Nirmala Memorial Foundation College of Commerce and Science

(Autonomous)

Re-accredited by NAAC with B++, ISO 9001-2015 Certified, Recognised under section 2(f) & 12(B) of the UGC Act 1956

Permanently Affiliated to the University of Mumbai,

Syllabus

Bachelor of Science in Computer Science

(B.Sc. Computer Science)

(Semester I and II)

(Programme Code: UGCS02)

As Per New Education Policy (NEP) 2020

(To be implemented from the Academic Year 2026-2027)

Approved in the Academic Council Meeting held on ***8th June 2026***

INTRODUCTION OF THE PROGRAMME

1. Introduction

In the era of Information and Communication Technology (ICT), the transformative impact of computers on society is undeniable. The pervasive applications of computing across diverse fields have given rise to dynamic industries, evolving in tandem with the swift pace of technological change. As the landscape of the computing field continues to advance, it becomes imperative for students to cultivate a robust foundation that not only facilitates their current skills but also empowers them to adapt to the evolving nature of the field.

In line with the National Education Policy (NEP) 2020, our revised Computer Science program is designed to instill in students the ability to navigate the ever-changing technological terrain. Recognizing that specific languages and platforms may undergo transformations, the curriculum places a strong emphasis on fostering adaptability. Students will not only be exposed to a diverse array of programming languages, tools, paradigms, and technologies but will also delve into the fundamental principles that underpin the realm of computer science.

The core of our program encompasses essential courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering. Complementing these foundational elements are specialized courses in areas such as artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other cutting-edge topics in computer science.

Key Philosophy of the Program:

- **Form Strong Foundations:** Lay the groundwork for a comprehensive understanding of Computer Science.
- **Nurture Skills:** Develop programming, analytical, and design skills to tackle real-world problems effectively.
- **Introduce Gradually:** Familiarize students with emerging trends in a gradual and coherent manner.
- **Prepare for Industry Challenges:** Groom students to meet the challenges of the ICT industry with confidence and competence.

In acknowledgement of the evolving aspirations of students, our program not only prepares them for careers in the industry but also opens doors to research opportunities. The primary goal is to deliver a modern curriculum that equips graduates with both theoretical depth and practical acumen, empowering them to excel in the workplace while fostering a mindset of lifelong learning.

This program not only paves the way for a successful career in the software industry but also inspires students to pursue further studies and research opportunities. Graduates can seamlessly transition into postgraduate programs in Computer Science, leading to research and development roles, employment in IT industries, or even a career in business management.

As we unveil this syllabus, we invite students on a journey of exploration, learning, and innovation, ensuring they are not only prepared for the present but also poised to shape the future of Computer Science.

2. Aims and Objectives

Understanding and Knowledge Base: Develop a profound understanding and knowledge of the fundamental theories, systems, and applications that form the bedrock of Computer Science. This includes establishing a strong foundation in theoretical concepts and cultivating expertise in the practical application of Computer Science theories.

Analytical Abilities and Problem Solving: Foster essential skills and analytical abilities required for devising computer-based solutions to real-life problems. This involves developing critical thinking skills for problem identification and analysis, as well as cultivating the ability to design and implement effective solutions using computational tools.

Training in Emerging Technologies: Provide training in emergent computing technologies, facilitating the development of innovative solutions for both industry and academia. This includes exposing students to cutting-edge technologies and their applications, as well as encouraging exploration and experimentation with emerging tools and platforms.

Preparation for Post-Graduate Studies: Develop the necessary study skills and knowledge for students to pursue further post-graduate study in Computer Science or related fields. This involves equipping students with the academic rigor required for advanced studies and fostering a passion for continuous learning and research in the field.

Professional Skillset Development: Develop the professional skillset required for a successful career in an information technology-oriented business or industry. This includes providing practical exposure to industry-relevant tools and practices, as well as instilling a sense of professional ethics and responsibility.

Independent and Collaborative Work: Enable students to work independently and collaboratively, communicate effectively, and become responsible, competent, confident, insightful, and creative users of computing technology. This involves cultivating independence in problem-solving and project execution, as well as enhancing communication and collaboration skills for effective teamwork.

PROGRAM OUTCOME

At the end of three-year Bachelor of Computer Science, the students will be able:

- Formulate, model, and design solutions and procedures, utilizing software tools to address real-world problems effectively.
- Design and develop computer programs and computer-based systems in diverse areas such as networking, web design, security, cloud computing, IoT, data science, and other emerging technologies.
- Familiarize themselves with modern-day trends in industry and research-based settings, fostering the ability to innovate novel solutions to existing problems.
- Apply concepts, principles, and theories related to computer science to new and challenging situations.
- Demonstrate proficiency in using current techniques, skills, and tools essential for computing practice.
- Apply standard Software Engineering practices and strategies in real-time software project development.
- Pursue higher studies of specialization and confidently enter technical employment.
- Work independently or collaboratively as effective team members on substantial software projects, showcasing project management and teamwork skills.
- Communicate and present their work effectively and coherently, both in oral and written formats.
- Display ethical conduct in the usage of the Internet and Cyber systems, understanding and adhering to ethical standards in computing practices.
- Engage in independent and life-long learning, adapting to the rapidly changing IT industry and staying abreast of evolving technologies.

SEMESTER I

COURSE STRUCTURE

VERTICAL		COURSE CODE	SUBJECT	CREDIT
Vertical 1	Major	**NUCS101**	Digital System and Architecture	**2**
	Major	**NUCS102**	Fundamental of Database Systems	**2**
	Major	**NUCS103**	Computer Science Practical I (PR)	**2**
Vertical 2	Minor	***		
Vertical 3	OE1	**NUCS104**	Indian Financial Systems	**2**
	OE2	**NUCS105**	Social Media and Communication	**2**
Vertical 4	VSC	**NUCS106**	Introduction to Programming with Python	**2**
	SEC	**NUCS107**	Statistics with R Programming	**2**
Vertical 5	AEC	**NUEN101**	Communication Skills in English I	**2**
	VEC	**NUGT101**	Green Technologies	**2**
	IKS	**NUIK101**	Indian Knowledge System	**2**
Vertical 6	CC	**NUCC103**	Co-curricular	**2**
			Total Credits	**22**

SEMESTER II

COURSE STRUCTURE

VERTICAL		COURSE CODE	SUBJECT	CREDIT
Vertical 1	Major	**NUCS201**	Design and Analysis of Algorithm	**2**
	Major	**NUCS202**	Object Oriented Programming	**2**
	Major	**NUCS203**	Computer Science Practical 2 (PR)	**2**
Vertical 2	Minor	**NUCS204**	DS_Discriptive Statistics	**2**
Vertical 3	OE1	**NUCS205**	Basics of Stock Market	**2**
	OE2	**NUCS206**	Research Principles and Practices	**2**
Vertical 4	VSC	**NUCS207**	Web Designing	**2**
	SEC	**NUCS208**	Advanced Python Programming	**2**
Vertical 5	AEC	**NUEN201**	Communication Skills in English II	**2**
	VEC	NUDT201	Digital Tools for Sustainability	**2**
Vertical 6	CC	**NUCC203**	Co-curricular	**2**
			Total Credits	**22**

Semester – I

Vertical – I

Mandatory Courses

Name of the Course: Digital System and Architecture – NUCS101

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Digital Systems and Architecture course serves as a foundational exploration into the fundamental principles governing digital systems and computer architecture. This course delves into the design and organization of digital circuits and systems that form the backbone of modern computing devices. **Relevance:** In the era of rapid technological advancement, understanding digital systems and architecture is paramount. From smartphones to supercomputers, digital systems are pervasive. This course is essential for anyone aspiring to comprehend the inner workings of these systems and contribute to their development. **Usefulness:** The course equips students with the knowledge and skills to design, analyze, and optimize digital systems. It serves as a gateway for students to explore various aspects of computer architecture, laying the groundwork for more advanced studies and applications in the field. **Application:** Knowledge gained in this course finds practical applications in diverse domains, including embedded systems, computer networks, signal processing, and beyond. Students will learn how to translate theoretical concepts into tangible solutions, bridging the gap between abstraction and real-world implementation. **Interest:** Digital System and Architecture is an intellectually stimulating course that captivates students with its blend of theoretical concepts and hands-on application. The allure of creating efficient and high-performing digital systems often sparks curiosity and enthusiasm among students. **Connection with Other Courses:** This course establishes crucial linkages with other courses in computer science. It provides a solid foundation for more advanced courses such as computer organization, microprocessor systems, and hardware description languages. The knowledge gained here forms a seamless continuum in the study of computer systems. **Demand in the Industry:** As the demand for faster, more efficient computing systems continues to rise, professionals well-versed in digital systems and architecture are highly sought after. Industries ranging from electronics and telecommunications to automotive and healthcare actively seek

		individuals with expertise in designing and optimizing digital systems. **Job Prospects:** Graduates with proficiency in digital systems and architecture find themselves well-positioned for a myriad of career opportunities. Roles may include digital design engineer, embedded systems developer, hardware architect, and systems analyst. The skills acquired in this course open doors to a wide array of industries where digital technology plays a pivotal role.
2	**Vertical:**	**Major**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** **1.** To understand fundamentals of Logic gates, Number system and Flip Flops. **2.** To have an understanding of Digital System and Operation of a Digital Computer. **3.** To Learn Different Architecture & Organization of memory system, processor organization and control unit. **4.** Basic understanding of 8085 microprocessor and its applications.	
8	**Course Outcomes:** **CO1.** Learn how number system and codes are useful in computer system design. **CO2.** Learn how Flip Flops are useful in memory design and data communication through CPU and Memory and I/O devices. **CO3.** Learn about basics of instruction sets and its types. **CO4.** Learn about Processor Internal Architecture and Design.	
9	**Modules: -** **Module 1 (15 hours):**	
	Fundamentals of Digital Logic: Boolean algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. **Combinational Circuits:** Adders, Subtractors, Multiplexer, De-Multiplexer. **Sequential Circuits:** Flip- Flops (SR, JK & D), Counters: synchronous and asynchronous Counter. **Computer System:** Comparison of Computer Organization & Architecture, Computer Components and Functions, Interconnection Structures. Bus Interconnections, Input / Output: I/O Module Programmed I/O, Interrupt Driven I/O, Direct Memory Access.	
	Module 2 (15 hours):	

	Memory System Organization: Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence. Virtual Memory, External Memory: Magnetic Discs, Optical Memory, Flash Memories, RAID Levels **Instructions:** Instruction Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085/8086 CPU]. **Processor Organization:** Structure and Function. Register Organization [8085/8086 CPU]. Basic Microprocessor operations: Data Transfer (Register / Memory) Operations, Arithmetic & Logical Operations. Instruction Cycle, Introduction to RISC and CISC Architecture, Instruction Level Parallelism and Superscalar Processors, Design Issues.
10	**Text Books** 1. M. Mano, Computer System Architecture 3rd edition, Pearson 2. Carl Hamacher et al., Computer Organization and Embedded Systems, 6 ed., McGraw-Hill 2012 3. R P Jain, Modern Digital Electronics, Tata McGraw Hill Education Pvt. Ltd. , 4th Edition, 2010
11	**Reference Books** 1. William Stallings (2010), Computer Organization and Architecture designing for performance, 8th edition, Prentice Hall, New Jersy. 2. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, PearsonEducation Inc, 3. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill 4. Ramesh Gaonkar (2013), Microprocessor Architecture, Programming and Application with 8085, 6th edition, Penram.
12	**Internal Continuous Assessment: 40%** | **Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks **Format of Question Paper: External Examination (30 Marks)– 1 hr duration**
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10

Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Fundamentals of Database Systems – NUCS102

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Fundamentals of Database Systems course is a foundation in the study of information management and technology. It provides students with a comprehensive understanding of the principles, design, and implementation of databases, which are critical components in virtually every domain where data is utilized. **Relevance:** In today's data-driven world, the management and retrieval of information are paramount. This course is highly relevant as it addresses the core concepts essential for organizing, storing, and manipulating data efficiently. **Usefulness:** This course is immensely useful for individuals aspiring to work with data in various capacities. Whether designing databases, developing applications that interact with databases, or analyzing data trends, a solid understanding of database fundamentals is crucial. **Application:** The principles learned in this course find application across diverse sectors, including business, healthcare, finance, and technology. Students will gain the skills to model real- world scenarios, design efficient databases, and implement systems that store and retrieve information seamlessly. **Interest:** This course often attracts students due to its practical and tangible applications. The ability to structure and manage data effectively, ensuring its integrity and accessibility, can be intellectually stimulating and applicable to numerous real-world scenarios. **Connection with Other Courses:** This course forms a vital connection with various other courses in computer science and information technology. It is foundational to courses like database management, data warehousing, and data mining. Additionally, it complements courses related to software development, ensuring a holistic understanding of system architecture. **Demand in the Industry:** As businesses and organizations amass ever-growing volumes of data, there is an increasing demand for professionals versed in database systems. Industries such as finance, healthcare, e-commerce, and technology actively seek individuals who can design, implement, and manage robust databases. **Job Prospects:** Graduates proficient in the fundamentals of database systems enjoy promising job prospects. Potential roles include database administrator, data analyst, database developer, and business intelligence analyst. These professionals play a pivotal role in ensuring the efficient and secure management of an organization's data assets.

