://checkio.org/
8. https://www.jetbrains.com/pycharm-edu/

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
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SEMESTER-II

COMPUTER APPLICATIONS (VOCATIONAL)

INTRODUCTION TO PROGRAMMING USING PYTHON

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1

Lab 2h/week
Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- Use the Python interactive interpreter
- Getting familiar with a Python IDE
- Python fundamentals, data types, operators
- Operators, flow control using if, else and elif, While statement, loops using For, Loop Patterns,
- Implementation of different collections like list, tuple and dictionary and their various functions,
- Demonstrating creation of functions, passing parameters and return values,
- Working with modules
- Handling Exceptions
- Implementation of reading, writing and organizing files
- Basic numpy and pandas functions

SEMESTER-III
COMPUTER APPLICATIONS (VOCATIONAL)
OPERATING SYSTEM
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:
1. To understand the services provided by and the design of an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand the structure and organization of the file system.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.

SECTION-A

Introduction: Definition, Early Systems, Simple Batch system, Multi-programming/Multi-Tasking, Time Sharing Systems, Personal Computer System, Parallel Systems, Distributed Systems, Real–time Systems.
Processes: Process concept, Inter Process communication, Process Scheduling, Threads.
CPU–Scheduling: Basic concepts, Scheduling Criteria, Scheduling Algorithms, Algorithm Evaluation.

SECTION–B

Process Synchronization: Critical – section problem, semaphores, classical problem of synchronization. Semaphores, **Threads:** Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.
Memory Management: Background, Logical v/s Physical address space, swapping, continuous allocation, paging, segmentation.

SECTION–C

Virtual Memory: Background, demand paging, performance of demand paging, page replacement, page replacement algorithms, thrashing.
Deadlocks: System Model, Deadlock characterization, methods for handing deadlocks, Deadlocks Prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, combined approach to deadlock handling.

SECTION–D

Operating System Security – authentication & authorization, file ownership and user groups, Access Control, password vulnerabilities, strong passwords, Operating System protection from security breaches, such as runaway processes (denial of service), memory-access violations, stack overflow violations, the launching of programs with excessive privileges. Protecting against viruses and worms
CASE STUDY – Windows Operating System, Linux

Recommended Books & Materials:

1. Silberschatz, Galvin, and Gagne, Operating System Concepts, Global Edition, Wiley India 2023
2. Crowley, Operating Systems, A Design Oriented Approach, Tata McGraw Hill.
3. Dietel, Operating Systems, Second Edition by Addison Wesley.
4. William Stallings, Operating Systems –Internals and Design Principles, Pearson Publications
5. Andrew S. Tanenbaum, Modern Operating Systems, Pearson Publications
6. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, https://pages.cs.wisc.edu/~remzi/OSTEP/

SEMESTER-III
COMPUTER APPLICATIONS (VOCATIONAL)
OPERATING SYSTEM
(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2hr./week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Operating Systems lab exercises based on:

1. Working with options of File Explorer.
2. Reviewing system information via Control Panel.
3. Managing user accounts and permissions.
4. Configuring System settings and Updates.
5. Downloading, installing and uninstalling applications.
6. Configuring network connections.
7. Sharing files and Printer.
8. Creating a Virtual Machine with different OS windows/Ubuntu.
9. Working with system files.
10. Understanding and working with Windows Registry.
11. Restoring files using Windows Recovery Tool.
12. Using shell scripts to manage users and configuring system files.
13. Handling file and directory operations using shell scripts.

SEMESTER-IV
COMPUTER APPLICATIONS (VOCATIONAL)
WEB DESIGNING & DEVELOPMENT
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcomes:

- learn the web technologies and the web development process.
- getting familiar with HTML Basics, CSS
- create websites using BootStrap and JavaScript
- Awareness of Responsive Design and Web performance optimization

SECTION-A

Introduction to Web Design and Development: Overview of web technologies and the web development process, Understanding the difference between web design and development, Introduction to HTML, CSS, and JavaScript
HTML Basics: Structure of an HTML document, Common HTML elements (headings, paragraphs, lists, links, images, Tables, Linking, Frames, Forms), Semantic HTML and its importance, Introduction to DOM.

SECTION-B

CSS Fundamentals: Introduction to CSS and its role in web design, CSS selectors, properties, and values, Box model, layout techniques (flexbox, grid)
Responsive Design: Principles of responsive web design, Media queries and breakpoints, Using frameworks like Bootstrap for responsive layouts

SECTION-C

JavaScript Basics: Introduction to JavaScript and its role in web development, Basic Programming Techniques & Constructs: Variables, data types, functions, and control structures, Operators, Functions, GET/POST Methods, DOM Manipulation & Event handling,

SECTION-D

Forms Validation, Cookies, Inter-page communication and form data handling using JavaScript
Web Performance Optimization: Techniques for optimizing website performance, Using tools to analyze website performance, Importance and usage of SEO (Search Engine Optimization).

