TECHNO INDIA UNIVERSITY

WEST BENGAL

Department of Computer Applications

BACHELOR OF COMPUTER APPLICATIONS (BCA)

(4 YEARS)

TECHNO INDIA UNIVERSITY
WEST BENGAL

1st Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-CC-UMA-T11101	Basic Mathematics I	3	0	0	3
TIU-SEC-UCA-T11101	Problem Solving Techniques using C	3	0	0	3
TIU-CC-UCA-T11101	Computer fundamentals &Digital Electronics	2	0	0	2
TIU-AEC-UEN-S11102	General English-1	1	1	0	2
TIU-MDE-ULL-T11101	Indian Constitution	3	0	0	3
TIU-VAC-UOG-T11101	Environmental Science and Sustainability	2	0	0	2
Practical					
TIU-SEC-UCA-L11101	Problem Solving Techniques using C Lab	0	0	3	1.5
TIU-CC-UCA-L11103	PC Tools and their Applications	0	0	2	1
TIU-CC-UCA-L11101	Computer fundamentals & Digital Electronics Lab	0	0	3	1.5
Sessional					
TIU-AEC-UEN-S11101x	Hindi/Bengali/French (Language Other than Mother Tongue) [Optional Course]	2	0	0	0
Education					
TIU-SEC-UCA-S11101	Entrepreneurship Skill Development - I	0	0	0	2
Total Credits					**21**

TECHNO INDIA UNIVERSITY

WEST BENGAL

2nd Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-CC-UMA-T12101	Basic Mathematics II	3	0	0	3
TIU-CC-UCA-T12101	Data Structures Through C	3	0	0	3
TIU-CC-UCA-T12102	Computer Organization & Architecture	3	0	0	3
TIU-CC-UCA-T12103	Operating Systems	3	0	0	3
TIU-SEC-UCA-T12101	OOP Using Java	3	0	0	3
TIU-VAC-UED-T12101	Indian Knowledge System	2	0	0	2
Practical					
TIU-CC-UCA-L12101	Data Structures Through C LAB	0	0	3	1.5
TIU-CC-UCA-L12103	Operating Systems LAB	0	0	3	1.5
TIU-SEC-UCA-L12101	OOP Using Java LAB	0	0	3	1.5
TIU-SEC-UCA-L12102	Web Technology Lab	0	0	3	1.5
Education					
TIU-SEC-UES-S12101	Entrepreneurship Skill Development	0	0	0	1
Total Credits					**24**

TECHNO INDIA UNIVERSITY

WEST BENGAL

3rd Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UEN-AEC-S2101	Career Advancement and Skill Development (French/German Language)	2	0	0	2
TIU-UCA-MJ-T21201	Operating Systems	3	1	0	3
TIU-UMA-MD-T2101	Discrete Structures	2	1	0	3
TIU-UCA-MJ-T21202	Object Oriented Programming with Java	2	1	0	3
TIU-UCA-MJ-T21203	Web Technologies	2	1	0	2
Practical					
TIU-UCA-MJ-L21202	Object Oriented Programming with Java Lab	0	0	3	2
TIU-UCA-MJ-L21201	Operating Systems Lab	0	0	3	2
TIU-UCA-MJ-L21203	Web Design Lab	0	0	3	2
Sessional					
TIU-UES-SEC-S2101	Entrepreneurship Skill Development	0	0	4	2
Total Credits					21

TECHNO INDIA UNIVERSITY

WEST BENGAL

4th Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UEN-AEC-S2201	Career Advancement and Skill Development (French/German Language Contd.)	2	0	0	2
TIU-UCA-MJ-T22201	Python Programming Techniques	2	1	0	3
TIU-UCA-MJ-T22202	Data Communication and Computer Networking	3	1	0	4
TIU-UCA-MJ-T22203	Fundamentals of Database Management Systems	2	1	0	3
TIU-UMA-MD-T2201	Computer Oriented Numerical Methods	2	1	0	3
Practical					
TIU-UCA-MJ-L22201	Python Programming Techniques Lab	0	0	3	2
TIU-UCA-MJ-L22202	Database Lab	0	0	3	2
TIU-UMA-MD-L2201	Numerical & Statistical Methods Lab	0	0	3	1
Sessional					
TIU-UES-SEC-S2201	Entrepreneurship Skill Development	0	0	4	2
Total Credits					22

TECHNO INDIA UNIVERSITY

WEST BENGAL

5th Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UTR-S301	Career Advancement and Skill Development – (SAP-ABAP and PHP-MySQL)	2	0	1	3
TIU-UCA-T319	Environment and Ecology	2	0	0	2
TIU-UCA-T317	SSAD &Software Engineering	2	1	0	3
TIU-UCA-T321	TOOLS AND TECHNIQUES OF PROGRAMMING USING R	2	1	0	3
TIU-UCA-T313	Web Technologies	2	1	0	3
TIU-UCA-E307	Computer Graphics and Multimedia (Elective I)	3	1	0	4
TIU-UCA-E309	Compiler Design (Elective I)				
Practical					
TIU-UCA-L321	R Programming Lab	0	0	3	2
TIU-UCA-L313	Web Design Lab	0	0	3	2
Sessional					
TIU-UES-S399	Entrepreneurship Skill Development	0	0	4	2
TIU-UES-P399	Minor Project	0	0	3	2
Total Credits					26

TECHNO INDIA UNIVERSITY

WEST BENGAL

6th Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UCA-S300	Career advancement and Skill Development	2	0	1	3
TIU-UMG-T314	Professional Ethics & Human Values	2	1	0	3
TIU-UCA-T306	Data Science Through R	3	1	0	4
TIU-UCA-E304	Advanced Web Design (Elective II)	3	1	0	4
TIU-UCA-E306	Cloud Computing (Elective II)				
TIU-UCA-E308	Distributed Design(Elective II)				
TIU-UCA-E310	Software Project Management (Elective III)	3	1	0	4
TIU-UCA-E312	Management Fundamentals & information Systems (Elective III)				
Practical					
TIU-UCA-L316	Data Science Through R Lab	0	0	3	3
Sessional					
TIU-UES-S398	Entrepreneurship Skill Development	0	0	3	2
TIU-UCA-P396	Final Project	0	0	8	10
Total Credits					33

TECHNO INDIA UNIVERSITY

WEST BENGAL

7th Semester

BACHELOR OF COMPUTER APPLICATION (BCA) Degree will be awarded , if a student wishes to exit at the end of third year. Minimum eligibility criteria for opting the course in the fourth year will be as follows:

1. BCA (Honours with Research): BCA Degree
2. BCA (Honours): BCA Degree

7th Semester BCA (Honours) Specialization-AI & ML

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-MDE-UCA-T41101	**Social Network Analysis**	2	1	0	3
TIU-MDE-UCA-L41101	**Social Network Analysis LAB**	0	0	3	1.5
TIU-CC-UCA-T41101	**Optimization of ML**	3	0	0	3
TIU-CC-UCA-L41101	**Optimization of ML LAB**	0	0	3	1.5
TIU-DSE-UCA-E41101A	**Professional Elective-VIII(Speech Recognition through R/ Evolutionary Algorithm through R)**	3	0	0	3
TIU-DSE-UCA-L41101A	**Professional Elective-VIII(Speech Recognition through R/ Evolutionary Algorithm through R)** LAB	0	0	3	1.5
TIU-DSE-UCA-E41102A	**Professional Elective-IX(Augmented Reality & Virtual Reality through Python/ Security aspects of ML through Python)**	2	1	0	3
TIU-DSE-UCA-L41102A	**Professional Elective-IX(Augmented Reality & Virtual Reality through Python/ Security aspects of ML through Python)** LAB	0	0	3	1.5
TIU-SEC-UES-S41101	**ESD**	0	0	3	1.5
TIU-AEC-UCA-S41101	**CASD(Project on Data Science)**	0	0	3	1.5
	Dissertation Work[Evaluation in Semester eight]	-	-	-	-
TIU-SEC-UCA-S41101	**Summer Internship II**	0	0	8	4
Total Credits					**25**

TECHNO INDIA UNIVERSITY

WEST BENGAL

7th Semester BCA (Honours) Specialization-Data Science

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-MDE-UCA-T41101	**Social Network Analysis**	2	1	0	3
TIU-MDE-UCA-L41101	**Social Network Analysis LAB**	0	0	3	1.5
TIU-CC-UCA-T41101	**Optimization of ML**	3	0	0	3
TIU-CC-UCA-L41101	**Optimization of ML LAB**	0	0	3	1.5
TIU-DSE-UCA-E41101A	**Professional Elective-VIII(Speech Recognition through R/ Evolutionary Algorithm through R)**	3	0	0	3
TIU-DSE-UCA-L41101A	**Professional Elective-VIII(Speech Recognition through R/ Evolutionary Algorithm through R)**LAB	0	0	3	1.5
TIU-DSE-UCA-E41102B	**Professional Elective-IX(Business Intelligence & Analytics through Python/ Explainable AI through Python)**	3	0	0	3
TIU-DSE-UCA-L41102B	**Professional Elective-IX(Business Intelligence & Analytics through Python/ Explainable AI throughPython)** LAB	0	0	3	1.5
	Dissertation Work[Evaluation in Semester eight]	3	0	0	3
TIU-SEC-UCA-S41101	**Summer Internship II**	0	0	8	4
Total Credits					**25**

TECHNO INDIA UNIVERSITY

WEST BENGAL

7th Semester BCA (Honours with Research)

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-CC-UCA-T41102	**Advanced Data Analysis Tools**	0	2	0	2
TIU-CC-UCA-L41102	**Advanced Data Analysis Tools LAB**	**0**	0	3	1.5
TIU-CC-UCA-T41103	**Research Methodology**	2	2	0	4
TIU-CC-UCA-I41101	**Research Internship Report and Viva Voce**	0	0	20	10
TIU-DSE-UCA-E41102C	**Professional Elective-VIII (Cloud Computing for Data Analytics /Block Chain Technology)**	2	1	0	3
TIU-DSE-UCA-E41103A	**Professional Elective-IX (Data Mining & Warehousing through R/ Machine Learning Algorithms and their applications)**	2	1	0	3
TIU-DSE-UCA-L41103A	**Professional Elective-IX-LAB (Data Mining & Warehousing through R LAB/ Machine Learning Algorithms and their applications LAB)**	0	0	3	1.5
Total Credits					**25**

TECHNO INDIA UNIVERSITY
WEST BENGAL

8th Semester

8th Semester BCA (Honours)

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-DSE-UCA-E42101A	Professional Elective-X (Cyber Security and Ethical Hacking /Software Project Management)	0	2	4	4
TIU-DSE-UCA-E42102A	Professional Elective-XI(Advanced Java/Dot NET)	2	2	0	4
TIU-DSE-UCA-E42103A	Professional Elective-XII(App Development using R/App Development using Python)	0	0	8	4
TIU-SEC-UCA-D42101	Dissertation Work	0	0	16	8
Total Credits					20

8th Semester (BCA Honours with Research)

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
TIU-SEC-UCA-D42102	Dissertation [For Research Track]	|	| 20		
Total Credits					20

TECHNO INDIA UNIVERSITY

WEST BENGAL

Department of Computer Applications

Detailed Syllabus of 4 Years BCA Program

1st Semester

Basic Mathematics I

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: Basic Mathematics I	**Subject Code:** TIU-CC-UMA-T11101
Contact Hours/Week: **L-T-P: 3-0-0**	**Credit:** 3

COURSE OBJECTIVES

The aim of this course is to

- Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
- This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.
- This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.

COURSE OUTCOMES

CO	Module Name	Course Outcome Description	Knowledge Level
CO-1	Set, Relation, and Function	Understand set operations, relations, and functions, including their properties and applications.	K2
CO-2	Set, Relation, and Function	Apply the concepts of functions, including domain, range, and types, in solving computational problems.	K3
CO-3	Counting and Recurrence Relation	Apply counting principles, permutations, combinations, and binomial coefficients to solve combinatorial problems.	K3
CO-4	Counting and Recurrence Relation	Analyze and solve recurrence relations using characteristic equation methods in real-world problems.	K4
CO-5	Elementary Graph Theory	Identify different types of graphs and trees, understand their properties, and apply them in computing.	K3
CO-6	Matrix Algebra	Evaluate and apply matrix operations, eigenvalues, eigenvectors, and the Cayley-Hamilton theorem in solving linear equations.	K4

Books:

1. Set, Relation, and Function
   - "Discrete Mathematics and Its Applications" – Kenneth H. Rosen
   - "Discrete Mathematical Structures" – Bernard Kolman, Robert Busby, and Sharon Ross
   - "Discrete Mathematics" – Seymour Lipschutz and Marc Lipson (Schaum's Outline)
2. Counting and Recurrence Relation
   - "Concrete Mathematics: A Foundation for Computer Science" – Ronald L. Graham, Donald E. Knuth, and Oren Patashnik
   - "Introduction to Algorithms" – Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein (for recurrence relations)
   - "Discrete Mathematics" – Richard Johnsonbaugh

3. Elementary Graph Theory
   - "Graph Theory with Applications" – John Adrian Bondy and U.S.R. Murty
   - "Introduction to Graph Theory" – Douglas B. West
   - "Graph Theory" – Reinhard Diestel (Advanced)
4. Matrix Algebra
   - "Linear Algebra and Its Applications" – Gilbert Strang
   - "Introduction to Linear Algebra" – Serge Lang
   - "Matrix Analysis and Applied Linear Algebra" – Carl D. Meyer

Supplementary Reading:

Engineering Mathematics, Vol:1 & Vol:2, Sastry, PHI

COURSE CONTENT:

MODULE 1:	**Set, Relation and Function**	15 Hours
Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm. Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.		
MODULE 2:	**Counting and Recurrence Relation:**	12 Hours
Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem. Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.		
MODULE 3:	**Elementary Graph Theory:**	7 Hours

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs. Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.		
MODULE 4:	**Matrix Algebra**	10 Hours
Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.		
Total Lectures		44 Hours

Problem Solving Techniques using C

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: Problem Solving Techniques using C	**Subject Code:** TIU-SEC-UCA-T11101
Contact Hours/Week: L-T-P: 3-0-0	**Credit:** 3

COURSE OBJECTIVES

The aim of this course is

- To develop programming skills using the fundamentals and basics of C language.
- To impart the knowledge about pointers which is the backbone of effective memory handling
- To study the advantages of user defined data type this provides flexibility for application development.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

Course Outcomes	Description	Bloom's Taxonomy
CO1	Understand the basics of computers, input/output devices, storage, binary number system, and character encoding	K2
CO2	Describe operating system concepts, resource management	K2
CO3	Describe process handling, and file system operations.	K2
CO4	Develop basic C programs using variables, operators, conditional statements, and loops.	K3
CO5	Implement arrays, functions, recursion, and structured programming techniques in C.	K3
CO6	Apply advanced C programming concepts including pointers, structures, linked lists, and file handling.	K3

Recommended Books:

1. Byron S Gottfried "Programming with C" Second edition, Tata McGrawhill, 2007(Paper back)
2. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.
3. Kanetkar Y, "Let us C", BPB Publications, 2007.
4. Hanly J R & Koffman E.B, "Problem Solving and Programm design in C", Pearson Education, 2009.

SUPPLEMENTARY READING

1. E. Balagurusamy, "Programming with ANSI-C", Fourth Edition,2008, Tata McGrawHill.
2. Venugopal K. R and Prasad S. R, "Mastering 'C'", Third Edition, 2008, Tata McGraw Hill.

COURSE CONTENT:

MODULE 1:	Computer Appreciation	3 Hours
Characteristics of Computers, Input, Output, Storage units, CPU, Computer System, Binary number system, Binary to Decimal Conversion, Decimal to Binary Conversion, ASCII Code, Unicode.		
MODULE 2:	**Computer Organization**	**3 Hours**

Central Processing Unit - Processor Speed, Cache, Memory, RAM, ROM, Booting,
Memory- Secondary Storage Devices: Floppy and Hard Disks, Optical Disks CD-ROM, DVD, Mass Storage Devices: USB thumb drive.
Input Devices - Keyboard, Mouse, joystick, Scanner, web cam.
Output Devices-Monitors, Printers – Dot matrix, inkjet, laser, Multimedia- What is Multimedia, Text.

MODULE 3:	**Introduction to OS**	**3Hours**

Operating systems: Application scenarios, kind of resource support needed by applications, what is an "Operating System" and what support is provided to run an application, hardware and software layers, organization of a computer system, operational view of a computing system with resources like processor, memory, input and output, issues in resource management, introduction to the issues in communication with devices, kernel and shell of an operating system, processes and file.

MODULE 4:	**Introduction to 'C' Language**	**3Hours**

Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic Input/output statement, Simple 'C' programs.

MODULE 5:	**Conditional Statements and Loops:**	**8 Hours**

Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming.

MODULE 6:	**Arrays:**	**8 Hours**

One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Standard library string functions.

MODULE 7:	**Functions:**	**8 Hours**

Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.

MODULE 8:	**Applications:**	**8 Hours**

Structures and Unions: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions. **Pointers:** Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation. **Self Referential Structures and Linked Lists:** Creation of a singly connected linked list, Traversing a linked list, Insertion into a linked list, Deletion from a linked list. **File Processing.** Concept of Files, File opening in various modes and closing of a file, Reading from a file, writing in a file.

TOTAL LECTURES	**44 Hours**

Computer Fundamentals & Digital Electronics

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: Basic Computer Fundamentals & Digital Electronics	**Subject Code:** TIU-CC-UCA-T11101
Contact Hours/Week: **L-T-P: 2-0-0**	**Credit:** 2

COURSE OBJECTIVES

The aim of this course is to:

- Provide a fundamental understanding of the components and functioning of computers.
- Introduce number systems and their applications in digital electronics.
- Familiarize students with logic gates, combinational, and sequential circuits.
- Enable students to perform arithmetic operations using digital techniques.
- Equip students with the practical knowledge of digital electronics and circuit design.

COURSE OUTCOMES

CO	Module Name	Course Outcome Description	Knowledge Level
CO-1	Computer Fundamentals	Understand basic components of a computer.	K2
CO-2	Number System	Understand different number systems and their conversions.	K2
CO-3	Logic Gates & Minimization	Understand various digital components.	K3
CO-4	Combinational & Arithmetic Circuits	Perform different computer arithmetic operations.	K4
CO-5	Sequential Circuits	Understand sequential components.	K3

TEXTBOOKS & REFERENCES

1. **Computer Fundamentals** – P.K. Sinha
2. **Digital Logic and Computer Design** – M. Morris Mano
3. **Fundamentals of Digital Circuits** – Anand Kumar
4. **Digital Design** – John F. Wakerly
5. **Switching & Finite Automata Theory** – Zvi Kohavi
6. **Digital Principles and Applications** – Leach and Malvino

COURSE CONTENT

Module	Module Name	Topics Covered
1	Computer Fundamentals	Brief history of computers, CPU, Processor Speed, Cache, Memory (RAM, ROM), Booting, Secondary Storage Devices, Input & Output Devices.
2	Number System	Binary, Octal, Hexadecimal, Number system conversion, Signed magnitude representation, Arithmetic operations, Complements.
3	Logic Gates & Minimization	OR, AND, NOT, NAND, NOR, XOR, XNOR, Universal Gates, De Morgan's Theorem, Duality, Minterm, Maxterm, SOP, POS, K-Map Simplification.
4	Combinational & Arithmetic Circuits	Encoder, Decoder, Multiplexer, Half & Full Adder/Subtractor, Parallel Adder/Subtractor.
5	Sequential Circuits	Flip-Flops (S-R, D, J-K, T, Master-Slave J-K), Registers (Parallel Load & Shift), Synchronous & Asynchronous Counters.

General English-I

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: General English-I	**Subject Code:** TIU-AEC-UEN-S11102
Contact Hours/Week: **L-T-P: 1-1-0**	**Credit:** 2

COURSE OBJECTIVES

The aim of this course is to:

- Describe aspects of personal and everyday life in both oral and written form.
- Produce short and simple connected texts on familiar topics.