2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** **1.** To introduce students to the fundamentals and architecture of database systems. **2.** To explain the role of ERD components in database design and implementation. **3.** To provide hands-on experience in database creation and manipulation using MySQL. **4.** To develop understanding of normalization techniques and database security concepts. **5.** To educate students on data protection, access control, and the use of DCL statements like GRANT and REVOKE.	
8	**Course Outcomes:** CO1. Analyze database requirements and design entity-relationship models for a given system. CO2. Create and manage relational databases using MySQL commands for data manipulation and query execution. CO3. Apply normalization techniques to improve database efficiency and integrity. CO4. Implement data access control using permissions, and understand indexing for query optimization.	
9	**Modules** **Module 1 (15 hours):**	
	Introduction to DBMS: Overview of Database, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture. **Data models**: Client/Server Architecture, Object Based Logical Model, Record Based Logical Model (relational, hierarchical, network). **Entity Relationship Model and ER to Table:** Entities (Weak and Strong), Attributes, Relations (with and without Constraints), and additional constraints (key constraints, participation constraints, aggregation / generalization), Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER) Entity to Table. **DDL Statements:** Creating Databases, Using Databases, Data types, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables. **DML statements:** Viewing the structure of a table: insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, average, sum), group by clause, having clause.	
	Module 2 (15 hours):	
	Relational data model: Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint, Check constraint. **Functions:** String Functions, Math Functions, Date Functions. **Joining Tables and Sub-queries**: inner join, outer join (left outer, right outer, full outer), sub-queries with IN, EXISTS, ANY/ALL clause. **Normal forms:** Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition. **Database Protection:** Security Issues and Mechanisms, Threats to Databases, Role of DBA, Backing Up and Restoring databases. **Views**: Creating, altering, dropping, renaming and manipulating views. **DCL Statements:** Creating/dropping users, privileges (granting/revoking/viewing privileges), Transaction control commands – Commit, Rollback.	

10 **Text Books**

1. Fundamentals of Database System, ElmasriRamez, NavatheShamkant, Pearson Education, Seventh edition, 2017
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition,2014
3. Murach's MySQL, Joel Murach, 3rd Edition, 3rd Edition, 2019

11 **Reference Books**

1. Database System Concepts, Abraham Silberschatz, HenryF.Korth, S.Sudarshan, McGraw Hill,2017
2. MySQL: The Complete Reference, VikramVaswani , McGraw Hill, 2017
3. Learn SQL with MySQL: Retrieve and Manipulate Data Using SQL Commands with Ease, Ashwin Pajankar, BPB Publications, 2020

12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	**Format of Question Paper: External Examination (30 Marks)– 1 hr duration**

14 **Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Computer Science Practical 1 – NUCS103

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Major Computer Science Practical Course, encompassing Digital Systems and Architecture as well as Database Systems, is a comprehensive and hands-on exploration into the foundational aspects of both hardware and software that underpin modern computing. This practical course is designed to provide students with a holistic understanding of digital systems, computer architecture, and the effective management of data within databases. **Relevance:** In an era where seamless integration of hardware and software is pivotal, the combination of Digital Systems and Architecture with Database Systems is highly relevant. This practical course addresses the symbiotic relationship between the two, offering students a holistic perspective on building robust computing solutions. **Usefulness:** This course is immensely useful for students aiming to bridge the gap between hardware and software. By integrating digital systems with database concepts, students gain a unique skill set that enables them to design, implement, and optimize computing systems comprehensively. **Application:** The skills acquired in this practical course find direct application in the development of efficient and integrated computing solutions. Students learn to design digital systems, optimize hardware performance, and seamlessly integrate these systems with databases to handle and manipulate data effectively. **Interest:** The Major Computer Science Practical Course is designed to spark interest by offering a hands-on approach to both hardware and software components. Students engage in practical exercises that involve designing digital circuits, implementing database solutions, and integrating these components, fostering a deeper understanding and appreciation for the intricacies of computing systems. **Connection with Other Courses:** This practical course serves as a nexus, connecting various other courses in the computer science curriculum. It lays a foundation for advanced courses in computer organization, embedded systems, software engineering, and database management. The integrated approach ensures students comprehend the synergies between different aspects of computer science. **Demand in the Industry:** Professionals who can seamlessly navigate both digital systems and database management are in high demand. Industries ranging from electronics and telecommunications to software development and data analytics actively seek individuals proficient in both hardware and

		software aspects, recognizing the practical value of this dual expertise. **Job Prospects:** Graduates from this practical course enjoy promising job prospects in roles that require a holistic understanding of computing systems. Potential job titles include systems architect, database administrator, embedded systems developer, and hardware-software integration specialist. These professionals are well-positioned to contribute to diverse industries seeking comprehensive computing solutions.
2	**Vertical:**	Major
3	**Type:**	Practical
4	**Credits:**	2 credits (1 credit = 30 Hours of Practical work in a semester)
5	**Hours Allotted:**	60 hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** **1.** To verify and understand the functioning of various logic gates through truth tables. **2.** To develop skills in designing and implementing basic digital circuits and systems. **3.** To build foundational knowledge in relational database design and SQL querying. **4.** To provide practical exposure to transaction management and data control techniques in database systems.	
8	**Course Outcomes:** CO1. Design and implement digital circuits, including logic gates, combinational circuits, and flip-flops using Logisim. CO2. Simplify Boolean expressions and apply multiplexers/demultiplexers in circuit design. CO3. Create and manage relational databases, applying normalization and SQL queries for data manipulation. CO4. Demonstrate understanding of data control by managing permissions and access in MySQL.	
9	**Modules:-** **Module 1 (30 hours): Digital Systems & Architecture – Practical**	
	1. Logic Gates Truth Table Verification: Study and verify the truth table of various logic gates (NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR) using Logisim. **2. Boolean Expression Simplification:** Simplify given Boolean expressions and realize them using Logisim. **3. Half/Full Adder Design:** Design and verify the operation of a half/full adder using Logisim. **4. Half/Full Subtractor Design:** Design and verify the operation of a half/full subtractor using Logisim. **5. 4-Bit Magnitude Comparator:** Design a 4-bit magnitude comparator using combinational circuits in Logisim. **6. Flip-Flop Implementation:** Verify the operation of flip-flops (e.g., D, JK) using logic gates in Logisim. **7. Counter Operation Verification:** Verify the operation of a counter using Logisim. **8. 4-Bit Shift Register Operation:**	

	Verify the operation of a 4-bit shift register using Logisim. **9. Multiplexer/Demultiplexer Design:** Design and implement expressions using multiplexers/demultiplexers in Logisim. **10. 3-Bit Binary Ripple Counter:** Design and implement a 3-bit binary ripple counter using JK flip-flops in Logisim. **Preferred Software for practicals** : Any open source simulator (like Logisim)
	Module 2 (30 hours): Fundamentals of Database Systems – Practical
	1. Conceptual Design Using ER Diagrams: • Identify entities, attributes, keys, and relationships. • Apply generalization and specialization. **2. Database Management Operations:** • View all databases • Create a database. • View all tables in a database. • Create tables with and without constraints. • Perform CRUD operations. **3. Table Management Operations:** • Alter a table (add column, drop column, drop table, truncate table, rename table). • Perform backup/restore operations on a database. **4. Basic Queries and Aggregate Functions:** • Execute simple queries. • Utilize aggregate functions. **5. Advanced Query Functions:** • Utilize Date functions. • Utilize String functions. • Utilize Math functions. **6. Join Queries:** • Execute inner join queries. • Execute outer join queries. **7. Sub-queries:** • Apply sub-queries with IN clauses. • Apply sub-queries with EXISTS clauses. **8. ER Model to Relational Model Conversion and Normalization:** • Convert ER model to a relational model • Apply normalization up to 3rd Normal Form. **9. Views:** • Create views with and without check options. • Drop views. • Select data from views. **10. Data Control Language (DCL) Statements:** • Implement DCL statements for granting and revoking permissions. • Demonstrate COMMIT and ROLLBACK statements. **Mini Assignment:**

	1. Generate an E-R Diagram for Hotel Management System. 2. Create a database for Book Store. Introduce 5 Tables in Database. And Perform CRUD and table alteration operations. 3. Create users and give permissions. **Mini Project/Mini Assignment:** 1. Create a Database for Hotel Reservations Management. Apply CRUD operations on it. 2. Create a Database for a small Inventory Management System. Apply CRUD operations on it. **Preferred Software for practicals** : **PostgreSQL (Open Source)/MySQL**	
10	**Text Books** 1. R P Jain, Modern Digital Electronics, Tata McGraw Hill Education Pvt. Ltd. , 4th Edition, 2010 2. Murach's MySQL, Joel Murach, 3rd Edition, 3rd Edition, 2019	
11	**Reference Books** 1. MySQL: The Complete Reference, VikramVaswani , McGraw Hill, 2017 2. Learn SQL with MySQL: Retrieve and Manipulate Data Using SQL Commands with Ease, Ashwin Pajankar, BPB Publications, 2020	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	Format of Question Paper: (Semester End Practical Examination: 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Vertical – III

Open Electives(OE)

Name of the Course: Indian Financial System – NUCS104

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides a comprehensive introduction to the Indian financial system, offering foundational knowledge of its structure, components, and functioning. It delves into the role of banks and other financial institutions in economic development and explores various banking services available to individuals and businesses. The course also introduces students to the basics of insurance and personal financial planning, enabling them to make informed financial decisions and develop sound saving and investment strategies. Through real-world examples, case studies, and practical insights, students will gain a deeper understanding of how financial instruments, services, and institutions interact to support the financial stability of individuals and the economy.
2	**Vertical:**	**Open Electives**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. Understand the basic structure and role of the Indian financial system in the economy. 2. Identify the key functions of banks and the services they offer to individuals. 3. Recognize the importance of the Reserve Bank of India (RBI) as a regulatory authority. 4. Explain the concept of insurance and its relevance in personal financial planning. **5.** Develop basic awareness of saving, budgeting, and investment as essential financial habits.	
8	**Course Outcomes:** **After completing this course, students will have the knowledge and skills to** CO1. Describe the structure and components of the Indian financial system. CO2. Explain the roles and functions of various banking institutions and the regulatory framework. CO3. Understand the concept and significance of insurance in financial planning. CO4. Gain awareness of essential financial habits such as saving, budgeting, and basic investment concepts. CO5. Build a foundational understanding of financial services relevant to individuals in everyday life.	

<table>
<tr><td>•</td><td>Modules:- Module 1 (10 hours):

• Overview of Indian Financial System

o What is a financial system?
o Importance of financial systems in the economy
o Basic components: Institutions, markets, instruments, and services (in simple language)</td></tr>
<tr><td></td><td>Module 2 (10 hours):

• Banks and Banking Services
o Types of banks: Public, private, cooperative
o Basic services: Savings account, fixed deposits, loans, credit cards
o Role of RBI in regulating banks</td></tr>
<tr><td></td><td>Module 3 (10 hours):

• Insurance and Financial Planning Basics
o What is insurance? Types: Life and general insurance
o Importance of insurance in financial planning
o Basic idea of budgeting, saving, and investment</td></tr>
<tr><td>10</td><td>Text Books

1. Halan, Monika. Let’s Talk Money, Harper Business
2. Pathak, Bharati V. The Indian Financial System (selected basic chapters)
3. RBI’s “Financial Literacy” booklets and SEBI’s student guides</td></tr>
<tr><td>11</td><td>Reference Books

5. Introduction to Financial Planning (4th Edition 2017) - Indian Institute of Banking & Finance.
6. Bhasham, A.L, Wonder that was India: A Survey of the Culture of the Indian Subcontinent Before the Coming of the Muslims. London, Sidgwick and Jackson, 1954'
7. Sinha, Madhu. Financial Planning: A Ready Reckoner July 2017, McGraw Hill.
8. Halan, Monika, Let’s Talk Money: You've Worked Hard for It, Now Make It Work for You, July 2018 Harper Business.
9. Pandit, Amar The Only Financial Planning Book that You Will Ever Need, Network 18 Publications Ltd.</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination : 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:

<table><tr><th>Sr. No</th><th>Particular</th><th>Marks</th></tr><tr><td>1.</td><td>Class Test</td><td>15</td></tr><tr><td>2.</td><td>Class participation</td><td>05</td></tr><tr><td></td><td>Total</td><td>20</td></tr></table></td><td>Semester End Examination (30 Marks)</td></tr>
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14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Type & Module	Marks
Q1.	Objective Question A) Multiple choice questions B) True or False	 08 Marks 07 Marks
Q2.	Theory Question	15 Marks
	OR	
Q2.	Theory Question	15 Marks
	Total	**30**

Name of the Course: Social Media and Communication – NUCS105

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course offers a comprehensive overview of the evolution, structure, and impact of social media from its early platforms to the modern digital ecosystem. Students will explore the historical development of social media, the rise of mobile-based platforms, and the societal transformations driven by these technologies. The course also examines contemporary trends, including algorithmic curation, data privacy, ethical concerns, and the growing role of AI and machine learning in shaping digital interactions. Emphasis is placed on the application of social media in academic, professional, and interpersonal communication, equipping students with both theoretical understanding and practical insight.
2	**Vertical :**	**Open Electives**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: 1. **To introduce** students to the evolution and historical development of social media platforms and digital communication tools. 2. **To familiarize** students with modern social media platforms, their key features, and their influence on communication, culture, and society. 3. **To explore** the role of algorithms, artificial intelligence, and machine learning in shaping user experiences on social media. 4. **To sensitize** students to issues of digital ethics, data privacy, and the responsible use of social media. 5. **To enable** students to critically assess the use of social media in academic, interpersonal, and professional settings.	
8	**Course Outcomes:** By the end of this course, **students will be able to**: CO1. Describe the historical evolution and foundational concepts of social media platforms and their societal impact. CO2. Analyze the features and influence of major modern social media platforms, including their role in shaping digital interactions. CO3. Evaluate the ethical, privacy, and algorithmic challenges associated with social media usage in contemporary digital society. CO4. Apply knowledge of social media tools and technologies in academic, interpersonal, and professional contexts.	