Recommended books:

1. Jon Duckett, HTML and CSS: Design and Build Websites
2. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development"
3. Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics
4. Ben Frain, Responsive Web Design with HTML5 and CSS
5. Ethan Brown, Web Development with Node and Express
6. Terry Felke-Morris, Web Development and Design Foundations with HTML5, McGraw Hill
7. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Cengage
8. Luke Welling and Laura Thomson, PHP and MySQL Web Development, Pearson Education

SEMESTER-IV
COMPUTER APPLICATIONS (VOCATIONAL)
WEB DESIGNING & DEVELOPMENT
(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- Exploring Web Technologies and Setting up the Development Environment (e.g. Visual Studio Code)
- Creating HTML Documents using headings, paragraphs, lists, links, and images
- Advanced HTML Elements (create forms), applying CSS styles, understanding Box model, Layout techniques
- Integrate Bootstrap into the project and use its grid system to create a responsive layout
- Basic JavaScript programming: GET/POST methods, DOM Manipulation, Event handling, Form validation, working with cookies
- Analyze the performance of the developed webpage using tools like Google Page Speed Insights and Understanding basic SEO

SEMESTER-V
COMPUTER APPLICATIONS (VOCATIONAL)
DATABASE MANAGEMENT
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcomes:

- learn the various aspects of database systems.
- identify different models and the concept of ER Modelling.
- getting familiar with relational algebra and calculus.
- create queries with SQL
- Understanding database security, backup and recovery concepts

SECTION-A

Introduction to Databases: Overview of databases and DBMS, History and evolution of database systems; Types of databases: Relational, NoSQL, Object-oriented; Relational model concepts::tables, rows, columns; Comparison of database models (Hierarchical, Network, Relational); **Entity-Relationship (ER) Modeling:** Introduction to ER diagrams, Entities, attributes, relationships, Designing a database using ER modelling

SECTION-B

Relational Database Design: Converting ER diagrams to relational schemas; Relational integrity constraints, Understanding keys: Primary, Foreign, Composite; Normalization: 1NF, 2NF, 3NF, BCNF
Relational algebra operators like selection, projection, cartesian product, join and write queries using them.

SECTION-C

SQL Fundamentals: Introduction to SQL: Syntax and structure, Data Definition Language (DDL): CREATE, ALTER, DROP, Data Manipulation Language (DML): INSERT, UPDATE, DELETE; **Advanced SQL Queries:** SELECT statements: WHERE, ORDER BY, GROUP BY; Joins: INNER, OUTER, CROSS, SELF; Subqueries and Common Table Expressions (CTEs).

SECTION-D

Database Security: Understanding database security concepts, User roles and permissions, Data encryption and access control measures
Backup, Recovery, and Maintenance: Strategies for database backup and recovery, Disaster recovery planning, Regular maintenance practices for databases

Recommended books:

1. Silberschatz, Korth, and Sudarshan, Database System Concepts
2. John Viescas and Michael Hernandez, SQL Queries for Mere Mortals
3. Elmasri, R., Navathe, B. S., Fundamentals of Database Systems, 7th edition, Pearson Education, 2016.
4. Murach, J., Murach's MySQL, 3th edition, Pearson, 2019.
5. Connolly, T. M., Begg, C. E., Database Systems: A Practical Approach to Design, Implementation, and Management, 6th edition, Pearson, 2019.
6. Silberschatz, A., Korth, H.F., Sudarshan S., Database System Concepts, 7th edition, McGraw Hill, 2019.
7. R. K. Gupta, Database Management Systems by BPB Publications
8. John Date, Database Management Systems by Cengage
9. Raghu Ramakrishnan and Johannes Gehrke, Database Management System by Pearson

SEMESTER-V
COMPUTER APPLICATIONS (VOCATIONAL)
DATABASE MANAGEMENT WITH MySQL
(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- DBMS Introduction and Database Creation: Familiarize with DBMS software, create simple databases and tables.
- ER Diagrams and Relational Schema: Design ER diagrams, convert them to relational tables with primary and foreign keys.
- Normalization: Apply 1NF, 2NF, and 3NF to optimize tables for minimal redundancy.
- Basic SQL Queries: Practice data retrieval using SELECT, WHERE, ORDER BY, GROUP BY, DISTINCT, BETWEEN, IN, LIKE, and aggregate functions (COUNT, SUM, AVG, MIN, MAX).
- Advanced SQL Joins: Practice INNER, OUTER, CROSS, and SELF joins on relational data.
- Subqueries: Write nested queries for complex data retrieval.
- User Roles and Security: Implement roles, permissions, and basic encryption for database security.

SEMESTER-V
COMPUTER APPLICATIONS (VOCATIONAL)
INTERNSHIP WITH LOCAL PUBLIC/PRIVATE INDUSTRY/ BUSINESS/ ORGANIZATION FIELD PRACTICE-I

M. Marks: 50 **Credits**
Time: 3 Hours **L-T-P**
0-0-2
Field Practice (4h) /week

Course Outcomes:

- To put theory into practice
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To understand and adhere to professional standards in the field
- To gain insight to professional communication
- To identify personal strengths and weaknesses
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Internship/Professional practice can provide students the opportunity to enhance skills which include knowledge of office automation, problem-solving skills, database creation, debugging, cybersecurity, programming languages, frameworks etc. Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to implement as much knowledge as possible. The students shall take part in discussions to foster friendly and stimulating environment in which they are motivated to reach high standards and become self-confident.

Assessment: Each student, is required to

- Submit a report.
- Present the seminar on the internship orally through power point slides.
- Answer the queries.