- Demonstrate some control of essential grammatical structures with occasional inconsistencies.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

Course Outcomes	Description	Bloom's Taxonomy
CO1	Participate effectively in critical conversations and demonstrate the ability to prepare, organize, and deliver their work to the public.	K3
CO2	Read critically and interpret texts with attention to form and genre, ambiguity and complexity, considering how aesthetic experiences fostered by works of literature are central to their meaning and ethical force.	K2
CO3	Practice a deliberate writing process with emphasis on inquiry, audience, research, and revision.	K3
CO4	Differentiate between genres of writing, understand the formal elements of language use in those genres, and write in appropriate genres and modes for a variety of purposes and audiences, in print and/or digital contexts.	K3
CO5	Read works of criticism and theory, situating their own readings of primary and secondary texts in relation to larger critical debates.	K2
CO6	Identify topics and formulate questions for productive inquiry; identify appropriate methods and sources for research and evaluate critically the sources they find; and use sources effectively in their own writing, citing them appropriately.	K3

Books for Readings:

- Taylor,Shirley - Communication for Business, 4th Edn. – Pearson Education.
- Kaul, Asha – Effective Business Communication, Prentice Hill.

COURSE CONTENT:

MODULE 1:		18 Hours
• Principles of Communication– Definition, Purpose, Process. • Verbal Communication – Types of Communication, Barriers of Communication, 7 C's of Communication Short-Skits, Listening skills-Comprehension.		
MODULE 2:		7 Hours
• Idioms and phrases		
MODULE 3:		10 Hours

• Writing Business Letters– Formats, Styles, Types.	
Total Lectures	35 Hours

Indian Constitution

Program	B.C.A.
Year, Semester	1st Yr., 1st Sem.
Course Title	Indian Constitution
Subject Code	TIU-MDE-ULL-T11101
Contact Hours/Week	L-T-P: 3-0-0
Credit	3

COURSE OBJECTIVES

- **Understand the Evolution of the Indian Constitution –** Examine the historical background, drafting process, and significance of the Preamble and Basic Structure.
- **Analyze Fundamental Rights, Duties, and State Policy Principles –** Explore their interpretations, implications, and role in democratic governance.
- **Evaluate the Structure and Functions of the Union Government –** Understand the roles and powers of the President, Prime Minister, Council of Ministers, and Parliament.
- **Examine the State Government Framework –** Assess the authority and responsibilities of the Governor, Chief Minister, and State Secretariat.
- **Understand the Role of Local Administration –** Study the functions of District Administration, Municipal Corporations, and Zila Panchayats in grassroots governance.
- **Analyze the Election Commission's Role in Democracy –** Explore its structure, functioning, and the responsibilities of the Chief Election Commissioner and State Election Commission.

COURSE OUTCOMES

CO	Module Name	Course Outcome Description	Knowledge Level (Bloom's Taxonomy)
CO1	The Constitution - Introduction	Explain the historical development and significance of the Indian Constitution, including the Preamble and Basic Structure.	K2

CO2	Fundamental Rights, Duties & State Policy Principles	Analyze the Fundamental Rights, Duties, and Directive Principles of State Policy and their role in governance.	K4
CO3	Union Government	Evaluate the structure, powers, and functions of the Union Government, including the President, Prime Minister, and Parliament.	K5
CO4	State Government	Examine the framework, authority, and responsibilities of the Governor, Chief Minister, and State Secretariat.	K2
CO5	Local Administration	Assess the role of local governance institutions such as District Administration, Municipal Corporations, and Zila Panchayats.	K4
CO6	Election Commission	Describe the role, functioning, and significance of the Election Commission at the national and state levels.	K2

TEXTBOOKS & REFERENCES

- **"Introduction to the Constitution of India"** – D.D. Basu
- **"Local Government in India"** – *Pradeep Sachdeva*
- **"Governance in India"** – *M. Laxmikanth*
- **"Electoral Politics in India: The Resurgence of the Bharatiya Janata Party"** – Suhas Palshikar

COURSE CONTENT

Unit 1: The Constitution - Introduction
- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2: Union Government
- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3: State Government
- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4: Local Administration
- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5: Election Commission

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Environmental Science and Sustainability

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem
Course Title: Environmental Science and Sustainability	**Subject Code:** TIU-VAC-UOG-T11101
Contact Hours/Week: **L-T-P: 2-0-0**	**Credit:** 2

COURSE OBJECTIVES

The aim of this course is:

- To understand about eco-systems, their structure (atrophic relationships, a biotic factors, and biomes) and function (energy flow and biogeochemical cycles);
- To understand about different types of pollution and their effect on our day to day life.
- To understand about the relationships between development (urban, industrial, agricultural, etc.), human population growth, and the environment;

COURSE OUTCOME:

After completion of this course the student should be able to:

CO	Description	Bloom's Taxonomy
CO1	Explain the process and philosophical basis of scientific inquiry	K1
CO2	Describe the basic principles of ecology, including population ecology, community ecology, and ecosystem function.	K1
CO3	Describe the characteristics of the major biomes and ecosystems of the Earth	K2
CO4	Describe the interrelationships between land, sea, the atmosphere and the living things that occupy these environments	K2
CO5	Discuss the role that humans play in affecting the characteristics of the environment.	K2

CO6	Evaluate current environmental issues and problems including the solutions and management practices that have been used or offered to address these issues and problems.	K2

BOOKS:

Main Reading:

1. Environmental Chemistry by B.K.Sharma & H. Kaur, Goel Publishing House.
2. Environmental Chemistry by A. K De, New Age International Publishers.

Supplementary Reading:

1. Instrumental method of Analysis by B.K. Sharma, Goel Publishing House.
2. A Test Book of Environmental Chemistry & Pollution Control by S. S. Dara, S. Chand and Co.
3. Environmental Chemistry by Samir K. Banerjee, Prentice Hall of India Pvt.Ltd. New Delhi.

COURSE CONTENT:

MODULE 1:	**Fundamentals of Environment & Ecology**	**8 Hours**
Environment definition, Environmental Segments, Concepts of Ecosystem: Fundamentals of Ecology and Ecosystem, Components of ecosystem, Food chain, Food web, Tropic level, Energy flow. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest, Grassland, Desert and Aquatic ecosystem. Effects of human activities on environment: Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment Sustainable Development.		
MODULE 2:	**Natural Resources Water Resources - Availability and Quality aspects.**	**7Hours**
Mineral Resources, Soil, Material cycles- Carbon, Nitrogen and Sulphur Cycles. Energy, Different types of energy, Conventional and Non-Conventional Sources Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas. Gas Hydrates, Hydrogen as an alternative future source of Energy.		
MODULE 3:	**Environmental Pollution & Current Environmental Issues of Importance**	**6Hours**
Definition causes effects and control measures of: Air Pollution, Water pollution, Land pollution, Noise pollution. Climate Change and Global warming: Effects, Acid Rain, Ozone Layer depletion, Photochemical Smog, Solid waste management, Waste water treatment.		
MODULE 4:		**6 Hours**
Environment Quality Standards Ambient air quality standards, Water quality parameters and standards; Turbidity, pH, Suspended solids, hardness, residual chlorine, sulfates, phosphates, iron and manganese, DO, BOD, COD.		