9	**Modules**:-
	Module 1: Social Media – Past and Present 1. Concept and Scope of Social Media 2. Brief History and Evolution of Social Media 3. Early Platforms: Orkut, Friendster, MySpace 4. Evolution of Digital Communication Tools 5. Societal and Cultural Impact of Early Social Media
	Module 2: Modern Social Media Landscape and Applications 1. Overview of Major Platforms: Instagram, Twitter, TikTok, Snapchat 2. Recommendation Systems and Algorithmic Influence 3. Data Privacy, Ethics, and Digital Footprint 4. Social Media in Interpersonal and Academic Communication 5. Influencer Economy and Monetization Models 6. Academic and Research Applications of Social Media 7. Copyright Acts
10	**References:** 1. Boyd, D, and Ellison, N., 2007, Social network sites: Definition, history, and scholarship. Journal of computer-mediated communication, 13(1), 210-230 2. Burton, G. (2010). Media and Society: Critical Perspectives. New York; Mc Graw-Hill Publication. 3. Lipschultz, J.H. (2020). Social Media Communication Concepts, Practices, Data, Law and Ethics. Routledge. 4. Kaplan, A.M. and Haenlein, M. (2010) Users of the World, Unite! The Challenges and Opportunities of Social Media. Business Horizons, 53, 59-68. 5. Williams, R, and Gulati, G. J, 2017, Social Media Communication: Concepts, Practices Data, Law and Ethics. https://slejournal.springeropen.com/articles/10.1186/s40561-020-00118-7
12	**Internal Continuous Assessment: 40%** | **Semester End Examination : 60%**
	Internal Evaluation: 20 Marks 1. Classroom Presentations/ Assignments 10 Marks 2. Essay Submission/ Book review/ Field Visit Report /Educational Activity Report 10 Marks
	External Evaluation : 30 Marks **Format of Question Paper:** for the final examination Time: 1hour Marks: 30 **Q.1 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.2 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.3 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)**

Vertical – IV

Vocational & Skill Enhancement Courses (VSEC)

Name of the Course: Introduction to Programming with Python – NUCS106

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** Introduction to Programming with Python Course serves as an entry point into the world of coding, introducing learners to the versatile and beginner-friendly Python language. Python is renowned for its readability and simplicity, making it an ideal choice for individuals taking their first steps in programming. **Relevance:** In today's digital era, programming skills are increasingly essential across various disciplines. Python, being an interpreted, high-level language, is relevant for diverse applications, from web development and data analysis to artificial intelligence and automation. **Usefulness:** The course provides a foundational understanding of Python syntax, data structures, and control flow, empowering learners to write functional and efficient code. Python's broad applicability makes the skills acquired in this course valuable for numerous programming tasks. **Application:** Upon completion, participants can apply Python to solve real-world problems, automate repetitive tasks, and create simple applications. The practical knowledge gained serves as a stepping stone for more advanced Python courses or specialization in areas like data science or web development. **Interest:** Python's user-friendly syntax and extensive libraries make it an enjoyable language for beginners. The course is designed to spark interest by combining theory with hands-on projects, fostering a passion for coding and problem-solving. **Connection with Other Courses:** Python is a gateway language that seamlessly integrates with other programming languages and technologies. The skills acquired in a Basic Python Programming Course provide a solid foundation for advanced programming languages and specialized courses in data science, machine learning, and more.

		Demand in the Industry: Python's popularity in the industry is soaring. Its versatility, readability, and extensive community support have led to its widespread adoption. Professionals proficient in Python are in high demand across various sectors, including technology, finance, healthcare, and academia. **Job Prospects:** Completion of this Course opens doors to entry-level positions in software development, quality assurance, data analysis, and scripting. Python developers are sought after for their ability to quickly prototype solutions and contribute to various stages of software development.
2	**Vertical:**	**Vocational Skill Course**
3	**Type:**	Practical
4	**Credits:**	2 credits (1 credit = 15 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. Master Python features, execution, and diverse data types. 2. Demonstrate expertise in if statements, loops, and control statements 3. Efficiently create and manipulate arrays, strings, and data structures. 4. Apply functions, modules, and strings for versatile programming tasks. 5. Effectively manage files, utilize regular expressions, and work with date & time.	
8	**Course Outcomes:** CO1. Apply Python features for diverse programming tasks confidently. CO2. Implement control flow statements for precise program execution. CO3. Manipulate arrays, strings, and data structures with precision and ease. CO4. Create modular, efficient code using functions, modules, and strings. CO5. Skillfully manage files, utilize regular expressions, and work with date and time for program efficiency.	
9	**Modules:-** **Module (15 hours):**	
	Concept : **Overview and Core Elements of Python Programming** ● Python Basics: Features, execution flow, flavors, internals, interpreter, IDLE. ● Syntax Elements: Comments, docstrings, variables, input/output, command-line arguments. ● Data Types: Numbers, strings, lists, sets, dictionaries, and mappings. ● Operators: Types, precedence, associativity. **Control Structures** ● Conditional Statements: if, if-else, if-elif-else. ● Loops: while, for, infinite and nested loops.	

- Control Flow Tools: break, continue, pass, assert, return, else with loops.

Arrays and NumPy

- Array Basics: Creation, indexing, slicing, and operations.
- NumPy Arrays: Mathematical operations, aliasing, slicing, advanced indexing, attributes.

Functions and Modules

- Function Concepts: Definition, calling, parameters, return values (single/multiple), recursion, lambda.
- Function vs Method, pass by reference.
- Modules: Importing and using built-in modules.

Strings

- String Handling: Creation, built-in functions, formatting, searching, inserting substrings.
- String Analysis: Character and word count.

Programs to be completed during lab sessions:

Practical 1: Python Basics and Control Structures

- Write a Python program to accept your name, age, and city from the user and display it using formatted output.
- Demonstrate the use of if, if-else, and if-elif-else to classify a number as positive, negative, or zero.

Practical 2: Data Types, Operators, and Loops

- Create variables of different types (int, float, string, list, set, dict) and display their types using type().
- Accept two numbers and perform all arithmetic operations. Show results highlighting operator precedence.

Practical 3: Arrays and NumPy Operations

- Create a 1D and 2D NumPy array and display their shape, dimension, and data type.
- Perform basic slicing and indexing on a NumPy array.

Practical 4: Functions and Modules

- Write a function to calculate and return the sum and product of two numbers.
- Create a recursive function to compute the nth Fibonacci number.

Practical 5: Strings and String Functions

- Accept a string from the user and display its length, number of vowels, and reversed form.
- Use string formatting to display user details: name, marks, and grade.

Mini Assignment 1: Logic and Loops

Write a Python program to:

- Print even numbers from 1 to 50 using a **for** loop while skipping multiples of 5 using **continue**.

	● Use a **while** loop to find the factorial of a number. ● Demonstrate a lambda function to square elements in a list using **map().**
	Module (15 hours):
10	Concept : Lists, Tuples, and Dictionaries ● Lists: Creation, functions, methods, operations, slicing, and nested lists. ● Tuples: Creation, basic operations, and built-in functions. ● Dictionaries: Creating, updating, deleting, looping, and using dictionary methods. File Handling ● Working with text and binary files, file operations using with, seek(), and tell(). ● Using pickle for object serialization. ● Zipping/unzipping files and working with directories using os module. Regular Expressions ● Introduction to regex, sequence and special characters. ● Applying regex to files and extracting data (e.g., HTML tags, emails, phone numbers). Date and Time Handling ● Getting current date and time, formatting, combining, and comparing dates. ● Sorting dates, calculating duration, and using the calendar module. *Programs to be completed during lab sessions:* Practical 6: Lists and Tuples ● Create a list of 10 integers. Perform append, insert, delete, and reverse operations. ● Create a tuple of 5 elements. Demonstrate indexing and slicing. Practical 7: Dictionaries in Python ● Create a dictionary of 5 students with names as keys and marks as values. Display them using a loop. ● Add a new entry, update one mark, and delete one key-value pair. Practical 8: File Handling (Text and Binary) ● Create a text file, write user input into it using with, and read its content. ● Store and retrieve student records (name, marks) using the pickle module in a binary file. Practical 9: Regular Expressions ● Validate email addresses using regular expressions. ● Extract all phone numbers in the format xxx-xxx-xxxx from a string. Practical 10: Date, Time, and Calendar ● Display the current date and time in the format DD-MM-YYYY HH:MM:SS. ● Show the calendar for a given month and check if the year is a leap year.

	Mini Assignment : Create a Python program that: 1. Accepts a list of names and displays the first 3 and last 2 using slicing. 2. Counts the frequency of characters in a string using a dictionary. 3. Uses os.listdir() to list files in a directory and zips them using zipfile. 4. Calculates the number of days between two given dates entered by the user. **Preferred Software for practicals** : Jupyter Notebook or Python IDLE/VSCode	
11	**Reference Books** 1. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018 2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017 3. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018 4. Python Programming: Using Problem Solving Approach, ReemaThareja, Oxford Univeristy Press, 2017 5. Let Us Python, Yashwant. B. Kanetkar, BPB Publication, 2019	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Name of the Course: Statistics with R Programming – NUCS107

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** This course offers a comprehensive introduction to statistical computing and data analysis using R, a powerful open-source programming language widely adopted by professionals for its robust capabilities in statistics and data visualization. **Relevance:** In today's data-driven world, R programming holds significant relevance, offering powerful tools for statistical modeling, data visualization, and machine learning. Its widespread use makes it an essential skill for professionals working in data-intensive fields. **Usefulness:** This course empowers learners to handle data manipulation, conduct statistical analysis, and develop insightful visualizations. With its versatility, R serves as a valuable tool for both newcomers to data science and experienced professionals seeking to expand their analytical capabilities. **Application:** R programming is utilized across a wide range of fields such as finance, healthcare, marketing, and academia. Through this course, participants learn to apply R for solving real-world problems, uncovering data-driven insights, and supporting informed decision-making. **Interest:** The R programming course captures interest with its practical, hands-on approach. Participants actively work with real datasets, build visualizations, and develop statistical models—promoting a strong, experiential grasp of data analytics. **Connection with Other Courses:** This course seamlessly integrates with other data-focused disciplines, complementing studies in statistics, machine learning, and data science. It lays a strong foundation for pursuing advanced analytics and deeper exploration in related fields. **Demand in the Industry:** Professionals skilled in R programming are highly sought after across industries such as finance, healthcare, and more. Their ability to harness R for data analysis and informed decision-making supports the growing shift toward evidence-based practices. **Job Prospects:** Graduates of an R programming course unlock a wide range of career opportunities, including roles such as data analyst, statistician, business intelligence analyst, and data scientist. Their expertise in extracting actionable insights from data makes them valuable assets across industries.
2	**Vertical:**	**Skill Enhancement Course**
3	**Type:**	Practical

4	**Credits:**	2 credits (1 credit = 15 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** • Understand R basics, set up R Studio, and customize the environment. • Master R expressions, assignments, loops, and decision-making. • Develop proficiency in using R data structures: vectors, matrices, lists & data frames. • Demonstrate expertise in character strings manipulation in R. • Apply built-in statistical functions, regression analysis, and distribution functions fluently.	
8	**Course Outcomes:** CO1. Confidently navigate Studio, R GUI, and manage data in R. CO2. Fluent implementation of expressions, assignments, and loops in R. CO3. Use R data structures for effective data management. CO4. Efficiently manipulate and operate on character strings in R. CO5. Apply statistical functions, regression analysis & distribution functions with confidence.	
9	**Modules: -** **Module 1 (15 hours):**	
	Practical 1: Setting Up R Environment • Installing R and RStudio • Installing R Commander **Practical 2: Customizing RStudio and Data Management** • Customizing RStudio Layout • Loading and Managing Data **Practical 3: Implementing Expressions and Control Structures** • Basic Expressions and Assignment • Decision Making and Loops **Practical 4: Essential Data Structures in R** • Working with Vectors and Matrices • Working with Arrays, Lists, and Data Frames **Practical 5: Implementing Strings in R** • Working with Character Strings • Basic String Manipulations **Mini Project/Mini Assignment:** 1. Analyze and visualize academic performance.	