Instructions for the Assessment:

- Candidates will undergo training and prepare an internship report. As End-Semester Examination, evaluation of the student will be based on the quality of report submitted, presentation skills and their response in the Q/A session by the examiners. The internship report carries 30 marks, seminar of 10 marks, and Q/A 10 marks.

SEMESTER-VI
COMPUTER APPLICATIONS (VOCATIONAL)
E-BUSINESS
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- Analyze E-Business Models
- Examine Technological Infrastructure
- Understand Payment Systems
- Understand Legal and Ethical Issues in E-Business

SECTION–A

Introduction to E-Business and E-Commerce: Definition and scope of e-business, Evolution and history of e-business, Introduction to E-commerce, Difference between e-business and e-commerce, Advantages and challenges of e-business.

E-Business Models: B2B, B2C, C2C, C2B, B2G. Case studies of successful e-business models. Revenue models in e-business (advertising, subscription, transaction fee, sales, affiliate).

E-Business Applications: E-Tourism, Employment and Job Market Online**,** Online Real Estate, Online Publishing and e-Books, Online Banking and Personal Finance, On-Demand Delivery Systems and E- Grocers, Online Delivery of Digital Products.

SECTION–B

E-Marketing and Customer Relationship Management (CRM): Digital marketing strategies for E-business, SEO, SEM, and online advertising, Social media marketing and content marketing, Email marketing and customer engagement, CRM systems and their role in e-business.

E-Marketplaces: E-Marketplace, its Functions and features, types of e-Marketplaces. Auctions, characteristics and various types of auctions. Benefits, limitations and impacts of auctions. E-Commerce in the wireless environment. E-commerce platforms and tools (Shopify, Magento, Woo Commerce, etc.)

M-Commerce: Definition, advantages, types, examples and market trends.

SECTION–C

E-Business Strategy and Planning: Developing an E-business strategy, E-business planning process, SWOT analysis for e-business, E-business project management, Metrics and KPIs for e-business performance.

E-Procurement and E-Payment Systems: E-Procurement definition, processes, methods and benefits, Categories and users of smart cards, Payment methods, Payment gateways and online payment systems, Security issues in e-business.

SECTION–D

Legal, Ethical, and Social Issues in E-Business: Legal aspects of e-business (contracts, consumer protection, data privacy), Ethical issues in e-business (intellectual property, digital rights management), Social implications of e-business (digital divide, impact on employment), Case studies of legal and ethical dilemmas in E-business.
Future Trends in E-Business

Reference Books:

1. Turban, E. et al., Electronic Commerce: A Managerial Perspective, Prentice Hall.
2. Dave Chaffey, Electronic Business and Electronic Commerce Management, 2nd edition, Prentice Hall
3. Horton and Horton, E-Learning Tools and Technologies, Wiley Publishing.
4. Kamlesh K. Bajaj & Debjani Nag, E – Commerce – The Cutting Edge of Business
5. A. Meier, & H. Stormer, E-Business & e-Commerce: managing the digital value chain, Springer Science & Business Media.

SEMESTER-VI

COMPUTER APPLICATIONS (VOCATIONAL)

DIGITAL MARKETING

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab exercises based on:

1. Set up a basic website using Word Press and Optimize website content for SEO (Meta tags, keyword research, URL optimization , Header tags etc.).
2. Analyze website performance using Google Analytics. Conduct keyword research using tools like Google Keyword Planner, Chat GPT, Keyword Generator, Google Search Console, Google Trends. Perform an SEO audit for a website and recommending improvements.
3. Set up a Google Ads campaign (App, Display, Local, Performance Max, Search, Smart, Shopping, and Video).Create compelling ad copy and selecting relevant keywords. Analyze PPC campaign performance and adjusting bidding strategies like Target Cost Per Acquisition (CPA), Maximize Conversions, Enhanced Cost Per Click (ECPC), Maximize Clicks .
4. Develop a social media advertising campaign on Facebook with a social media post and perform facebook promotion using banners. Analyze the engagement metrics such as Activation rate, Number of active users, Retention rate, Churn rate, Conversion rate.
5. Create a YouTube channel for marketing.
6. Choose Mail chimp as the Email marketing platform, Build a contact list in Mail Chimp, Create a Campaign and build an Email, Develop the Header and body of email campaign, Enable Auto Responder performance and Tracking, Conduct A/B Testing of Emails and Start the E-Mail Marketing campaign.

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester-VII)*
(Faculty of Engineering & Technology)

SEMESTER-VII

COMPUTER APPLICATIONS (VOCATIONAL)

COMPUTER NETWORKS

(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcomes:

- To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
- To understand the working principle of various communication protocols.
- Study the basic taxonomy and terminology of the computer Networking and enumerate the layers of OSI model and TCP/IP model.
- Gain core Knowledge of network layer routing protocols and IP addressing.

SECTION–A

Introduction: Network Definition, Basic Components of a Network, Network types and topologies, Uses of Computer Networks.
Introduction to Analog and Digital Transmission: Telephone system, Modems, Types of modems, pulse code modulation.
Transmission Media: Coaxial cable, twisted pair cable, fiber optics & satellites.
OSI reference model, TCP/IP reference model, comparison of OSI and TCP reference models

SECTION–B

Transmission & Switching: Multiplexing, circuit switching, packet switching, hybrid switching. **Data Link Layer Design Issues:** Services provided to Network layer, Framing, error control, flow control, link management. Error detection & correction, Elementary Datalink Protocols.