MODULE 5:		6 Hours
Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics. Initiatives and Standards, Minimizing Power Usage, Cooling, Changing the Way of Work, Going Paperless, Greening Your Information Systems.		
TOTAL LECTURES		**33 Hours**

Problem Solving Techniques using C Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: Problem Solving Techniques using C Lab	**Subject Code:** TIU-SEC-UCA-L11101
Contact Hours/Week: **L-T-P: 0-0-3**	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

1. To make the student learn a programming language.
2. To learn problem solving techniques.
3. To teach the student to write programs in C and to solve the problems.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

Course Outcomes (COs):	DESCRIPTION	BLOOM'S TAXONOMY LEVELS
CO1	Understand and apply basic programming concepts to perform fundamental operations.	K3
CO2	Demonstrate the ability to perform number-based algorithms and mathematical operations.	K3
CO3	Apply iterative algorithms for sequence generation and computational tasks.	K3
CO4	Develop array-based solutions for managing and processing data efficiently	K3
C05	Understand and implement matrix operations for problem-solving	K3
CO6	Demonstrate the ability to apply and implement algorithms to solve real-world problems	K3

COURSE CONTENT:

UNIT	CONTENTS	Hours
2	Constants, Variable, Datatype, Operators and Expressions	3
3	Decision Making and Branching	6
4	Decision Making and Looping	6
5	Array, String	12
6	User Defined Functions	3
7	Structure and Union	3
8	Pointer	3
	Total	36

Books:

1. Byron S Gottfried “Programming with C” Second edition, Tata McGrawhill, 2007 (Paper back)

2. R.G. Dromey, “How to solve it by Computer”, Pearson Education, 2008.

3. Kanetkar Y, “Let us C”, BPB Publications, 2007.

4. Hanly J R & Koffman E.B, “Problem Solving and Programm design in C”, Pearson Education, 2009.

SUPPLEMENTARY READING

1. E. Balagurusamy, “Programming with ANSI-C”, Fourth Edition,2008, Tata McGraw Hill.

2. Venugopal K. R and Prasad S. R, "Mastering 'C'", Third Edition, 2008, Tata McGraw Hill.

3. B.W. Kernighan & D. M. Ritchie, "The C Programming Language", Second Edition, 2001, Pearson Education

4. ISRD Group, "Programming and Problem Solving Using C", Tata McGraw Hill,2008.

5. Pradip Dey , Manas Ghosh, "Programming in C", Oxford University Press, 2007.

PC Tools and Their Applications

Program	B.C.A.
Year, Semester	1st Yr., 1st Sem.
Course Title	PC Tools and Their Applications
Subject Code	TIU-CC-UCA-L11103
Contact Hours/Week	L-T-P: 0-0-2
Credit	1

COURSE OBJECTIVES

The aim of this course is to:

- Provide an understanding of MS Office applications and their functionalities.
- Develop skills to create and format documents, spreadsheets, and presentations effectively.
- Introduce automation features like Macros and Mail Merge.
- Enable students to analyze and visualize data efficiently using MS Excel.
- Enhance proficiency in designing and delivering professional presentations.

COURSE OUTCOMES

CO	Module Name	Course Outcome Description	Knowledge Level
CO-1	Introduction to MS Office	Understand the basic functionalities of MS Office applications.	K2
CO-2	Microsoft Word	Create and format professional documents using MS Word.	K3
CO-3	Microsoft Excel	Analyze and visualize data effectively using MS Excel.	K4
CO-4	Microsoft PowerPoint	Develop presentations using MS PowerPoint.	K3
CO-5	Advanced MS Office Features	Apply advanced MS Office features such as Macros and Mail Merge.	K4
CO-6	Integration & Productivity	Utilize MS Office tools for enhanced productivity and automation.	K4

TEXTBOOKS & REFERENCES

1. **Microsoft Office 365 Bible** – John Walkenbach, Herb Tyson, Michael R. Groh
2. **Microsoft Office Inside Out** – Ed Bott, Carl Siechert
3. **Excel 2019 Power Programming with VBA** – Michael Alexander, Dick Kusleika
4. **Mastering Microsoft PowerPoint** – Patrice-Anne Rutledge
5. **Office 2019 All-in-One For Dummies** – Peter Weverka

COURSE CONTENT

Module	Module Name	Topics Covered
1	Introduction to MS Office	Overview of MS Office Suite, Installation and setup, Introduction to the user interface of Word, Excel, and PowerPoint.
2	Microsoft Word	Creating and formatting documents, Text manipulation (fonts, paragraphs, styles), Inserting images and tables, Page layout, Header & Footer, Mail Merge, Macro.
3	Microsoft Excel	Introduction to spreadsheets, Data entry and formatting, Formulas & Functions (SUM(), AVERAGE(), MAX(), MIN(), COUNT(), IF(), COUNTIF()), Creating and formatting charts and graphs.

4	Microsoft PowerPoint	Creating and designing presentations, Using templates and themes, Transition and animation effects, Presentation delivery techniques.
5	Advanced MS Office Features	Automation using Macros, Mail Merge, Integration of Word, Excel, and PowerPoint, Cloud-based collaboration tools.

Computer fundamentals & Digital Electronics Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 1st Sem.
Course Title: Computer fundamentals & Digital Electronics Lab	**Subject Code:** TIU-CC-UCA-L11101
Contact Hours/Week: **L-T-P: 0-0-3**	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

Understand and Analyze Logic Gates: Develop a fundamental understanding of basic logic gates and their behaviour, including verification of truth tables and realization of universal gates.

Design and Implement Combinational Circuits: Gain hands-on experience in designing and testing combinational circuits such as adders, subtractors, multiplexers, encoders, and decoders using basic logic gates.

Explore Sequential Circuits: Learn the working principles of flip-flops, shift registers, and counters by designing and implementing synchronous and asynchronous sequential circuits.

Apply Boolean Algebra and Number System Conversions: Implement Boolean functions using SOP and POS forms, and perform number system conversions such as Binary to Grey code and BCD to Excess-3 code using logic gates.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

Course Outcomes (COs)	Description	Bloom's Taxonomy Levels
CO1	Verify the logic behaviour of basic gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, Inverter, and Buffer) and universal gates.	K2
CO2	Implement NAND as a universal gate, verify De Morgan's theorem, and realize Boolean functions using SOP and POS forms.	K3
CO3	Design and test multiplexers, encoders, decoders, adders, subtractors, and BCD-to-Excess-3 converters.	K3
CO4	Verify truth tables of flip-flops (S-R, J-K) and implement shift registers and counters (synchronous and asynchronous).	K4
CO5	Implement and optimize logic circuits for arithmetic operations and digital systems using ICs and basic gates.	K6
CO6	Analyze and debug combinational and sequential circuit designs for correctness and efficiency.	K5

COURSE CONTENT :

1. Verify logic behaviour of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. To verify De- Morgan's theorem for 2 variables
4. Design and test of an S-R flip-flop using NAND/NOR gate.
5. Convert BCD to Excess-3 code using NAND gate
6. To Convert Binary to Grey Code
7. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1 MUX using gates.
10. Implementation of 4-Bit Parallel Adder Using 7483 IC.
11. Design and verify operation of half adder and full adder.
12. Design and verify operation of half subtractor.
13. Design and Implement a 4 bit shift register using Flip flops.
14. Implement Boolean function using logic gates in both SOP and POS
15. Design and Implement a 4 bit synchronous counter.
16. Design and verify 4 bit asynchronous counter.