	Module 2 (15 hours):	
	Practical 6: Built-in Statistical Functions in R • Calculating Mean, Median, and Standard Deviation • Other Built-in Statistical Functions **Practical 7: Regression Analysis** • Performing Linear Regression • Performing Multiple Regression **Practical 8: Working with Distributions** • Normal Distribution Functions • Binomial Distribution Functions **Practical 9: Time Series Analysis and Data Visualization** • Time Series Analysis • Creating and Analyzing Contingency Tables **Practical 10: Graphical Models and Data Visualization** • Creating Basic Plots • Creating Special Plots and Saving Graphics **Mini Project/Mini Assignment:** 1. Analyze movie ratings from a dataset like IMDb or Kaggle.	
10	**Text Books** 1. Statistical Programming in R, K.G. Srinivasa G.M. Siddesh,Chetan Shetty , Oxford University Press, 2017 2. Learning R: A Language for Data Analytics and Visualization, Sybgen Learning, R. K. Maurya, 2021	
11	**Reference Books** 1. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd edition (2018) 2. Learning Python, Mark Lutz, O'Reilly–Shroff, 5th edition (2013) 3. Automate the Boring Stuff with Python, Al Sweigart, No Starch Press, 1st edition (2015) 4. Python Cookbook, David Beazley and Brian K. Jones, O'Reilly Media, 3rd edition (2013)	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission: 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	Format of Question Paper: (Semester End Practical Examination: 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Vertical – V

Ability Enhancement Courses(AEC)

Name of the Course: Communication Skills in English I – NUEN101

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course aims to develop foundational communication skills in English through both theoretical and practical approaches. It begins with an introduction to the nature of communication, including verbal and non-verbal forms, effective writing and speech, and listening techniques. Learners will enhance their reading and listening skills through guided practice using varied texts and listening materials. The second part of the course focuses on speaking and formal writing. It includes training in public speaking, conversational English for different contexts, and practical writing tasks such as job applications, RTI requests, and formal letters. The course is designed to build confidence and competence in real-world communication scenarios.`
2	**Vertical :**	**Ability Enhancement Courses(AEC)**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: • To enhance the English language proficiency of students by familiarizing them with • Listening, Speaking, Reading, and Writing (LSRW) skills • To introduce learners to different perspectives of looking at a text or passage • To equip learners in the functional aspects of English so that they use the • acquired language skills correctly and confidently • To guide learners in the effective use of the digital medium of communication	
8	**Course Outcomes:** After completion of the course, learners would be able to: CO1. Understand and interpret any text they are reading from different perspectives CO2. Arouse the interest of learners in listening to and watching good-quality audio and visual media CO3. Acquire proficiency in the skills of listening, speaking, reading, and writing that will help them meet the challenges of the world CO4. Develop good oral and written skills of communication in the English language	
9	**Modules**:-	
	Module 1: 1. Introduction to Communication Skills • English as an international language and varieties of English • Verbal and Non-Verbal Communication • Features of Effective Writing Skills • Characteristics of an Effective Speech • Effective Listening Skills This section provides a theoretical base for the following units that are practical in nature.	

	2. Reading Skills: • Scanning a text for information • Skimming a passage to look for main ideas, understanding text type Passages of around 200- 250 words from fables, folk stories, short stories, non-fiction, history, business or environment could be chosen in this section. 3. Listening Skills • Listening for main ideas/Gist • Listening for details • Listening for text organization features • Listening for tone, accent, style and register Listening skills in English should be developed through various activities, along with the practice done while teaching in the class.
	Module 2 : 1. Speaking Skills in English i) Public Speaking in English • Introduction • Characteristics of an effective speech • Analysis of model speeches • Drafting and presenting a speech in formal and informal gatherings ii) Conversation skills • Opening a conversation • Introducing oneself in various contexts • Introducing others formally and informally 2. Formal Writing Skills: • Job applications with biodata (solicited and unsolicited) • RTI applications • Applications for duplicate documents (I-cards / mark sheet, etc.)

10 **References:**

6. Bellare, Nirmala. Reading & Study Strategies. Books. 1 and 2. Oxford University Press, 1997, 1998
7. Bellare, Nirmala. Easy Steps to Summary Writing and Note-Making. Amazon Kindle Edition, 2020
8. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, 1994.
9. Das, Bikram K., et. al. An Introduction to Professional English and Soft Skills.Cambridge University Press India Pvt. Ltd., 2010
10. Das, Yadjnaseni& R. Saha (eds.) English for Careers. Pearson Education India, 2012.
11. Dimond-Bayir, Stephanie. Unlock Level 2 Listening and Speaking Skills Student's Book and Online Workbook: Listening and Speaking Skills Student's Book+ Online Workbook. Cambridge University Press, 2014.
12. Doff, Adrian and Christopher Jones. Language in Use (Intermediate and Upper Intermediate). CUP, 2004.

11 **Internal Continuous Assessment: 40%** | **Semester End Examination : 60%**

Internal Evaluation: 20 Marks

Role Play/ Skits	10 marks
Resume Writing,	05 marks
Class Participation and Attendance	05 marks

External Evaluation: 30 Marks

Semester End Examination

Question Paper Pattern

Question No.	Questions	Marks
Q 1	Writing Skills/ Comprehension	15 marks
Q 2	Practical/ Theory	15 marks

Vertical – V

Value Education Course(VEC)

Name of the Course: Green Technologies

Sr. No.	Heading	Particulars
1	**Description the course:**	Green Technologies focus on the development and application of environmentally sustainable technologies that minimize negative impacts on the environment while promoting efficient utilization of resources. This course introduces students to the concepts of Green IT, renewable and energy-efficient technologies, sustainable computing practices, e-waste management, and eco-friendly innovations. It also explores the role of Information Technology in smart cities, green networking, cloud computing, and environmental monitoring. The course aims to create awareness about sustainable technological solutions and encourage responsible use of technology for achieving environmental sustainability and green development goals.
2	**Vertical:**	VEC
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To introduce students to the concepts and need of green technologies for sustainable development. 2. To familiarize students with renewable energy systems and their applications. 3. To understand eco-friendly practices in waste management, green buildings, and transportation. 4. To encourage adoption of sustainable and responsible technologies in daily life and industry.	
8	**Course Outcomes:** CO1: Explain the need and significance of green technologies in addressing environmental challenges. CO2: Demonstrate understanding of renewable energy systems and sustainable practices. CO3: Analyze the role of green innovations in waste management, transportation, and urban planning. CO4: Apply eco-friendly approaches to promote sustainable development in personal and community life.	
9	**Modules** **Module 1: Introduction to Green Technologies(15 Hours)**	
	1. Introduction to Green IT: need, scope, and importance 2. Environmental impact of IT: energy consumption, carbon footprint, e-waste 3. Sustainable IT practices – Reduce, Reuse, Recycle 4. Energy-efficient hardware and software 5. Low-power processors, green devices 6. Power management in OS & networks 7. Green coding & algorithm optimization 8. E-waste management and eco-labels (Energy Star, EPEAT, ISO 14001)	

Module 2: Applications of Green Technologies (15 Hours)

1. Green Data Centers: virtualization, cloud computing, server consolidation, energy-efficient cooling
2. Green Networking: smart routing, bandwidth optimization, IoT for sustainability.
3. Role of IT in smart grids, smart cities, and environmental monitoring
4. Case studies: Google, Microsoft, Infosys, TCS initiatives.
5. Future trends: carbon-aware computing, AI & Blockchain for sustainability, edge computing for energy efficiency

10 Text Books

1. Newton, David E. Green Technologies and the Environment. ABC-CLIO, 2015.
2. Godfrey Boyle. Renewable Energy: Power for a Sustainable Future. Oxford University Press, 2012.

11 Reference Books

1. Gopal Nath Tiwari & Swapnil Dubey. Fundamentals of Renewable Energy Systems. Narosa Publishing, 2016.
2. Vesma, Vilnis. Energy Management Principles and Practice. Routledge, 2021.
3. United Nations Reports on Sustainable Development Goals (SDGs).

12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	**Format of Question Paper: External Examination (30 Marks)– 1 hr duration**

14 Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Vertical – V

Indian Knowledge System(IKS)

Name of the Course: Indian Knowledge System – NUIK101

Sr. No.	Heading	Particulars
1	**Description the course :**	This course offers a comprehensive introduction to the Indian Knowledge System (IKS), exploring its core principles, historical context, and contemporary relevance. It examines the impact of colonial education policies and emphasizes the need to revisit ancient Indian traditions. The course highlights traditional Indian entrepreneurship through handloom, khadi, tribal handicrafts, herbal products, and culturally rooted food ventures. It also showcases sustainable practices like the use of clay bottles, banana leaf plates, and the repair-and-reuse culture. Students will further explore key domains of IKS such as Ayurveda, ancient sports, astronomy, yoga, traditional banking, trade, commerce, and governance models from texts like the Arthashastra.
2	**Vertical :**	IKS
3	**Type :**	Theory
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives**: The student should be able to: 1. To sensitize the students about context in which they are embedded i.e. Indian culture and civilization including its Knowledge System and Tradition. 2. To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system. 3. To help to study the enriched scientific Indian heritage. 4. To introduce the contribution from Ancient Indian system & tradition to modern science & Technology.	
8	**Course Outcomes**: CO1. Learner will understand and appreciate the rich Indian Knowledge Tradition CO2. Learner will understand the contribution of Indians in various fields CO3. Learner will experience increase subject-awareness and self-esteem CO4. Learner will develop a comprehensive understanding of how all knowledge is ultimately intertwined	
9	**Module:** Module 1: (15 Hours) 1. Introduction to IKS: What is knowledge System, Characteristic Features of Indian Knowledge System 2. Why IKS? Macaulay's Education Policy and its impact, Need of revisiting Ancient Indian Traditions 3. IKS and Entrepreneurship: Handloom, Khadi, Tribal Handicrafts and Herbal Products, Food-based start-ups rooted in tradition 4. Sustainable Indian Practices: Clay bottles, Banana leaf plates, Cloth Bags-Repair	

culture (Reuse, Patchwork, Jugaad)

Module 2: (15 Hours)

1. Medicine (Ayurveda)
2. Ancient Sports
3. Astronomy
4. Yoga and Wellbeing
5. Banking
6. Trade and Commerce
7. Art of Governance (Arthashastra)

10 **Reference Books:**

1. Concise history of science in India- D.M. Bose, S.N Sen, B.V. Subbarayappa.
2. Positive sciences of the Ancient Hindus- Brajendranatha seal, Motilal Banrasidas, Delhi1958.
3. History of Chemistry in Ancient India & Medieval India, P.Ray- Indian Chemicals
4. Society, Calcutta 1956
5. Charaka Samhita- a scientific synopsis, P. Ray & H.N Gupta National Institute of Sciences of India, New Delhi 1965.
6. MacDonnell A.A- History of Sanskrit literature
7. Winternitz M- History of Indian Literature Vol. I, II & III
8. Dasgupta S.N & De S.K- History of Sanskrit literature Vol. I.
9. Ramkrishna Mission- cultural heritage of India Vol. I, II & III.
10. Majumdar R. C & Pushalkar A.D- History & culture of the Indian people, Vol. I, II & III.
11. Keith A.B- History of Sanskrit literature.
12. Varadachari V- History of Sanskrit literature Chaitanya Krishna- A new History of Sanskrit

11 **Internal Continuous Assessment: 40%**

Continuous Internal Assessment: 20 Marks

- Field Visit Report: **10 Marks,**
- Class Participation/Activities :**10 Marks**

12 **External Assessment: 60% : (30 Marks)**

Format of Question Paper: For the External examination

Q1	(A)	Objectives (MCQs)	5
	(B)	Concept/One Sentence	5
Q2		A **OR** B	10
Q3		A **OR** B	10

Vertical – VI

Co-Curricular Courses (CC)

Title of Paper: Fitness and Sports I – NUCC103

Sr. No.	Heading	Particulars
1	**Description the course :** **Including but Not limited to :**	India is growing rapidly as a global super-power. To face the challenges of the century and to keep up with the pace of the world, maintaining health is of prime importance. Giving thrust to healthy society, Physical Education, Sports, Health & fitness and Yoga are of great significance in today's world. The Government of India insists on Physical Fitness, Mental Health and Overall Development of Personality for every citizen. However, creating efficient and skilled human resource in the field of Physical Education, Sports and Yoga is identified as the need of the hour. Thus, the Governments of India and Government of Maharashtra have included Physical Education, Sports and Yoga as a key area under the NEP 2020.
2	**Vertical :**	Co-Curricular
3	**Type :**	Activity Based
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: The student should be able to: • **To understand the core components of physical fitness** and learn basic techniques for assessing and improving personal health and endurance. • **To gain knowledge of various sports classifications, rules, and techniques** for both individual and team-based indoor and outdoor games. • **To develop life skills such as discipline, teamwork, and leadership** through active	
8	**Course Outcomes**: • **Understanding of physical fitness components** and apply appropriate assessment techniques like BMI, flexibility, and endurance tests. • **Identify and explain the rules, techniques, and classifications** of major indoor and outdoor sports, including both individual and team games. • **Exhibit improved teamwork, discipline, and personal growth** through participation in physical activities and application of sportsmanship values.	