SECTION–C

Local Area Network Protocols: CSMA Protocols, IEEE standards 802, Token Bus, Token Ring
Design Issues of Network Layer: Services provided to transport layer, routing, connection.
Application layer protocols and client-server model - The Internet & World Wide Web

SECTION–D

Network Security:. Overview of threats, cryptography, authentication, and firewalls
Network Services: File transfer, Access & Management, Electronic Mail, Remote login
Wireless and mobile networks.

References:

1. Tannanbum, A.S.: Computer Networks, Prentice Hall, 1992, 3rd Edition.
2. Stallings, William: Local Networks: An Introduction: Macmillan Publishing Co.
3. Stallings, William: Data Computer Communication, Macmillan Publishing Co.

SEMESTER-VII
COMPUTER APPLICATIONS (VOCATIONAL)
DATA & FILE STRUCTURES
(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcome:

- To understand the abstract data types stack, queue, and list.
- To understand the performance of the implementations of basic linear data structures.
- To understand prefix, infix, and postfix expression formats
- To be able to implement the abstract data type list as a linked list using the node and reference pattern.
- To understand and implement trees and graph data structures

SECTION–A

Basic Data Structures: Introduction to elementary Data Organization and its operations, complexity of Algorithms – Big O-Notation, and Time space trade off, Sparse Matrix, Arrays and its applications,
Searching Techniques: Linear and Binary Search
Stack and its applications – postfix notation, expression evaluation, recursion

SECTION–B

Linked Lists: Implementation of linked list, singly and doubly linked list, linked list operations with algorithms
Queues: Description of queue structure, implementation of queue using arrays and linked lists, description of priorities queue, Applications of queues.

SECTION–C

Trees: Description of tree structure and its terminology, binary search tree, AVL Trees, Threaded Binary Trees, B–Trees, B+ trees.
Graphs: Description of graph structure, implementing graphs in memory using adjacency matrix or adjacency lists, various graphs traversing algorithms, finding shortest path between two nodes.

SECTION–D

Sorting Techniques: Bubble Sort, selection sort, insertion sort, quick sort, merge sort, heap sort.
File Organization: Concept of field, record, file, blocking and compaction.
File Organization Techniques: Sequential indexed, indexed sequential, Direct, Hashing, Concept of master and transaction files.

Reference Books:

1. Seymour Lipschutz, Data Structure –Schaum Outline Series.
2. E Balaguruswamy, Data Structures using C, McGraw Hill Education
3. Yashwant Kanetker, Data Structures through C, BPB Publications
4. Trambley & Sorenson, Data Structures
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms
6. Mark Allen Weiss, Data Structures and Algorithm Analysis in C
7. Robert Sedgewick, Algorithms in C, Parts 1-4: Fundamentals, Data Structures, Sorting, Searching

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SEMESTER-VII

COMPUTER APPLICATIONS (VOCATIONAL)

SOFTWARE ENGINEERING

(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- learn the concept of the engineering approach to software development.
- Understand the concept of product vs project vs process .
- getting familiar with software development phases.
- Understand the software evolution and change management

SECTION–A

Introduction to Software: Definition, Software characteristics, the evolving role of software, changing nature of software, Software components, Software Applications.

Introduction to Software Engineering: Definition, Software Engineering Paradigms, product vs project vs process, a process oriented framework, process patterns, waterfall method, prototyping, incremental process models, evolutionary process models, the unified process, the Spiral model, the agile process. Process assessment, the capability maturity model integration (CMMI)

SECTION–B

Software Requirement Specification (SRS): Problem analysis, structuring information, Data flow diagram and data dictionary, structured analysis, Characteristics and component of SRS.

Planning a Software Project: Cost estimation, uncertainties in cost estimation, Single variable model, COCOMO model, on software size estimation, Project scheduling and milestones, Software & Personal Planning, Rayleigh curve, Personal Plan, Quality Assurance Plan, Verification & Validation (V & V), inspection & review

SECTION–C

System Design: Design Objectives, Design Principles, problem, Partitioning, Abstraction, Top Down and Bottom–up techniques.

Coding: Coding by Top–down and Bottom–up, Structured Programming, Object Oriented Programming, Information Hiding, Programming style, Internal Documentation

Software Metrics: Role of Metrics and measurement, Metrics for software productivity and quality, Measurement software, size–oriented metrics, function oriented metrics, Object-oriented metrics, Metrics for software quality.

SECTION–D

Testing: Level of testing, Test cases and test criteria, Testing levels, Testing types: White box v/s black box testing: Functional Testing, Structural Testing.