Books:

- "Digital Electronics: Principles and Applications" – Roger L. Tokheim
- "Fundamentals of Digital Circuits" – A. Anand Kumar
- "Digital Design" – M. Morris Mano & Michael D. Ciletti
- "Digital Principles and Design" – Donald D. Givone
- "Experiments in Digital Electronics: A Laboratory Manual" – S. Poornachandra, B. Sasikala
- "Digital Electronics Laboratory Manual" – Virendra Kumar

2nd Semester

TECHNO INDIA UNIVERSITY
WEST BENGAL

Basic Mathematics II

Program	B.C.A.
Year, Semester	1st Yr., 2nd Sem.
Course Title	Basic Mathematics II
Subject Code	TIU-CC-UMA-T12101
Contact Hours/Week	L-T-P: 3-0-0
Credit	3

COURSE OBJECTIVES

- This course helps the students to understand correct lines of arguments and proofs.
- This course introduces mathematical techniques that are foundations for understanding advanced computational methods, including numerical methods and optimization.
- This course helps the students to understand various problem-solving strategies and methods to tackle both theoretical and practical challenges in computer science.

COURSE OUTCOMES

CO	Module Name	Course Outcome Description	Knowledge Level
CO-1	Logic and Methods of Proofs	Understand and apply logical reasoning, propositional logic, and proof techniques.	K3
CO-2	Algebraic Structures	Understand the concepts of algebraic structures such as groups, monoids, and semigroups.	K3
CO-3	Numerical Methods	Apply numerical techniques to solve algebraic and transcendental equations.	K4
CO-4	Numerical Methods	Implement numerical interpolation and integration techniques for computational problems.	K4
CO-5	Optimization Techniques	Formulate and solve linear programming problems using graphical and simplex methods.	K4
CO-6	Optimization Techniques	Solve transportation problems using optimization methods.	K4

TEXTBOOKS & REFERENCES

1. **Discrete Mathematics and Its Applications** – Kenneth H. Rosen
2. **Discrete Mathematical Structures** – Bernard Kolman, Robert Busby, Sharon Ross
3. **Introductory Methods of Numerical Analysis** – S.S. Sastry
4. **Operations Research: An Introduction** – Hamdy A. Taha
5. **Linear Programming and Network Flows** – Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali

COURSE CONTENT

Module	Module Name	Topics Covered
1	Logic and Methods of Proofs	Propositions, logical operations, compound statements, truth tables, quantifiers, tautologies, contradictions, contingency, CNF, DNF. Rules of inference, proof methods (modus ponens, modus tollens, syllogism, proof by contradiction), Mathematical Induction.
2	Algebraic Structures	Semi-group, Monoid, Group, Subgroup, Cyclic group.
3	Numerical Methods	Concept and importance of errors, Solution of algebraic & transcendental equations (Bisection method, Newton-Raphson method), Numerical Interpolation (Newton's Forward & Backward interpolation, Lagrange's formula), Numerical Integration (Trapezoidal rule, Simpson's 1/3 rule). Only formula and problem-solving.
4	Optimization Techniques	Linear Programming (Introduction, LP formulation, Graphical method, Special cases, Simplex method, Duality), Transportation problem (Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation, MODI method).

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Data Structures Through C	**Subject Code:** TIU-CC-UCA-T12101
Contact Hours/Week: **L-T-P: 3-0-0**	**Credit:** 3

COURSE OBJECTIVE:

To make student familiar with

- To introduce the concept of data structures through ADT including List, Stack, Queues.
- To design and implement various data structure algorithms.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structure algorithms.
- To discuss about sorting and searching techniques.

COURSE OUTCOME:

On completion of the course, the student will be able to:

Course Outcomes	Description	Bloom's Taxonomy Levels
CO1	Demonstrate an understanding of fundamental data representation concepts, including abstract and system-defined types, and primitive data structures.	K3
CO2	Implement and apply linear data structures such as arrays, stacks, queues, circular queues, Deques, and priority queues for problem-solving.	K3
CO3	Utilize linked representation of linear data structures, including singly linked lists, doubly linked lists, circular linked lists, linked stacks, and linked queues, for efficient data manipulation.	K2
CO4	Analyze and implement non-linear data structures such as binary trees, binary search trees, and graphs with various representations and operations.	K3
CO5	Apply searching techniques like linear search, binary search, and hashing to optimize data retrieval and storage.	K3
CO6	Implement and evaluate sorting algorithms such as insertion sort, bubble sort, selection sort, and quick sort to improve data organization and efficiency.	K3

Books:

1. S. Chottopadhyay, D. Ghoshdastider& M. Chottopadhyay, Data Structures though C Language, First Edition, 2001, BPB Publication.
2. Lipshutz, Data Structures with C, McGraw Hill.

Supplementary Reading:

1. Y. Kanitkar, Let Us C
2. Robert Lafore, Data Structures and Algorithms in Java, Sams.
3. A.M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.
4. Standish, Data Structure, Addison-Wesley.
5. B. Salzberg, File Structures - An Analytic Approach, Prentice-Hall.
6. A.L. Tharp, File Organization and Processing, John Wiley and Sons.
7. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
8. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.

COURSE CONTENT:

MODULE 1:	**Basic Concepts of Data Representation**	**4Hours**
Abstract and system defined types, primitive data structures.		
MODULE 2:	**Linear data structures and their sequential representation**	**12 Hours**
array, stack, queue, circular queue, Deque, priority queue and their operations and applications.		
MODULE 3:	**Linear data structures and their linked representation**	**12Hours**
linear linked lists, doubly linked lists, circular linked list, linked stack, linked queue and their operations and applications.		
MODULE 4:	**Non-Linear Data Structures**	**12Hours**
Binary trees, binary search trees, representations and operations, thread representations, sequential representations, graphs and their representation.		
MODULE 5:	**Searching Techniques**:	**2Hours**
Linear search, Binary search, Concept of hashing.		
MODULE 6:	**Sorting Techniques**:	**3Hours**
Insertion Sort, Bubble sort, Selection sort, Quick sort		
TOTAL LECTURES		**4 5Hours**

TECHNO INDIA UNIVERSITY
WEST BENGAL

Computer Organization and Architecture

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Computer Organization and Architecture	**Subject Code:** TIU-CC-UCA-T12102
Contact Hours/Week: **L-T-P: 3-0-0**	**Credit:** 3

COURSE OBJECTIVES

The aim of this course is

- To conceptualize the basics of organizational and architectural issues of a digital computer.
- To analyze performance issues in processor and memory design of a digital computer.
- To understand various data transfer techniques in digital computer.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

Course Outcomes	Description	Bloom's Level
CO1	Explain the basics of computer hardware and how software interacts with computer hardware.	K2
CO2	Illustrate how computers represent and manipulate data.	K2
CO3	Perform different computer arithmetic operations.	K3
CO4	Convert between different number systems.	K3
CO5	Design a simple computer with hardware design including data format, instruction format, instruction set, addressing modes, bus structure, input/output, memory, Arithmetic/Logic unit, control unit, and data, instruction and address flow.	K4
CO6	Implement Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits.	K3, K4

Books:

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill, 2002.