9	**Module:** This module introduces the fundamentals of physical fitness, including strength, endurance, flexibility, body composition, and cardiovascular health. It emphasizes the importance of fitness for students and explains basic assessment methods like BMI and endurance tests. It also covers the classification of sports into indoor/outdoor and individual/team. Basic rules and techniques of popular games like cricket, football, volleyball, and athletics are explained. The module highlights how sports encourage discipline, teamwork, and contribute to personality development.
10	**Reference Books:** 1. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication. 2. Muller, J.P. (2000). Health, Exercise and Fitness. Delhi: Sports. 3. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics. 4. Kamlesh, M.L. (2007). Physical Education and Sports. New Delhi: Metropolita Book **5.** Singh Hardayal (1991), Science of Sports Training, DVS Publication, New Delhi
11	**Internal Continuous Assessment: 40%(20 Marks)** ❖ Assignment/Report Writing
12	**External Assessment: 60% (30 Marks)** **Certificate Submission Guidelines** *Each student must submit at least* **three certificates** *from the following approved categories:* 1. Attending **Zumba or Aerobics** sessions conducted by a certified fitness trainer. 2. Participation in **Team Sports** such as Cricket, Volleyball, Football, Kabaddi, Basketball, or Kho-Kho. 3. Participation in **Indoor Sports** like Carrom, Chess, or Badminton. 4. Participation in **Marathons or Walkathons**. 5. Serving as a **Volunteer** in roles such as Event Coordinator, Scorekeeper, Timekeeper, or Referee. *Note: Students participating in sports competitions conducted by University at State or National Level, students who have represented Mumbai University or College at Intercollegiate / Inter Zonal / West Zone Inter University / All India Inter University/ International tournament are exempt from submission of report.*

Nirmala Memorial Foundation College of Commerce and Science

(Autonomous)

Re-accredited by NAAC with B++, ISO 9001-2015 Certified, Recognised under section 2(f) & 12(B) of the UGC Act 1956

Permanently Affiliated to the University of Mumbai,

Syllabus

Bachelor of Science in Computer Science

(B.Sc. Computer Science)

(Programme Code: UGCS02)

As Per New Education Policy (NEP) 2020

(To be implemented from the Academic Year 2025-2026)

Approved in the Academic Council Meeting held on ***5th July 2025***

Semester – II

Vertical – I

Mandatory Courses

Name of the Course: Design and Analysis of Algorithms – NUCS201

Sr. No.	Heading	Particulars
1	**Description the course :**	The **Design and Analysis of Algorithms** course offers a foundational study of algorithmic principles, focusing on the systematic design and evaluation of algorithm efficiency. As a core component of computer science education, it equips students with critical skills needed to solve complex computational problems effectively.
2	**Vertical :**	Major
3	**Type :**	Theory
4	**Credits :**	2 credits (1 credit = 15 Hours for Theory)
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To help students understand the fundamental principles of algorithm design. 2. To introduce students to the theoretical foundations of basic data structures. 3. To familiarize students with essential problem-solving techniques such as searching, sorting, selection, and recursion, and enable them to evaluate the efficiency of different algorithms. 4. To teach students key algorithm design paradigms and their application in solving real-world problems.	
8	**Course Outcomes:** **At the end of the course:** **CO1.** Students will be able to analyze and evaluate the efficiency of their programs based on the performance of the algorithms implemented. **CO2.** Students will demonstrate an understanding of various data structures and their appropriate use cases. **CO3.** Students will be capable of selecting and applying suitable algorithm design principles by accurately interpreting the requirements of real-world problems.	
9	**Modules:**	
	Module 1: 15 hours	
	Introduction to algorithms - What is algorithm, analysis of algorithm, Types of complexity, running time analysis, how to Compare Algorithms, Rate of Growth, Types of Analysis, Asymptotic Notation, Big-O Notation, Omega-Ω Notation, Theta-Θ Notation, Asymptotic Analysis, Performance. **Introduction to Data Structures -** What is data structure, types, Introduction to Array(1-d & 2-d), Stack and List data structures, operations on these data structures, advantages disadvantages and applications of these data structures like solving linear equations. **Recursion -** What is recursion, Recursion vs Iteration, recursion applications like Factorial of a number, Fibonacci series & their comparative analysis with respect to iterative version. **Basic Sorting Techniques** - Bubble, Selection and Insertion Sort.	
	Module 2: 15 hours	

	Searching Techniques - Linear Search and its types, Binary Search and their comparative analysis, Selection Techniques - Selection by Sorting, Partition-based Selection Algorithm, String Algorithms - Pattern matching in strings, Brute Force Method. **Algorithm Design Techniques** - Introduction to various types of classifications/design criteria and design techniques, Greedy Technique - Concept, Advantages & Disadvantages, Applications. Divide-n-Conquer - Concept, Advantages & Disadvantages, Applications, Implementation using problems like - merge sort.
10	Online References • https://www.geeksforgeeks.org/fundamentals-of-algorithms/ • https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/ • https://mitpress.mit.edu/books/introduction-algorithms-third-edition • https://visualgo.net/en
11	**Reference Books:** 1. Data Structure and Algorithm Using Python, Rance D. Necaise, Wiley India Edition, 2016. 2. Data Structures and Algorithms Made Easy, Narasimha Karumanchi, CareerMonk Publications, 2016. 3. Introduction to Algorithms, Thomas H. Cormen, 3rd Edition, PHI. 4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, Pearson, 3rd Edition, 2011. 5. Design and Analysis of Algorithms, S. Sridhar, Oxford University Press, 2014.
12	**Internal Continuous Assessment: 40%** / **Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks / **Format of Question Paper: External Examination (30 Marks)– 1 hr duration**
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Object Oriented Programming – NUCS202

Sr. No.	Heading	Particulars
1	**Description the course :**	The Introduction to Object-Oriented Programming (OOP) using C++ course provides a comprehensive foundation in the essential principles of object-oriented programming through hands-on experience with the C++ language. Designed as an entry point for students, this course enables learners to grasp and implement fundamental concepts that underpin modern software design and development, such as classes, objects, encapsulation, inheritance, and polymorphism. By mastering these core ideas, students are equipped to build robust, maintainable, and reusable software solutions in C++.
2	**Vertical :**	Major
3	**Type :**	Theory
4	**Credits :**	2 credits (1 credit = 15 Hours for Theory)
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. Enable learners to comprehend the fundamental principles of object-oriented programming (OOP). 2. Equip learners with the ability to design object-oriented solutions using Unified Modelling Language (UML) diagrams. 3. Develop proficiency in the syntax and features of the C++ programming language. 4. Foster analytical skills to evaluate and implement key OOP concepts in software development. 5. Empower learners to design and develop programs that effectively apply object-oriented programming concepts.	
8	**Course Outcomes:** **At the end of the course:** CO1. **Students will be able to** comprehend, recall, demonstrate, and clearly articulate the fundamental concepts of object-oriented programming. CO2. **Students** will be capable of designing and constructing UML diagrams to represent object-oriented systems. CO3. **Students** will be able to effectively illustrate and utilize various control statements in C++. CO4. **Students** will develop the ability to critically analyze and implement core object-oriented programming concepts in practical scenarios. **CO5. Students** will be proficient in writing and developing C++ programs that apply and integrate object-oriented programming principles.	
9	**Modules:**	
	Module 1: (15 hours)	
	Introduction to Programming Concepts: Basic concepts of Object Oriented Programming, benefits of object oriented programming, object oriented languages, applications of object oriented programming. **Tokens:** Keywords, identifiers, and simple C++ program without class, compiling and running C++ program. Basic data types, variables, rules for naming variables, the type cast operator, implicit and explicit type casting. **Decision Making, Loops, Arrays and Strings:** Conditional statements - if, if...else, switch	

	loops- while, do...while, for, types of arrays and string. **Classes, Abstraction & Encapsulation:** Classes and Objects, Dot Operator, data members, member functions, passing data to functions, scope and visibility of variables in function. **Constructors and Polymorphism :** Default constructor, parameterized constructor, copy constructor, destructors. Binding-static binding & overloading, constructor overloading function overloading, operator overloading.
	Module 2: (15 hours)
	Inheritance: Defining base class and its derived class, access specifiers, types of inheritance-single, multiple, hierarchical, multilevel, hybrid inheritance, friend function and friend class, constructors in derived classes. **Run time Polymorphism -** Dynamic Binding, Function overriding, virtual function, pure virtual function, virtual base class, abstract class. **Pointers:** Introduction to pointers, * and & operators, assigning addresses to pointer variables, accessing values using pointers, pointers to objects & this pointer. **File Handling:** File Stream classes, opening and closing file-file opening modes, text file handling, binary file handling.
10	Online References • https://www.w3schools.com/cpp/ • https://www.programiz.com/cpp-programming • https://www.tpointtech.com/cpp-tutorial
11	**Reference Books:** 1. Object Oriented Programming with C++, Balagurusamy E., 8th Edition, McGraw Hill Education India. 2. UML & C++: A Practical Guide to Object Oriented Development, Lee/Tepfenhart, Pearson Education, 2nd Edition2015 3. Mastering C++ by Venugopal, Publisher: McGraw-Hill Education, 2017 4. Let Us C++ by KanetkarYashwant, Publisher: BPB Publications, 2020 5. Object Oriented Analysis and Design by Timothy Budd TMH, 2001
12	**Internal Continuous Assessment: 40%** / **Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks **Format of Question Paper: External Examination (30 Marks)– 1 hr duration**
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Computer Science Practical 2 – NUCS203

(**Design and Analysis of Algorithms** and **Object-Oriented Programming (OOP) using C++**.)

Sr. No.	Heading	Particulars
1	**Description the course :**	The Computer Science Practical Course offers an integrated exploration of **Design and Analysis of Algorithms** and **Object-Oriented Programming (OOP) using C++**. Designed to build a strong foundation in core computer science principles, the course combines theoretical understanding of algorithmic strategies with hands-on programming experience. Through the C++ language, students will develop practical skills in designing efficient algorithms and implementing robust, object-oriented software solutions.
2	**Vertical :**	Major
3	**Type :**	Practical
4	**Credits :**	2 credits (1 credit = 30 Hours of Practical work in a semester)
5	**Hours Allotted :**	60 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. Enable learners to comprehend the fundamental principles of object-oriented programming (OOP). 2. Equip learners with the ability to design object-oriented solutions using Unified Modelling Language (UML) diagrams. 3. Develop proficiency in the syntax and features of the C++ programming language. 4. Foster analytical skills to evaluate and implement key OOP concepts in software development. 5. Empower learners to design and develop programs that effectively apply object-oriented programming concepts.	
8	**Course Outcomes:** **At the end of the course:** **CO1.** Design and implement algorithms across diverse problem domains effectively. **CO2.** Evaluate and compare algorithms based on their time and space complexity. **CO3.** Apply divide and conquer strategies to develop efficient computational solutions. **CO4.** Implement and analyze algorithms using greedy strategies for problem-solving. **CO5.** Utilize advanced C++ features such as friend functions, inline functions, and the `this` pointer. **CO6.** Understand and manage the effects of scope specifiers on class members for proper encapsulation.	
9	**Modules:**	
	Module 1: 30 hours (Design and Analysis of Algorithms)	
	1. Array Operations a) Write a program in python to store 5 numbers in an array. Print 3rd element of an array. Update 3rd element of an array, Hence print array. Also calculate the sum of elements in array. b) Write a program in python to store two matrices as an 2- D array. Hence find matrix addition of matrices. **2. List-Based Stack Operations** a) Write a program in python to take positive integers as input from user until he enter negative integer. b) Write a program in python to display last element of stack and check whether the stack is empty or not. **3. Linear and Binary Search** a) Write a program in python to find position of particular number in the given array, by using linear search.	

b) Write a program in python to find position of particular number in the given array, by using binary search.

4. Sorting Algorithms

a) Write a program in python to find smallest element of given array by using bubble sort algorithm. (Take : A={9, 8, 7, 6, 5 })
b) Write a program in python to find smallest element of given array by using selection sort algorithm. (Take: A={7,9,6,8,4})
c) Write a program in python to find smallest element of given array by using insertion sort algorithm. (Take : A={7,9,6,8,4})

5. Nth Max/Min Element

a) Write a program in python to find 4th maximum value of the given data. {5,3,13,7,2,4,8,12}
b) Write a program in python to find 4th minimum value of the given data. {5,3,13,7,2,4,8,12}

6. String Pattern Matching

a) Find a substring within a string using naive matching.

7. Recursion

a) Write a program in python to find factorial of 6 by using recursion.
b) Implement the Fibonacci series recursively.

8. Greedy Algorithm

a) Write a program in python to find minimum number coins needed for changes of 59.

9. Divide and Conquer

a) Write a program in python to sort the array by using divide and conquer sort algorithm. (Take : A={6, 5, 12, 10, 9, 1})

10. Dynamic Programming

a) Write a program in python to find factorial of 6 by using dynamic programming principles.
b) Write a program in python to find length of Longest Common Subsequence (LCS) using dynamic programming.