Software Maintenance: Types of Maintenance, Corrective and Preventive Maintenance; Software Evolution, Change management

Recommended books:

1.Roger S. Pressman, Software Engineering
2.Pankaj Jalote, An Integrated Approach to Software Engineering

SEMESTER-VII
COMPUTER APPLICATIONS (VOCATIONAL)
OBJECT-ORIENTED PROGRAMMING IN C++
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- Building logic for solving problems in C++ language by analyzing data types, keywords etc.
- Creating programs or applications to solve real world problems using object oriented approach.
- Writing reusable code or functions in C++ language, which in turn will increase the program efficiency.
- Able to implement techniques like inheritance, polymorphism, method overloading, etc for program construction

SECTION–A

Getting Started:
Introduction. A brief history of C++, Variable, Constant, Expression, Statements, Comments and keywords of C++,
Operator: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional, Precedence of Operators., Data type, Type conversion, library function.
Input/Output Statements: Inputting using cin and outputting using cout statements, Preprocessor directives
Basic Program construction: A complete C++ program: invoking Turbo C++, naming your program, using the editor, saving your program, compiling and linking, running the program
Errors*:* Compiler, linker and runtime.
Other IDE features*:* Compiling and linking, shortcut exiting from IDE, examining files, opening an existing file

SECTION–B

Decision Making and Looping statement
If statement, if.....else statement, nesting of if statement, switch statement, conditional operator statement. While loop, do loop, for loop, nesting of loops, break and continue statement, go to statement.
Arrays:
Defining an array, array type, array elements, Accessing & initializing array, Programming of C++ with array, String handling, array of strings
Functions
What is a function? Declaring and defining function, Local, global variables, execution of function, Passing argument to function, Return values, Reference arguments, Overloading functions, Inline function and default parameter, Variable and storage classes.

SECTION–C

Object Oriented Programming
Objects & Classes, Constructor & Destructor
Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion, Pitfalls operator overloading and conversion
Inheritance: Derived class and Base Class, Derived Class Constructors, Overriding member functions, class hierarchies, Public & Private inheritance, Levels of inheritance
Polymorphism: Problems with single inheritance, Multiple inheritance.

SECTION–D

Structures: A simple structure, specifying the structure, defining a structure variable Accessing Structure member
Other structure features, Structure within structure, Structure and classes, Arrays of structure
Pointers: Addresses and pointers, Pointers and Arrays, Pointers and Functions, Pointers and Strings, Pointer to objects, Pointer to pointers.
Files & Streams: Overview of streams, String I/O, character I/O, Object I/O, I/O with multiple objects, File Pointers, Disk I/O with member functions, Redirections, Error handling, Command–line Argument

Books:

1. Robert Lafore, Turbo C++
2. C++ Programming language by Saucham’s outline series

SEMESTER-VII

COMPUTER APPLICATIONS (VOCATIONAL)

DATA & FILE STRUCTURES WITH C++

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on Implementation of Data Structures using C:

1. Arrays
2. Searching(binary search, linear search) by implementing searching module as a function
3. Strings
4. Functions – inbuilt, recursion
5. Classes, objects
6. Super class/sub class – access specifiers, function overloading/overriding
7. Structures & Unions
8. Pointers
9. Linked list
10. Stacks (Using Arrays, linked lists)
11. Queues (Using Arrays, linked lists)
12. Trees – Traverse the BST, AVL Trees and B tree.
13. Sorting(selection sort, insertion sort, quick sort, merge sort, heap sort, bubble sort) ,
14. Graph-transversal, finding the shortest path
15. File handling

SEMESTER-VII
COMPUTER APPLICATIONS (VOCATIONAL)
(MINOR-1)
DATA ANALYTICS
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- Understand the data analytics lifecycle and methodologies.
- Apply statistical techniques to analyze data.
- Utilize data visualization tools to present findings effectively.
- Employ programming languages and tools for data analysis.
- Analyze data-driven solutions for real-world problems.

SECTION-A

Overview of Data Analytics: Definition and importance of data analytics, Types of data analytics: Descriptive, diagnostic, predictive, and prescriptive; The data analytics lifecycle

Data Collection and Preparation: Data sources: Structured and unstructured data; Data collection methods (surveys, web scraping, APIs); Data cleaning and pre-processing techniques

Introduction to Statistics for Data Analytics: Descriptive statistics (mean, median, mode, variance), Inferential statistics (hypothesis testing, confidence intervals), Overview of statistical distributions (normal, binomial, etc.)

SECTION-B

Exploratory Data Analysis (EDA): Techniques for exploring data patterns and trends, Using summary statistics and visualizations, Identifying outliers and anomalies

Data Visualization Principles: Importance of data visualization in analytics, Best practices for effective visualizations, Matplotlib, Seaborn for data visualization

Advanced Statistical Techniques: Regression analysis (linear and logistic regression), Correlation vs. causation, ANOVA and chi-square tests

SECTION-C

Introduction to Programming for Data Analytics: Overview of Python for data analysis, Data manipulation with libraries (Pandas, NumPy), Writing functions and scripts for analysis

Data Management and Databases: Data extraction using SQL queries, Integrating databases with analytics tools

SECTION-D

Business Intelligence and Analytics: Role of data analytics in business decision-making, Key performance indicators (KPIs) and metrics, Case studies of successful data analytics applications

Ethical Considerations in Data Analytics: Data privacy and security issues, Ethical use of data and analytics, Regulatory compliance (GDPR, CCPA)

Recommended books:

1. Anil Maheshwari, Data Analytics, McGraw Hill.
2. Gaurav Arora, Data Analytics: Principles, Tools, and Practices: A Complete Guide for Advanced Data Analytics Using the Latest Trends, Tools, and Technologies.
3. Amit Sachan, Arulanantha Prabu, Business Statistics Using Python 1st Edition, McGraw Hill
4. **A** S. D. B. Shapiro**,** Data Analytics: A Comprehensive Guide to Data Analysis
5. Wes McKinney**,** Python for Data Analysis
6. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists

SEMESTER-VII

COMPUTER APPLICATIONS (VOCATIONAL)

(MINOR-1)

DATA ANALYTICS

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- Install and set up Jupyter Notebook, Python, and relevant libraries (Pandas, NumPy, Matplotlib).
- Collect sample datasets from various sources (CSV files, web scraping basics).
- Perform basic data cleaning tasks (handling missing values, standardizing formats).
- Calculate and interpret descriptive statistics (mean, median, mode, variance) using Python.
- Use Python libraries to calculate and visualize distributions (e.g., normal, binomial).
- Conduct EDA **(**Exploratory Data Analysis) on a sample dataset using summary statistics. Identify trends, patterns, outliers, and missing values.
- Create different visualizations (histograms, scatter plots, box plots) using Matplotlib and Seaborn. Perform and interpret regression analysis (linear and logistic regression) on sample datasets.
- Manipulate datasets using Pandas and NumPy (sorting, filtering, grouping). Perform basic SQL queries (SELECT, JOIN, GROUP BY) on a sample database.

SEMESTER-VII

COMPUTER APPLICATIONS (VOCATIONAL)

INTERNSHIP WITH LOCAL PUBLIC/ PRIVATE/ INDUSTRY/ BUSINESS/ ORGANIZATION FIELD PRACTICE-2

M. Marks: 50 **Credits**
Time: 3 Hours **L-T-P**
0-0-2
Field Practice (4h) /week

Course Outcomes:

- To put theory into practice
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To understand and adhere to professional standards in the field
- To gain insight to professional communication
- To identify personal strengths and weaknesses
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Internship/Professional practice can provide students the opportunity to enhance skills which include knowledge of office automation, problem-solving skills, database creation, debugging, cybersecurity, programming languages, frameworks etc. Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to implement as much knowledge as possible. The students shall take part in discussions to foster friendly and stimulating environment in which they are motivated to reach high standards and become self-confident.

Assessment: Each student, is required to

- Submit a report.
- Present the seminar on the internship orally through power point slides.
- Answer the queries.

Instructions for the Assessment:

- Candidates will undergo training and prepare an internship report. As End-Semester Examination, evaluation of the student will be based on the quality of report submitted, presentation skills and their response in the Q/A session by the examiners. The internship report carries 30 marks, seminar of 10 marks, and Q/A 10 marks.

SEMESTER-VIII
COMPUTER APPLICATIONS (VOCATIONAL)
CLOUD COMPUTING
(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

1. Understand the fundamental concepts and models of cloud computing.
2. Analyze different cloud service and deployment models.
3. Implement and manage cloud-based solutions using popular platforms.
4. Evaluate security and compliance issues in cloud computing.
5. Develop applications that leverage cloud services.

SECTION-A

Introduction and Overview: Definition and characteristics of cloud computing, History and evolution of cloud computing, Benefits and challenges of cloud computing
Cloud Computing Architecture: Basic architecture of cloud computing, Components: Front-end, back-end, cloud service models; Virtualization technology and its role in cloud computing;
Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Comparison of service models and use cases

SECTION-B

Cloud Deployment Models: Public cloud: Characteristics, benefits, and examples; Private cloud: Characteristics, benefits, and examples; Hybrid cloud: Integration of public and private clouds; Community cloud: Shared infrastructure for specific communities
Cloud Providers and Platforms: Overview of major cloud service providers (AWS, Azure, Google Cloud), Features and services offered by each provider, Cost models and pricing strategies
Cloud Storage and Data Management: Types of cloud storage: Block, file, object storage; Data management strategies in the cloud; Backup and disaster recovery in cloud environments

SECTION-C

Security in the Cloud: Key security concepts: Confidentiality, integrity, availability; Cloud security architecture and controls; Identity and access management (IAM) in the cloud
Cloud Monitoring and Management: Tools and techniques for monitoring cloud resources, Performance management and optimization, Incident response and remediation in cloud environments

SECTION-D

Cloud Application Development: Overview of cloud-native application development, Microservices architecture and containerization (Docker, Kubernetes), Serverless computing concepts and platforms (AWS Lambda, Azure Functions)
Future Trends and Challenges: Emerging trends in cloud computing, Challenges and considerations for cloud adoption, Case studies of successful cloud implementations

Recommended books:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini**,** Cloud Computing: Concepts, Technology & Architecture
2. Michael J. Kavis**,** Architecting the Cloud: Design Decisions for Cloud Computing Service Models
3. Judith S . Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper, Cloud Computing for Dummies
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing : principles and paradigms, Pearson Education
5. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill Education

SEMESTER-VIII

COMPUTER APPLICATIONS (VOCATIONAL)

TECHNOLOGY AND ETHICS

(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

- Understand key ethical theories and their application to technology.
- Analyze the ethical implications of various technologies.
- Evaluate case studies involving ethical dilemmas in technology.
- Develop informed opinions on technology-related ethical issues.
- Propose ethical frameworks for technology design and implementation.