Mini-Assignment:

Title: *"Create a mini project on Sorting of contact numbers"*

Module 2 : 30 Hrs (Object-Oriented Programming (OOP) using C++.)

C++ Programming Concepts: Basic concepts of Object Oriented Programming. Basic data types and declaration variables. Conditional statements and Branching statements. Classes and Objects, scope and visibility of variables in function. Constructors and Polymorphism**.**

Programs to be completed during lab sessions :

1. **Introduction to Classes**

Design an Employee class for reading and displaying the employee information, the getInfo() and dispInfo() are member functions will be used respectively.

2. Branching and Looping with Classes

a) Write and execute a C++ program using classes to find Factorial (For Loop)
b) Write and execute a C++ program using classes to check whether the number is Even number or Odd number.

3. To demonstrate array

Write a program in C++ using array to arrange number in Matrix form.

4. Scope Resolution Operator

	Write a program in C++ to calculate the Area of Circle and Rectangle using Scope Resolution Operator. **5. Constructors and Destructors** Write a program in C++ to display the side of the Cube, using default constructors, parameterized constructors, copy constructors, and destructor **6. Demonstrate Access Specifier** Write a program to display details of Employee by displaying Age as Public specifier and Identification as Private specifier, and Contact as Protected specifier. **7. Implement classes to demonstrate single inheritance scenarios** Write a program in C++ to calculate Product of two numbers using Single Inheritance. **8. Implement classes to demonstrate multilevel inheritance scenarios** Write a program in C++ to calculate marks of students where class student gets the Student details, class Marks gets marks and class result to calculate total marks of Student. **9. Explore the use of pointers within classes** Write a program in C++ to except input to create an account and can access through function and calculate the Rate of Interest. Using this pointer. **10. Develop programs to demonstrate function overloading and overriding within classes.** Write a program in C++ a) To add two different data types using add function using function overloading. b) Calculate sum of two numbers using friend function. **Mini-Assignment**: **Title:** *"Create Student's 5 Records displaying the details and calculate the CPGA"* **Assignment Description:** Create a Student Details Class which has Student RollNo, Student Name, Subjects, Marks. The functions using scope resolution should include: • **Mark_Obtained – accept the marks of the students** • **Calculate CPGA** – Calculate average of marks accepted from class • **Object of a class** – all the functions are called **Requirements:** • Declaration of variables and functions • Operator to be used scope resolution (::)
10	Online References • https://www.w3schools.com/cpp/ • https://www.programiz.com/cpp-programming • https://www.tpointtech.com/cpp-tutorial
11	**Reference Books:** 1. Object Oriented Programming with C++, Balagurusamy E., 8th Edition, McGraw Hill Education India. 2. UML & C++: A Practical Guide to Object Oriented Development, Lee/Tepfenhart, Pearson Education, 2nd Edition2015 3. Mastering C++ by Venugopal, Publisher: McGraw-Hill Education, 2017 4. Let Us C++ by Kanetkar Yashwant, Publisher: BPB Publications, 2020

<table>
<tr><td></td><td colspan="2">5. Object Oriented Analysis and Design by Timothy Budd TMH, 2001</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:
Practical journal submission, viva, assignments
● Journal Submission : 10 Marks
● Assignments: 10 Marks
Total: 20 marks</td><td>A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.
Its compulsory to carry certified journal at the time of practical exam</td></tr>
<tr><td>14</td><td colspan="2">Format of Question Paper:

Total Marks: 30 Duration: 2 Hours
<table>
<tr><th>Question</th><th>Practical Question Based On</th><th>Marks</th></tr>
<tr><td>Q.1</td><td>Module 1</td><td>12</td></tr>
<tr><td>Q.2</td><td>Module 2</td><td>12</td></tr>
<tr><td>Q.3</td><td>Viva</td><td>06</td></tr>
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Vertical – II

(Minor)

Name of the Course: Descriptive Statistics – NUCS204

Sr. No.	Heading	Particulars
1	**Description the course:**	• **Introduction:** Descriptive Statistics simplifies complex data, revealing patterns through measures like central tendency and data visualization, forming the foundation for data understanding. • **Relevance and Usefulness:** Descriptive Statistics is essential in today's data-driven world, turning raw data into clear insights. Used across fields like business and healthcare, it helps professionals make informed decisions through measures like mean, median, and visualizations. • **Applications:** Widely applicable, Descriptive Statistics is employed in finance, healthcare, sociology, and beyond, making it an essential skill for professionals in data analysis. • **Interest and Connection with Other Courses:** Descriptive Statistics unravels complex data visually, appealing to both analytical and creative minds. It lays the groundwork for advanced studies like inferential statistics and machine learning. • **Demand in the Industry:** With industries becoming more data-driven, the demand for professionals skilled in Descriptive Statistics is rising—particularly in roles such as data analysts, business analysts, and statistical consultants. • **Job Prospects:** Professionals proficient Descriptive Statistics are highly sought after, contributing significantly to organizational success through data-driven decision-making.
2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** **1:** To understand different types of Data, and to analyze and present the data. **2:** To compute various Measures of Central Tendencies. **3:** To compute various Measures of Dispersion. **4:** To understand the concept of Skewness and Kurtosis. **5**: To compute the Correlation Coefficient for bivariate data and further apply the regression analysis.	
8	**Course Outcomes :** **CO 1.** Able to organize, manage and present the data. **CO 2.** To understand the use Measures of Central Tendencies and Dispersion. **CO 3.** Able to understand and compute the consistent and inconsistent data **CO 4.** Able to identify the association between variables **CO 5.** Able to understand forecasting techniques and to find cause and effect relationship	

	between variables through regression analysis.
9	**Modules:-** **Module 1: (15 Hours)**
	1.Introduction of Statistics: Meaning of Statistics, Importance of Statistics, Different types of Scales: Nominal, Ordinal, Interval and ratio. Univariate frequency distribution of discrete and continuous variables and Cumulative frequency distribution. Data Presentation: Frequency Distribution, Frequency Curve, Frequency Polygon Histogram and Ogives Curves. **2. Measures of Central Tendencies**: Concept of Central Tendency: Mean, Median, Mode, characteristics of good measures of Central Tendency, Partition values: Quartiles, Deciles and Percentiles -examples of ungrouped and grouped data **3.Measures of Dispersion:** Concept of Dispersion, measures of Dispersion: Range, Quartile Deviation, Mean Absolute Deviation, Standard Deviation, Combined Standard Deviation-examples of ungrouped and grouped data, Variance. **4.Moments:** Raw and Central Moments, relation between Raw and Central moments, concept of Coefficient of Skewness and Kurtosis.
	Module 2: (15 Hours)
	1.Correlation: Concept of Correlation, its properties, Scatter Diagram, Karl Pearson's Coefficient of Correlation and Spearman's Rank Correlation, and Spearman' s Rank Correlation (with and without ties) **2.Concept of multiple correlation:** example for three variables **3.Regression:** Linear regression: Coefficients of regression, Concept of Linear Regression, Principle of Least Square, Fitting a straight line by method of least square. Non-linear regression: Fitting a quadratic polynomial, exponential function and multiple regression by method of least square. **4. Relation between Correlation and Regression**
10	**Text Books** **1.**Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, NewDelhi. **2.**Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, NewDelhi. **3.**Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi. **4.**Schaum‟s Outline Of Theory And Problems Of Beginning Statistics, Larry J. Stephens, Schaum‟s Outline Series Mcgraw-Hill **5.**Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi
11	**Reference Books** **1.**Goon AM, Gupta MK, Das Gupta B: Fundamentals of Statistics, Vol-I, the World Press Pt. Ltd, Kolkata **2.** Shah R.J: Descriptive Statistics: Seth Publication, Eight Edition **3.**Spiegel M.R: Theory and Problems of Statistics, Schaum's Publishing Series, Tata McGraw-Hill, First Edition **4.** Basic Statistics: Agarwal B.L: New Age International Ltd
12	**Internal Continuous Assessment: 40%**

13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Vertical – III

Open Electives(OE)

Name of the Course: Basics of Stock Market – NUCS205

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides a comprehensive introduction to the Indian financial system, offering foundational knowledge of its structure, components, and functioning. It delves into the role of banks and other financial institutions in economic development and explores various banking services available to individuals and businesses. The course also introduces students to the basics of insurance and personal financial planning, enabling them to make informed financial decisions and develop sound saving and investment strategies. Through real-world examples, case studies, and practical insights, students will gain a deeper understanding of how financial instruments, services, and institutions interact to support the financial stability of individuals and the economy.
2	**Vertical:**	**Open Electives**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. Understand the concept and function of stock markets. 2. Identify the key participants and their roles in the stock market. 3. Familiarize with Indian stock exchanges (NSE & BSE). 4. Recognize common stock market terms such as shares, IPO, and dividends. 5. Compare features of stocks, bonds, mutual funds, ETFs, and SIPs. 6. Understand the concept of risk vs return. 7. Learn the importance of diversification in portfolio building.	
8	**Course Outcomes (CO):** **After completing this course, students will have the knowledge and skills to** CO1. Explain the basic structure of stock markets, key participants, and commonly used investment terms. CO2. Differentiate between various investment options and evaluate them based on risk and return, with basic understanding of portfolio diversification.	
•	**Modules:-** **Module 1 (15 hours): Introduction to Stock Markets** • What is a stock market?	

- Types of markets: Primary vs Secondary
- Key participants: Investors, Brokers, SEBI
- Indian stock exchanges: NSE, BSE
- Basic terms: stock, share, equity, IPO, index, dividend

Module 2 (15 hours): Investment Instruments

1. Types of investment options: Stocks, Bonds, Mutual Funds, ETFs, SIPs
2. Risk vs Return: Low-risk vs High-risk options
3. Diversification and Portfolio basics

10 Text Books

1. Halan, Monika. *Let's Talk Money*, Harper Business
2. Pathak, Bharati V. *The Indian Financial System* (selected basic chapters)
3. RBI's "Financial Literacy" booklets and SEBI's student guides

11 Reference Books

1. Investment Analysis and Portfolio Management – Prasanna Chandra
2. Security Analysis and Portfolio Management – Punithavathy Pandian
3. Financial Markets and Institutions – L.M. Bhole & Jitendra Mahakud
4. Investment Management – V.K. Bhalla

12 Internal Continuous Assessment: 40% | **External Assessment : 60%**

13 Continuous Evaluation through: | **Semester End Examination (30 Marks)**

Sr. No	Particular	Marks
1.	Class Test	15
2.	Class participation	05
	Total	**20**

14 Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)

Questions	Type & Module	Marks
Q1.	Objective Question A) Multiple choice questions B) True or False	 08 Marks 07 Marks
Q2.	Theory Question	15 Marks
	OR	
Q2.	Theory Question	15 Marks
	Total	**30**

Vertical – III

Open Electives(OE)

Name of the Course: Research and Principles – NUCS206

Sr. No.	Heading	Particulars
1	**Description the course :**	This course provides a comprehensive introduction to the principles and practices of research, with a focus on its application in academic and professional settings. Students will explore both **qualitative and quantitative research methods**, learn how to **formulate research problems**, and understand the **process of developing a research proposal**. Key aspects include **literature review**, **data collection strategies**, **research design**, and **hypothesis formulation**. By the end of the course, students will be equipped with the essential skills to **initiate, plan, and present a research study**, preparing them for future academic projects, internships, or industry-driven research.
2	**Vertical :**	**Open Elective**
3	**Type :**	**Theory**
4	**Credits :**	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** • To introduce students to the fundamental concepts, types, and purposes of research. • To develop an understanding of qualitative and quantitative research methodologies. • To guide students through the research process—from identifying a topic to formulating objectives and hypotheses. • To familiarize students with research design strategies, ethical considerations, and techniques for writing research proposals.	
8	**Course Outcomes:** By the end of the course, students will: **CO1.** Gain a clear understanding of what research is and why it is important in academic and professional fields. **CO2.** Learn the difference between qualitative and quantitative research methods and when to apply them. **CO3.** Be able to identify research topics, review related literature, and frame effective research questions and hypotheses. **CO4.** Understand various research designs and how to choose appropriate methods for different types of studies. **CO5.** Acquire the skills to prepare a structured and ethical research proposal, ready for academic or practical use.	
9	**Modules:**	
	Module 1: Foundations of Research (15 Hrs) 1. Definition and Purpose of Research 2. Types of Research (Qualitative vs Quantitative; Basic vs Applied) 3. The Research Process (From idea to publication) 4. Sources of Research Problems 5. Research Ethics and Integrity	

	Module 2: Research Design (15 Hrs) 1. Types of Research Designs (Experimental, Exploratory, Descriptive) 2. Formulation of Hypothesis 3. Sampling Methods and Techniques 4. Preparing a Research Proposal (Topic, Objectives, Research Questions) 5. Data Collection Techniques and Tools	
10	**References** • Booth, W. C. Colomb, G. G. and Williams, J. M. (2016). *The Craft of Research.* • 4th edition, University of Chicago Press. • Bryman, Alan. (2018). *Social Research Methods*, London: OUP. • Creswell, J.W.(2014). *Research Methods: A Practical Guide*. 9th Edition, Pearson • Creswell, J.W.(2014). *Research Methods: A Practical Guide*. 9th Edition, Pearson. • Creswell, J.W. and Creswell, D. J. (2017). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* , 5th edition, SAGE Publications. • Creswell, J.W. and Creswell, D. J. (2017). *Research Design*, New Delhi: SAGE Publications. • Ghosh, B.N. (1984). *Scientific Method and Social Research*, New Delhi: Sterling. • Goode, W. J. and Hatt, P. K. (1952). *Methods in Social Research*, New York: Mc Graw-Hill Book Co.	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:** **Internal Evaluation:** 20 Marks • Classroom Presentations/ Assignments :10 Marks • Essay Submission/ Book review/ • Field Visit Report /Educational Activity Report 10Marks	**Semester End Examination : 30 Marks**
14	**Format of Question Paper:** for the final examination Time: 1hour Marks: 30 **Q.1 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.2 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.3 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)**	

Vertical – IV

Vocational Skill Course (VSC)

Vocational & Skill Enhancement Courses (VSEC)

Name of the Course: Web Designing

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Web Designing Course is an immersive exploration into the core technologies that drive the visual and interactive aspects of the web. Covering HTML, CSS, Javascript, XML, and PHP, this course equips individuals with the skills needed to create dynamic and aesthetically pleasing websites. **Relevance:** In the digital age, web design is paramount. The course remains highly relevant as it introduces participants to the fundamental languages and technologies that form the backbone of modern web development. **Usefulness:** The course is invaluable for anyone interested in creating responsive, user-friendly, and visually appealing websites. Participants gain practical skills in structuring web content, styling layouts, and implementing interactive features. **Application:** The concepts learned in this course find direct application in real-world web development projects. Participants design and build websites, applying HTML for structure, CSS for styling, Javascript for interactivity, XML for data representation, and PHP for server-side scripting. **Interest:** The creative and hands-on nature of web design often captivates students. Through practical exercises, participants engage in designing and developing websites, fostering a deep interest in creating visually engaging online experiences. **Connection with Other Courses:** This course establishes strong connections with various other courses in the field of web development and computer science. It provides a foundation for advanced studies in full-stack development, database management, and server-side scripting. **Demand in the Industry:** Professionals with strong web designing skills are in high demand. Industries spanning e-commerce, technology, and media actively seek individuals who can create user- friendly and visually appealing websites to enhance online presence and user engagement. **Job Prospects:** Graduates from a Web Designing Course find diverse job prospects. Roles may include web designer, front-end developer, UI/UX designer, and web content manager. These professionals are sought after for their ability to create visually stunning and functional web interfaces.
2	**Vertical:**	VSC
3	**Type:**	Practical
4	**Credits:**	2 credits (1 credit = 15 Hours of Practical work in a semester)

5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To understand the concept of Web Technologies 2. To understand the concepts of Hyper Text Markup Language and Cascading Style Sheets. 3. To learn JavaScript for creating dynamic websites. 4. To learn various operations performed on data among web applications using XML 5. To learn Server-Side Programming using PHP	
8	**Course Outcomes:** CO1. Design valid, well-formed, scalable, and meaningful pages using emerging technologies. CO2. Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites CO3. Develop and implement client-side and server-side scripting language programs. CO4. Develop and implement Database Driven Websites. CO5. Design and apply XML to create a markup language for data and document centric applications.	
9	**Modules:-** **Module 1 (15 hours):**	
	Module I: **Concepts**: Internet and the World Wide Web: What is Internet? Applications of Internet, internet related concepts. HTML 5: Getting started with HTML, Doctypes, Headings, Paragraphs, Text Formatting, Anchors and Hyperlinks, Lists, Tables, Comments, Classes and IDs, Linking Resources, Images, Image Maps. HTML OTHER ELEMENTS: Input Control Elements, Forms, Div Element, Sectioning Elements, Navigation Bars, Label Element, Output Element, Void Elements, Media Elements, Progress Element, Selection Menu Controls, Embed, IFrames, SVG, Canvas, Tabindex. CSS: Implementing Styles using CSS – Stylesheets, Formatting Text and Links using CSS, CSS Selectors, Changing Background, Adding Border, Margin and Padding, Setting Dimensions, Using Inline Container to mark up a part of a text. ***Programs to be completed during lab sessions :*** **1. Create a Personal Web Page** Design a personal webpage with your name, photograph, short bio, and links to your social media profiles. Use appropriate headings, paragraphs, text formatting, hyperlinks, and images. **2. Design a Student Registration Form** Create a form using various input controls (text, email, password, radio buttons, checkboxes, dropdown, etc.). Organize the form using `<fieldset>`, `<legend>`, `<div>`, and `<section>`. Include labels and use the `required` attribute. **3. Build a Responsive Navigation Bar with Embedded Media** Design a webpage with a horizontal navigation bar using `<nav>`. Embed a YouTube video using `<iframe>`, include an audio clip using `<audio>`, and add a Google Map using `<embed>`. **4. Apply CSS Styling to a Multi-Section Webpage** Create a webpage with at least three sections and apply an external CSS file to: • Change fonts and text color • Set background images/colors • Add padding, margins, and borders	

- Style links and headings

5. Create a Canvas and SVG Drawing

Use the `<canvas>` element and JavaScript to draw a rectangle, circle, and line. Additionally, use an inline `<svg>` to draw a star or a basic geometric shape.

Mini-Assignment:

Title: *"Designing a Multi-page Portfolio Website using HTML5 and CSS"*

Assignment Description:

Design a personal portfolio website with **minimum 3 interlinked pages** using HTML5 and CSS. The pages should include:

- **Home Page** – with your photo, introduction, and navigation bar
- **Projects Page** – showcasing 2–3 projects using tables and images
- **Contact Page** – a form for visitors to contact you (with input fields, radio buttons, dropdown, etc.)

Requirements:

- Use of `<header>`, `<footer>`, `<section>`, `<article>`, `<nav>`, `<div>`, and `<aside>`
- Apply **external CSS** to style text, layout, background, margins, and borders
- Include **at least one embedded video or audio file**

Use **responsive images and hyperlinks**

Module 2 (15 hours):

Module II:

Concepts: Java Script Events and Event Handlers: HTML Events, DOM Events, DOM Event Listener, onAbort, onBlur, onChange, onClick, onDblClick, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onReset, onResize, onSelect, onSubmit, onUnload, Form Validation Example. jQuery: Introduction, Syntax, Selectors, Events, Effects, Hide/Show, Fade, Slide, Animate, stop(), Callback, Chaining, HTML, Get, Set, Add, Remove, CSS Classes, css( ), Dimensions. JSON: Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange, JSONHTM, JSONP.

Programs to be completed during lab sessions :

1. Validate a Form Using JavaScript Events

Create a form with fields like name, email, and age. Write JavaScript code to:

- Ensure no field is left blank
- Display an alert if validation fails
- Use `onBlur`, `onFocus`, and `onSubmit` events

2. Handle Mouse and Keyboard Events on a Webpage

Create a webpage where:

- Clicking a button changes a paragraph's text (`onClick`)
- Hovering over an image changes it (`onMouseOver`, `onMouseOut`)
- Pressing a key updates a display box (`onKeyDown`, `onKeyUp`)

3. Create a jQuery-based Image Gallery

Build a webpage that shows images with buttons to:

- Hide/show them using `hide()` and `show()`
- Fade images in/out using `fadeIn()` and `fadeOut()`

	• Slide images up/down using `slideUp()` and `slideDown()` • Use chaining for combined effects **4. Create and Manipulate HTML Elements using jQuery** Create a dynamic to-do list where users can: • Add new tasks • Mark tasks as completed • Remove tasks Use jQuery methods like `append()`, `remove()`, `addClass()`, `css()` **5. Load and Display Data from a JSON File** Create a webpage that loads student data (name, course, contact) from a JSON file and displays it in a table. Use JavaScript or jQuery to parse the JSON and dynamically populate the table. **Mini-Assignment**: **Title:** *"Create a Dynamic Quiz Application using JavaScript, jQuery, and JSON"* **Assignment Description:** Develop a simple **MCQ quiz application** that: • Loads a set of questions and options from a JSON file • Allows users to select answers one by one • Displays score at the end with basic feedback (e.g., "Well done!", "Try again!") • Uses **jQuery** to dynamically show/hide questions and apply basic animations (fade/slide)	
10	**Text Books** 1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press, 2016 2. Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India, 2018 PHP: A Beginners Guide, Vikram Vaswani, TMH	
11	**Reference Books** 1. HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY, 2011 2. Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'Reilly, 2018 3. PHP, MySQL, JavaScript & HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley, 2018	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Name of the Course: Advanced Python Programming

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Advanced Python Programming Course is designed to elevate coding skills to a more sophisticated level, offering participants a deeper understanding of Python's advanced features and capabilities. Building upon the foundations laid in basic Python courses, this advanced course delves into complex programming concepts and techniques. **Relevance:** As technology advances, the relevance of Python continues to grow. The Advanced Python Programming Course is a response to the increasing demand for skilled Python developers who can tackle intricate challenges in various domains, including software development, data science, artificial intelligence, and more. **Usefulness:** This course goes beyond basic syntax and introduces participants to advanced Python topics such as decorators, generators, metaclasses, and asynchronous programming. Learners gain valuable insights into optimizing code performance, enhancing code readability, and solving complex problems efficiently. **Application:** Graduates of this course can apply their advanced Python skills to tackle more complex programming tasks, develop scalable applications, and contribute to large-scale software projects. The course's emphasis on practical applications ensures that participants are well- equipped for real-world programming challenges. **Interest:** The course maintains an engaging learning experience, balancing theoretical concepts with hands-on projects that challenge participants to apply their knowledge creatively. This approach fosters a continued interest in Python programming and encourages learners to explore advanced topics with enthusiasm. **Connection with Other Courses:** The knowledge gained in the Advanced Python Programming Course establishes a strong foundation for further specialization in advanced Python libraries, frameworks, and application domains. This course acts as a bridge to more specialized fields such as machine learning, web development, and data engineering. **Demand in the Industry:** Professionals with advanced Python skills are highly sought after in the industry. The ability to leverage Python's advanced features for efficient problem- solving, code optimization, and system architecture places graduates of this course in high demand across diverse sectors. **Job Prospects:**

		Completing the Advanced Python Programming Course opens doors to advanced positions in software development, data engineering, scientific computing, and research. Job prospects include roles such as Python developer, data scientist, machine learning engineer, and backend developer, among others.
2	**Vertical:**	SEC
3	**Type:**	Practical
4	**Credits:**	2 credits (1 credit = 15 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. Master OOPs principles, solving real-world problems. 2. Create robust Python classes, transfer members efficiently. 3. Understand and implement inheritance, utilize advanced polymorphism.. 4. Implement abstract classes, leverage interfaces for flexible code. 5. Create and synchronize threads, mitigate deadlock issues.	
8	**Course Outcomes:** CO1. Demonstrate comprehensive OOPs proficiency, apply principles effectively. CO2. Develop efficient, reusable classes, successfully transfer members. CO3. Ability to implement inheritance and apply advanced polymorphism. CO4. Ability to implement abstract classes, demonstrate flexibility through interfaces. CO5. Ability to thread creation, synchronization, and effective deadlock resolution.	
9	**Modules:-** **Module 1 (15 hours):**	
	Object-Oriented Programming in Python: Introduction to OOPs and key features (encapsulation, inheritance, polymorphism). Classes and Objects: Creating classes, _init_ (constructor), self-variable, and instance vs class variables. Methods: Instance methods, class methods, static methods. Passing members of one class to another. Inheritance and Polymorphism Types of Inheritance, Method Overriding, and super() method. Operator Overloading and Duck Typing. Abstract Classes Abstract classes and methods using abc module. Multithreading in Python: Creating threads, multitasking, and basic thread synchronization. ***<u>Programs to be completed during lab sessions :</u>*** Practical 1: Classes and Objects • Create a class Student with attributes name, roll_no, and marks. Write methods to display details. • Demonstrate the use of the __init__() constructor and self-variable with an example. Practical 2: Types of Methods and Variables • Create a class to show the use of instance, class, and static methods. • Write a program to demonstrate instance and class variables and how they are accessed	

and modified.

Practical 3: Inheritance and Method Overriding

- Implement single and multilevel inheritance using classes like Person, Employee, and Manager.
- Override a method in the child class and use the super() method to call the parent class version.

Practical 4: Polymorphism and Operator Overloading

- Demonstrate polymorphism using a function that behaves differently based on the object type.
- Create a class Complex Number and implement operator overloading for + and *.

Practical 5: Abstract Classes and Threads

- Create an abstract class Shape with an abstract method area() and implement it in Circle and Rectangle.
- Write a program to create two threads performing two different tasks using the threading module.

Mini Assignment

- Create a Python application that:
- Defines a class Account with deposit and withdrawal methods.
- Uses inheritance to create SavingsAccount and CurrentAccount with overridden behavior.
- Implements operator overloading to add balances of two accounts.
- Includes a thread to simulate concurrent balance checking and transaction logging.