SECTION-A

Understanding Ethics: Definition and importance of ethics, Key ethical theories: Utilitarianism, deontology, virtue ethics, The role of ethics in technology

The Impact of Technology on Society: Overview of technological advancements (AI, IoT, biotechnology), How technology shapes social interactions and behaviors, Positive and negative effects of technology on society

Privacy and Surveillance: Ethical considerations of data collection and surveillance, The balance between security and privacy, Case studies on privacy violations (e.g., Cambridge Analytica)

SECTION-B

Overview of emerging technologies: Artificial Intelligence and Machine Learning

Artificial Intelligence and Machine Learning, Ethical concerns in AI development and deployment, Bias and fairness in algorithms, Autonomous systems and accountability

Cybersecurity and Ethical Hacking: Understanding ethical hacking vs. malicious hacking, Responsibilities of cybersecurity professionals, Ethical dilemmas in data breaches and vulnerability disclosures

SECTION-C

Technology and Labour: The impact of automation on jobs and the workforce, Ethical considerations of job displacement, Future of work in a tech-driven economy

Environmental Ethics and Technology: The role of technology in environmental sustainability, Ethical implications of e-waste and resource depletion

Social Media and Communication Ethics: The ethical responsibilities of social media platforms, Misinformation, hate speech. Case studies on social media ethics (e.g., misinformation during elections)

SECTION-D

Intellectual Property and Technology: Understanding copyright, patents, and trademarks, Ethical considerations in software piracy and content sharing, Balancing innovation with intellectual property rights

Ethics in Technology Policy and Regulation: The role of government and organizations in regulating technology, Ethical frameworks for technology policy development, International considerations in technology ethics

Designing Ethical Technology: Principles of ethical design and development, User-centered design and its ethical implications, Case studies on ethical technology design (e.g., accessibility)

Recommended books:

1. Herman T. Tavani**,** Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing
2. David J. Morrow, The Ethics of Technology: A Geographical Perspective
3. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems (relevant chapters on ethics)
4. Subhash Chandra and M. C. Jain, Artificial Intelligence and Ethics
5. R. V. S. Suryanarayana, Technology and Ethics: A Global Perspective Pavan Duggal, Cyber Law and Ethics

SEMESTER-VIII

COMPUTER APPLICATIONS (VOCATIONAL)

ARTIFICIAL INTELLIGENCE

(THEORY)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course outcomes:
1. To understand the different needs and benefits of Artificial Intelligence, intelligent agents and different searching techniques.
2. To develop semantic-based and context-aware systems.
3. To acquire, organize process, share and use the knowledge embedded in multimedia content.
4. To understand the basic areas of artificial intelligence including knowledge representation, reasoning, learning, natural language processing, fuzzy systems and ANN.

SECTION–A

AI Introduction, foundation of AI and history of AI .Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

SECTION–B

Introduction to knowledge-based intelligent systems: Intelligent machines, Introduction to Expert Systems. Logic and Inferences: Propositional Logic, First Order Logic (FOL), Resolution method for FOL, Forward and Backward chaining.
Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

SECTION–C

Natural Language Processing: Natural Language Processing (NLP) Introduction ,overview of linguistics, Grammars and Languages, Basic Parsing Techniques, syntactic Processing, Semantic Analysis, Natural Language Generation , Natural Language Systems.
Learning Introduction, Role of Learning, Types of Learning , General Learning Model, Performance Measures.

SECTION–D

Probabilistic Reasoning: Representation, Bayesian Networks, Conditional Independence. Making Simple Decisions: Beliefs, Desires and Uncertainty, Decision Networks, Value of Information. Making Complex Decisions: Stochastic Problems.

Recommended Books & Materials:

1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice- Hall India Private Limited, 2006.
2. Rich Knight, Artificial Intelligence, Tata McGraw Hill, 2007.
3. P H. Winston, Artificial Intelligence, (3rd Edition), Addison Wesley, 2006.
4. E Charniak and D Mcdermott, 'Introduction to Artificial Intelligence', Addison Wesley, 2004
5. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
6. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.

SEMESTER-VIII
COMPUTER APPLICATIONS (VOCATIONAL)
MACHINE LEARNING
(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

1. Understand key concepts and terminology in machine learning.
2. Apply supervised and unsupervised learning algorithms to datasets.
3. Evaluate and optimize machine learning models.
4. Utilize machine learning libraries and tools for implementation.
5. Analyze real-world problems and propose machine learning solutions.

SECTION-A

Introduction to Machine Learning, Definition and history of machine learning, Types of machine learning: Supervised, unsupervised, and reinforcement learning, Applications of machine learning in various fields

Key Concepts and Terminology: Features, labels, training, and testing datasets, Overfitting vs. underfitting, Bias-variance tradeoff

SECTION-B

Data Pre-processing: Importance of data pre-processing, Techniques: Data cleaning, normalization, and transformation, Handling missing data and categorical variables

Supervised Learning: Regression Algorithms: Linear regression: Theory and implementation, Evaluation metrics: Mean squared error, R^2 score, Regularization techniques: Lasso and Ridge regression

SECTION-C

Supervised Learning: Classification Algorithms- Logistic regression and its applications, Decision trees and random forests, Model Evaluation and Selection: Train-test split and cross-validation, Confusion matrix and classification metrics (precision, recall, F1 score), Hyperparameter tuning and model selection techniques

SECTION-D

Dimensionality Reduction: Introduction to dimensionality reduction techniques, Principal component analysis (PCA)