Module 2 (15 hours):

Working with Databases

Introduction to DBMS

Performing CRUD operations (Create, Read, Update, Delete) on MySQL tables using Python

Exception Handling

Types of errors, exception handling in Python

User-defined exceptions and logging

Networking

Basics of TCP/IP and UDP

FTP operations, basic web page interaction, sending email using Python

Graphical User Interface (GUI)

Creating GUIs using Python

Widgets, layout managers, and event handling

Data Science Tools

Introduction to NumPy, pandas, Matplotlib, and SciPy

Programs to be completed during lab sessions :

	Practical 6: Database Operations with Python 1. Connect to a MySQL database and perform Insert, Update, and Delete operations on a table. **2.** Create a new database and table using Python, then retrieve and display records. **Practical 7: Exception Handling** 1. Write a program to handle built-in exceptions using try, except, else, and finally. **2.** Create a user-defined exception and use the logging module to log the error details. **Practical 8: Networking in Python** 1. Write a Python script to send a simple email using SMTP. 2. Demonstrate basic TCP socket programming by creating a client-server chat system. **Practical 9: GUI Programming with Tkinter** 1. Create a basic GUI with labels, entry widgets, and buttons using Tkinter. 2. Design a simple login form with event handling and basic validation. **Practical 10: Data Science Tools** 1. Use NumPy to create arrays and perform mathematical operations (mean, square, reshape). 2. Use pandas to load a CSV file and perform operations like filtering, grouping, and sorting. **Mini Assignment** **Design a mini project that:** ● Connects to a MySQL database to store user records. ● Includes a Tkinter GUI to add and display records. ● Uses exception handling for input validation and error logging. Includes a plot using Matplotlib to display data from the database (e.g., user scores or ages).	
10	**Reference Books** 5. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018 6. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017 7. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
13	Format of Question Paper: (Semester End Practical Examination: 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Vertical – V

Ability Enhancement Courses(AEC)

Name of the Course: Communication Skills in English II – NUEN201

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course develops essential communication skills for professional and digital environments. It covers vocabulary, business writing, effective communication techniques, public speaking, and presentation skills. Learners also gain digital communication abilities, including virtual meeting etiquette, content creation for blogs and social media, SEO writing, and cross-cultural awareness for global interactions.
2	**Vertical :**	**AEC**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: 1. To equip the learners with confidence and proficiency in spoken and written English in and professional and social context 2. To enhance confidence in public speaking, interpersonal exchanges and professional interactions 3. To enable the learners to adapt to diverse audiences, cultural frameworks and workplace setups 4. To equip them with deftness in use of different digital platforms to communicate efficiently in every situation	
8	**Course Outcomes:** After completion of the course, learners would be able to: CO1. Acquire proficiency in English for media-specific platforms and forums CO2. Speak and write effectively for diverse media platforms CO3. Enhance critical abilities to present effective social media content CO4. Understand the roles and functions of English in global media framework CO5. To attain proficiency in understanding media trends at a global level	
9	**Modules**:-	
	Module 1: **1.1 Professional English Language Development** • Vocabulary Building • Punctuation and Style • Close Reading of Content for Different Genre • Phrasal Verbs and Idioms • Business English for Letters, Emails, Reports • Paraphrasing **1.2: Essentials for Effective Communication** • The Seven C's of Effective Communication • The 4 C's of 21st Century Skills • 'You' Attitude and Professional Etiquette • Conflict Management **1.3 Public Speaking and Presentation Skills** • Organizing a speech • Presentation skills with visual aids like PowerPoint	

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Overcoming stage fright
Use of visual aids and storytelling

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Module 2 :
1.1: Digital Communication Skills

Communicating in online platforms
Managing digital identity
Virtual meetings etiquette (Zoom, Teams)
Understanding Video scripts and Podcast Scripts
Social Media Marketing

1.2: Digital Writing and Content Creation

Writing Blogs, Articles, and Online Features
SEO Writing and Keyword Optimization
Writing for Social Media
Writing Captions, White Paperand Headlines

1.3 Cross-cultural Communication

Cultural Quotient and Cultural Intelligence
Cultural differences in communication styles
Global communication etiquette
Dining Etiquette in Professional and Social Setup

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<tr><td>10</td><td>
References:

Effective Communication Skills” – by M.S. Rao
Mass Communication in India (4th Edition): Keval J. Kumar
Taylor, Grant. English Conversation Practice. 1967. Tata McGraw-Hill, 2013
Labade, Sachin, Katre Deepaetal. Communication Skills in English. Orient Black swan, Pvt Ltd, 2021
Sethi, J. Standard English and Indian usage: Vocabulary and grammar. PHI Learning Pvt. Ltd., 2011
The Secret of Viral Content Creation- Priyanka Agarwal
Mohan, R C Sharma Krishna. Business Correspondence and Report Writing. Third edition. Tata McGraw-Hill Education, 2002
Writing Skills For Technical Purposes: Raj Mohan Josh
Cross-Cultural Communication: Concepts, Cases and Challenges: Francisca O. Norales
Fundamentals of Writing: How to Write Articles, Media Releases, Case Studies, Blog Posts and Social Media Content: Paul Lima
Excuse Me: The Survival Guide to Modern Business Etiquette: Rosanne Thomas
Business Etiquette: A Guide For The Indian Professional: Shital Kakkar Mehra

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<tr><td>11</td><td>
Internal Evaluation: 20 Marks
10 marks Assignment,
05 marks Viva,
05 marks Class Participation and Attendance
</td></tr>
<tr><td>12</td><td>
External Evaluation : 30 Marks
Semester End Examination
<u>Question Paper Pattern</u>
<table>
<tr><th>Question No.</th><th>Questions</th><th>Marks</th></tr>
<tr><td>Q 1</td><td>Writing Skills/ Comprehension</td><td>15 marks</td></tr>
<tr><td>Q 2</td><td>Practical/ Theory</td><td>15 marks</td></tr>
</table>
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Vertical – V

Value Education Course(VEC)

Name of the Course: Digital Tools for Sustainability

Sr. No.	Heading	Particulars
1	**Description the course:**	Digital Tools for Sustainability focuses on the application of modern digital technologies to support sustainable development and environmental conservation. This course introduces students to the use of Information and Communication Technologies (ICT), Internet of Things (IoT), Artificial Intelligence (AI), Big Data, Cloud Computing, and Blockchain in solving sustainability challenges. It explores digital solutions for smart cities, resource management, environmental monitoring, energy optimization, and sustainable governance. The course aims to develop awareness of innovative digital practices that promote efficient resource utilization, environmental responsibility, and a sustainable future.
2	**Vertical:**	VEC
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To understand the role of digital tools in promoting sustainability and addressing global environmental challenges. 2. To familiarize students with applications of ICT, IoT, AI, and data-driven decision-making in sustainable development. 3. To introduce students to digital platforms for waste, energy, and water management. 4. To develop awareness of how technology supports UN Sustainable Development Goals (SDGs).	
8	**Course Outcomes:** CO1: Explain the role of digital tools in advancing sustainable practices. CO2: Use knowledge of ICT, IoT, and AI applications for environmental monitoring and management. CO3: Analyze how data, digital platforms, and blockchain contribute to sustainability. CO4: Demonstrate awareness of real-world digital solutions supporting SDGs and smart city initiatives.	
9	**Modules** **Module 1: Foundations of Digital Sustainability (15 Hours)**	
	1. Introduction to ICT for Sustainability: Role of information and communication technologies in energy conservation and environment protection. 2. IoT and Smart Systems: IoT for smart homes, agriculture, water management, and pollution monitoring. 3. Data-Driven Sustainability: Role of big data and analytics in predicting and managing environmental trends.	

<table>
<tr><td></td><td>4. AI for Sustainability: AI in climate modeling, energy optimization, and biodiversity tracking.</td></tr>
<tr><td></td><td>Module 2: Applications of Digital Tools in Sustainability (15 Hours)</td></tr>
<tr><td></td><td>1. Digital Platforms for Sustainability: Smart city apps, digital dashboards, and e-governance for resource management.
2. Blockchain for Transparency: Blockchain in supply chain sustainability, carbon trading, and waste tracking.
3. Cloud Computing & Collaboration Tools: Reducing physical infrastructure, digital workspaces, and remote collaboration for carbon reduction.
4. Future Trends: Role of digital twins, virtual simulations, and gamification for sustainable awareness.</td></tr>
<tr><td>10</td><td>Text Books
1. Hilty, L. M., & Aebischer, B. (2015). ICT Innovations for Sustainability. Springer.
2. Gupta, M. P. (2018). Digital Transformation: Powering the Great Reset. McGraw Hill.</td></tr>
<tr><td>11</td><td>Reference Books
1. Suryawanshi, V. (2020). ICT for Sustainable Development. CRC Press.
2. Gupta, M. P., & Sharma, A. (2019). Digital India: Technology to Transform a Nation. McGraw Hill.</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:
Class test of 15 marks

Quizzes/ Presentations/ Assignments: 5 marks
Total: 20 marks</td><td>Format of Question Paper: External Examination (30 Marks)– 1 hr duration</td></tr>
<tr><td>14</td><td colspan="2">Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)
<table>
<tr><th>Questions</th><th>Based On</th><th>Options</th><th>Marks</th></tr>
<tr><td>Q.1</td><td>Module 1</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.2</td><td>Module 2</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.3</td><td>Module 1 & 2</td><td>Any 2 out of 4</td><td>10</td></tr>
</table></td></tr>
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Vertical – VI

Name of the Course: Fitness and Sports II – NUCC203

Sr. No.	Heading	Particulars
1	**Description the course :**	India is growing rapidly as a global super-power. To face the challenges of the century and to keep up with the pace of the world, maintaining health is of prime importance. Giving thrust to healthy society, Physical Education, Sports, Health & fitness and Yoga are of great significance in today's world. The Government of India insists on Physical Fitness, Mental Health and Overall Development of Personality for every citizen. However, creating efficient and skilled human resource in the field of Physical Education, Sports and Yoga is identified as the need of the hour. Thus, the Governments of India and Government of Maharashtra have included Physical Education, Sports and Yoga as a key area under the NEP 2020.
2	**Vertical :**	Co-Curricular
3	**Type :**	Activity Based
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: • **To develop foundational knowledge of physical fitness techniques** including strength, cardiovascular, and flexibility training, along with understanding basic nutrition for sports performance. • **To enhance students' mental preparedness and focus** by introducing key concepts of sports psychology such as goal setting, motivation, confidence, and stress management. • **To promote a holistic approach to health and performance**, integrating physical	
8	**Course Outcomes**: CO1. **Apply appropriate physical training methods** including strength, cardiovascular, and flexibility routines to enhance overall fitness and performance. CO2. **Demonstrate understanding of basic sports nutrition** and its role in supporting physical activity and athletic goals. CO3. **Utilize principles of sports psychology** such as goal setting, stress management, and motivation to improve mental focus and performance in sports.	
9	**Module :** This module covers key aspects of physical training, including strength training through bodyweight and resistance methods, and cardiovascular workouts like HIIT and circuit training. It introduces flexibility and mobility routines essential for injury prevention and performance. Basic nutrition for fitness and sports is also discussed. The module then explores sports psychology, focusing on mental preparation and goal setting. It addresses techniques to manage performance anxiety and stress. Finally, it highlights the role of concentration, confidence, and motivation in achieving success in sports.	
10	**Reference Books:** 1. Singh, Hardayal. (1991). Science of Sports Training. New Delhi: DVS Publications. 2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.	

	3. Iyengar, B.K.S. (2001). Light on Yoga. London: Thorsons. 4. Tiwari, O.P. (1996). Asana: Why and How? Lonavla: Kaivalyadhama Yoga Institute. 5. Nagendra, H. R. & Nagarathna, R. (2002). Samagra Yoga Chikitse. Bengaluru: Swami	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
11	**Internal Continuous Assessment: 40% (20 Marks)** • Assignment/Report Writing	
12	**External Assessment: 60% : (30 Marks)** • Submission of **minimum 3 certificates** from approved fitness/sports activities (yoga, aerobics, team sports, etc.). • Attendance and involvement in fitness sessions, group games, or workshops. *Note: Students participating in sports competitions conducted by University at State or National Level, students who have represented Mumbai University or College at Intercollegiate / Inter Zonal / West Zone Inter University / All India Inter University/ International tournament are exempt from submission of report.*	

Letter Grades and Grade Points:

Semester GPA/ Program CGPA Semester/ Program	% of Marks	Alpha-Sign / Letter Grade Result		Grade Points
9.00-10.00	90.0-100	O	(Outstanding)	10
8.00-<9.00	80.0-<90.0	A+	(Excellent)	9
7.00-<8.00	70.0-<80.0	A	(Very Good)	8
6.00-<7.00	60.0-<70.0	B+	(Good)	7
5.50-<6.00	55.0-<60.0	B	(Above Average)	6
5.00-<5.50	50.0-<55.0	C	(Average)	5
4.00-<5.00	40.0-<50.0	P	(Pass)	4
Below 4.00	Below 40	F	(Fail)	0
Ab (Absent)	-	AB	(Absent)	0

Signature of BOS Chairman
Dr. Bhakti Chaudhari
BOS (Computer Science)

Signature of Faculty Member
Ms. Jeenal jain
(Computer Science)

Signature of I/C Principal
Dr. Swiddle D'Cunha