Unsupervised Learning- Clustering Algorithms: K-means clustering: Theory and implementation, Hierarchical clustering and DBSCAN, Evaluation of clustering results

Recommended Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow
3. Tom Mitchell, Machine Learning, McGraw Hill
4. Kamalkant Hiran, Dr. Ruchi Doshi, Ritesh Kumar Jain, Dr. Kamlesh Lakhwani. Machine Learning, BPB publications.
5. Dr. Amit Dua and Umair Ayub, Beginning with Machine Learning, BPB publications.
6. Saikat Dutt , Subramanian Chandramouli , Amit Kumar Das, Machine Learning, Pearson Education
7. Vinod Chandra , Anand Hareendran S., Machine Learning : A Practitioner's Approach, PHI Learning

SEMESTER-VIII

COMPUTER APPLICATIONS (VOCATIONAL)

MACHINE LEARNING

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- Understanding Machine Learning Concepts: Explore and define key concepts in machine learning, including features, labels, and the types of learning (supervised, unsupervised).
- Data Pre-processing: Perform data cleaning, normalization, and handling of missing values in a given dataset.
- Implementing Linear Regression: Build a linear regression model, compute evaluation metrics (MSE, R^2), and interpret the results.
- Logistic Regression Application: Develop a logistic regression model for binary classification and evaluate its performance.
- Decision Trees and Model Evaluation: Create a decision tree model and utilize techniques such as train-test split and cross-validation to assess its accuracy.
- Hyperparameter Tuning: Apply hyperparameter tuning techniques (e.g., grid search) to improve model performance on selected algorithms.
- Dimensionality Reduction with PCA: Implement Principal Component Analysis (PCA) on a dataset and visualize the impact of dimensionality reduction.
- K-means Clustering: Conduct K-means clustering on a dataset, visualize the clusters, and evaluate the clustering results.

Bachelor of Arts /Bachelor of Science/Honours (Computer Applications) (Vocational) (CBGS)
(under NEP 2020) *(Batch 2025-29) (Semester -VIII)*
(Faculty of Engineering & Technology)

SEMESTER-VIII

COMPUTER APPLICATIONS (VOCATIONAL)

(MINOR-2)

DATA VISUALIZATION

(THEORY)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Outcomes:

1. understanding of data visualization and key terms.
2. skills on creating visual representation of data.
3. develop insights how Tableau is better than excel.
4. using interactive data visualization

SECTION–A

Introduction: Data Visualization Importance of data visualization, Advantages and Disadvantages of Data Visualization, Applications of data Visualization. Data analysis Definition, data analysis process, sensitivity analysis with data tables in excel, summarizing data with data functions, optimization with excel solver.

SECTION–B

Types of Data Visualization Techniques (Charts, Plots, Maps) Correlation and Regression coefficients, visualization of correlation and regression coefficients. Tools for visualization of Data, Tableau basic overview, tableau installation, tableau data types, working with different Visualization in Tableau.

SECTION–C

Visualizing Data process: acquiring and processing Dataset. Quick Table calculation: Running Total, Moving average, Filtering, Multiple Measures, Boolean and Numerical Formulas. Dashboard Development : Layout , Dashboard Sizzling ,Titles, Formatting. Tableau Public and Desktop: Copy, Export, Print , Print screen .

SECTION–D

Interactive Data Visualization: Drawing with data , scales , axes, updates. Transition and motion. Common pitfalls of colour use, Visualization along Linear axis , visualization along logarithmic axes.

Recommended Books:

1. Kavitha Ranganathan, Impactful Data Visualization: Hide and Seek with Graphs, Penguin Random House India Private Limited 2023
2. Purna Chander Rao. Kathula, Hands-on Data Analysis & Visualization with Pandas, BPB Publications
3. Claus O. Wilke, Fundamentals of Data Visualization, ORielly, available at https://clauswilke.com/dataviz/
4. Jeffrey Ohlmann, Michael Fry, Data Visualization: Exploring And Explaining With Data By Cengage Learning
5. Dunlop, Dorothy D., and Ajit C. Tamhane, “Statistics and data analysis: from elementary to intermediate”, Prentice Hall, 2000.
6. Joseph F Hair, William C Black et. al , Multivariate Data Analysis, Pearson Education, 7th edition, 2013.

SEMESTER-VIII

COMPUTER APPLICATIONS (VOCATIONAL)

(MINOR-2)

DATA VISUALIZATION

(PRACTICAL)

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

1. Data analysis with excel: sensitivity analysis with data tables in excel, summarizing data with data functions, optimization with excel solver.
2. Tableau Environment: Registration, Installation for Student. Draw Charts, Plots, Maps.
3. Formatting Charts:
   - Bar Charts - Color Scales, Color Choice, Create Sheets, Sizing
   - Lines - Color Palettes, Sizing, Label Variations, Tooltip
   - Area Chart Formatting (Similar to Lines Formatting)
   - Pie Chart Formatting (Similar to Lines and Area Charts)
4. Quick Table calculation: Running Total, Moving average, Filtering, Multiple Measures, Boolean and Numerical Formulas. Dashboard Development: Layout , Dashboard Sizzling Titles , Formatting. Tableau Public and Desktop: Copy, Export, Print , Print screen .
5. Interactive Data Visualisation: Drawing with data, scales, axes, updates. Transition and motion