2. Computer Organization and Design, David A. Patterson, John L. Hennessy, Morgan Kaufmann

3. Computer Organization, R. Govindarajan

Supplementary Reading

1. J. P. Hayes, Computer Architectures & Organization, Third Edition, 1998, McGraw Hill

COURSE CONTENT:

MODULE 1:	Digital Computers	15. Hours
i)A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection. ii) Logic gates iii) Adders iv) Flip-Flops (as 1 bit memory device), Encoders, Decoders, Multiplexers, Registers, Shift Registers, Counters, RAM, ROM.		
MODULE 2:	**Data Representation & Computer Arithmetic**	3 Hours
Number systems, BCD, ASCII & EBCDIC Codes, Two's complement: Addition, subtraction, overflow, Floating point representation. Addition and Subtraction with Signed Magnitude data, Multiplication Algorithms: Hardware Algorithm and Booth Algorithm, Division Algorithm.		
MODULE 3:	**Processing Unit**	12 Hours
Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Micro programmed control unit. Machine instructions, Operands, addressing modes, Instruction formats, Instruction sets. , Software and Hardware interrupts (only brief introduction), Arithmetic and Instruction Pipelines.		
MODULE 4:	**Input-Output Organization**	3 Hours
Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini band, I/O peripherals - Input devices, Output devices, Secondary storage devices. Instruction level pipelining and Superscalar Processors, Multiple Processor Organizations, Closely and loosely coupled multiprocessors systems, Symmetric Multiprocessors, Clusters, UMA NUMA, Vector Computations, RISC: Instruction execution characteristics, RISC architecture and pipelining. RISC Vs CISC		
MODULE 5:	**Memory Organization**	7 Hours
Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM , Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management.		
Total Lectures		40 Hours

TECHNO INDIA UNIVERSITY
WEST BENGAL

Operating Systems

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Operating Systems	**Subject Code:** TIU-CC-UCA-T12103
Contact Hours/Week: **L-T-P: 3-0-0**	**Credit:** 3

COURSE OBJECTIVES

The aim of this course is:

- To understand the main components of an OS & their functions.
- To study the process management and scheduling.
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
- To understand the concepts and implementation Memory management policies and virtual memory.
- To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS
- To study the need for special purpose operating system with the advent of new emerging technologies

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO	DESCRIPTION	Bloom's Taxonomy
CO1	Understand the evolution and structural overview of operating systems, including their roles and functionalities.	K2
CO2	Analyze process management concepts, including process synchronization, scheduling algorithms, and context switching.	K3
CO3	Examine hardware requirements such as protection mechanisms, privileged mode operations, and their impact on operating system security	K2

CO4	Implement and manage threads, concurrency tools, deadlock detection/prevention techniques, and dynamic resource allocation	K3
CO5	Evaluate memory management techniques, including paging, virtual memory, and their applicability in distributed and multiprocessor systems..	K3
CO6	Demonstrate an understanding of file management systems and their role in efficient data organization and retrieval.	K3

Books

1. Silberschatz Galvin, "Operating System Concepts", John Wiley & Sons; 7th edition (December 14, 2004).
2. Andrew S.Tanenbaum, Albert S. Woodhull, "Operating Systems: Design & Implementation", PHI.

Supplementary Reading:

1. D. M. Dhamdhere, "Operating Systems: A Concept Based Approach", TMH.
2. A. S. Godbole, "Operating Systems", TMH

COURSE CONTENT:

MODULE 1:		**6 Hours**
Evolution of Operating Systems, Structural overview		
MODULE 2:		**12 Hours**
Concept of process and Process synchronization, Process Management and Scheduling Hardware requirements: protection, context switching, privileged mode		
MODULE 3:		**12Hours**
Threads and their Management; Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Dynamic Resource Allocation, Design of IO systems		
MODULE 4:		**10Hours**
Memory Management: paging, virtual memory management,		
MODULE 5:		**5Hours**
Distributed and Multiprocessor Systems. File management system		
TOTAL LECTURES		**4 5Hours**

TECHNO INDIA UNIVERSITY
WEST BENGAL

OOP Using Java

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: OOP Using Java	**Subject Code:** TIU-SEC-UCA-T12101
Contact Hours/Week: **L-T-P: 3-0-0**	**Credit:** 3

COURSE OBJECTIVES

The aim of this course is:

- To gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- To understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- To understand the principles of inheritance, packages and interfaces.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO No.	Description	Bloom's Taxonomy Level
CO1	Understand the fundamental concepts of Java programming, including data types, control structures, and object-oriented principles.	K2
CO2	Apply object-oriented programming concepts such as classes, objects, constructors, inheritance, polymorphism, and exception handling in Java.	K3
CO3	Develop multithreaded applications and implement Java's exception-handling mechanisms to ensure robust software development.	K3
CO4	Understand and implement GUI-based applications using Java Swing, event-driven programming, and applets.	K2
CO5	Utilize Java's advanced features, including generics, collections framework, JDBC, networking, and internationalization.	K3
CO6	Apply and implement efficient algorithms for searching, sorting, and data structures while applying Java's modern development methodologies.	K3

Books:

1. Y. Daniel Liang, "Introduction to Java Programming: Comprehensive Version", 7th Edition, 2009, Pearson Education Inc., New Delhi.
(Book Chapters: 1 to 24, 26, 29 to 37)
2. Cay S. Horstmann, "Big Java", 3rd Edition, Wiley India Pvt. Ltd., New Delhi**.**

Supplementary Reading:

1. Richard A. Johnson, "An Introduction to Java Programming and Object Oriented Application Development", First Edition, 2007, CENGAGE Learning India Pvt. Ltd., New Delhi.
2. E. Balagurusamy, "Programming with Java: A Primer"

COURSE CONTENT:

MODULE 1:		**25 Hours**
Introduction to Java Programming Language, Data Types and Operations, Structured Programming, Selection Statements, Loops, Methods, Method Abstraction and Stepwise Refinement, Arrays, Object-Oriented Programming: Classes and Objects, Constructors, Implementing & Designing Classes, Use of Keywords: static, final, this, Class Abstraction and Encapsulation, Strings and Text I/O, Inheritance and Polymorphism, use of super keyword, Overriding vs. Overloading, Object: The Cosmic Super class, Abstract Classes and Interfaces, Packages, Exception Handling, Thread, Multithreading.		
MODULE 2:		**10 Hours**
GUI Programming: GUI Basics, Graphics, Event-Driven Programming, Creating User Interfaces, Applets and Multimedia, Binary I/O, Files & Streams, Recursion, Dynamic Binding, Algorithm Efficiency, Searching & Sorting.		
MODULE 3:		**10Hours**
Generics & Generic Programming, Java Collections Framework, Networking, JDBC, and Internationalization, Advanced GUI Programming: MVC, JavaBeans and Bean Events, Containers, Layout Managers, and Borders, Menus, Toolbars, Dialogs and Swing Models, JTable and JTree, New Features of Java.		
TOTAL LECTURES		**4 5Hours**

TECHNO INDIA UNIVERSITY
WEST BENGAL

Indian Knowledge System

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Indian Knowledge System	**Subject Code:** TIU-VAC-UED-T12101
Contact Hours/Week: **L-T-P: 2-0-0**	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

The objective of this course is to expose students of Management to different aspects of the Indian Knowledge System. Students will develop an understanding of societal and cultural dimensions of the dynamic nature of society and the environment in which they will live and work as professionals and entrepreneurs. More specifically, they will get an appreciation of how societal and cultural issues interface with technology, science and business in the context of overall development of the country.

COURSE OUTCOME:

- On completion of the course, the student will be able to:

CO No.	Course Outcome Description	K Level
CO1	Understand the roots and social structure of Indian society, including rural and urban contexts.	K1
CO2	Analyze the role of social institutions such as caste, tribe, and excluded groups in shaping Indian society.	K4
CO3	Explain the cultural diversity of India, including languages and literature, and their impact on society.	K2
CO4	Evaluate the effects of cultural change on Indian society and its development.	K6
CO5	Apply principles of Indian philosophy to address contemporary social issues such as poverty and gender.	K3
CO6	Assess the relationship between science, technology, and societal development in the Indian context.	K6

COURSE CONTENT:

Module: I (Introduction to Indian Society)

Indian Society - Roots of Indian Society; Social Structure – Rural and Urban Contexts; Social Institutions in Indian Society; Caste, Tribe, Dalits and Other Excluded Groups; Power and Conflicts

Module: II (Introduction to Culture in Indian Society)

Basic understanding of culture in India; Languages and Literature in India; Culture Change and its Impact on Indian Society

Module: III (Basic Tenets of Indian Philosophy and its answers for various issues in Modern India

Poverty – multidimensional aspects; Gender issues in development; Constitution of India: Slums; Informal sector; Child, physically challenged

Module: IV (Science, Technology, and Society)

Appropriate Technology; Science, Technology and Development Linkage; Science and Technology Policy

Books:

- Indian Society and Culture: Vinita Pandey (Rawat Publication, Jaipur)
- Indian Society and Culture: Continuity and Chang: N. Hasnain. (Himalaya Publishing House)
- Indian Society and Culture by Padma Charan Dhal and Kalyani Jena, Atlantic Publishers and Distributors (P) Ltd.

Data structure through C Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Data structure through C Lab	**Subject Code:** TIU-CC-UCA-L12101
Contact Hours/Week: **L-T-P: 0-0-3**	**Credit:** 1.5

COURSE OBJECTIVE:

To make student familiar with

- To introduce the concept of data structures through ADT including List, Stack, Queues.
- To design and implement various data structure algorithms.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structure algorithms.

- To discuss about sorting and searching techniques.

COURSE OUTCOME:

On completion of the course, the student will be able to:

Course Outcomes (COs):	DESCRIPTION	BLOOM'S TAXONOMY LEVELS
CO1	Implement linear data structures such as arrays, linked lists, stacks, and queues.	K3
CO2	Develop algorithms for searching and sorting techniques with efficiency analysis.	K3
CO3	Implement non-linear data structures such as trees and graphs for various applications.	K3
CO4	Design and apply hashing techniques and collision resolution methods.	K3
CO5	Demonstrate proficiency in dynamic memory management and recursion.	K3
CO6	Develop problem-solving skills using data structures for real-world applications.	K3

Books:

1. S. Chottopadhyay, D. Ghoshdastider& M. Chottopadhyay, Data Structures though C Language, First Edition, 2001, BPB Publication.
2. Lipshutz, Data Structures with C, McGraw Hill.

Supplementary Reading:

1. Y. Kanitkar, Let Us C
2. Robert Lafore, Data Structures and Algorithms in Java, Sams.
3. A.M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.
4. Standish, Data Structure, Addison-Wesley.
5. B. Salzberg, File Structures - An Analytic Approach, Prentice-Hall.
6. A.L. Tharp, File Organization and Processing, John Wiley and Sons.
7. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
8. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.

COURSE CONTENT:

MODULE 1:	**Linear data structures and their sequential representation**	**12Hours**
array, stack, queue, circular queue, Deque, priority queue and their operations and applications.		
MODULE 2:	**Linear data structures and their linked representation**	**12Hours**
linear linked lists, doubly linked lists, circular linked list, linked stack, linked queue and their operations and applications.		
MODULE 3:	**Searching Techniques**:	**3Hours**
Linear search, Binary search		
MODULE 4:	Sorting Techniques	**3Hours**
Insertion Sort, Bubble sort, Selection sort, Quick sort		
MODULE 5:	**Non-Linear Data Structures**	**6Hours**
Binary trees, binary search trees, representations and operations		
TOTAL LECTURES		**36Hours**

Operating Systems Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Operating Systems Lab	**Subject Code:** TIU-CC-UCA-L12103
Contact Hours/Week: **L-T-P: 0-0-3**	**Credit:** 1.5

Course Objectives (COs):

- Familiarize students with fundamental Operating System concepts through hands-on programming.
- Implement and analyze various CPU scheduling algorithms for process management.
- Understand and apply deadlock avoidance techniques using Banker's Algorithm.
- Implement inter-process communication (IPC) mechanisms using pipes, FIFOs, and semaphores.
- Simulate different memory management techniques, including paging, segmentation, and contiguous allocation.
- Develop problem-solving skills by implementing real-world synchronization problems like the Producer-Consumer and Dining-Philosophers problems.

Course Outcomes (COs):

Upon successful completion of the lab, students will be able to:

- CO1: Implement and compare different CPU scheduling algorithms for efficient process execution.
- CO2: Apply deadlock handling techniques to ensure system reliability.
- CO3: Develop IPC mechanisms using pipes, FIFOs, and semaphores to enable process communication.
- CO4: Implement and evaluate memory management techniques such as paging, segmentation, and allocation strategies.
- CO5: Demonstrate the use of page replacement techniques to optimize memory performance.
- CO6: Design and implement file allocation methods for efficient data storage and retrieval.

COs	Bloom's Taxonomy	Bloom's Taxonomy Level
CO1	Implement and compare different CPU scheduling algorithms for efficient process execution.	K3
CO2	Apply deadlock handling techniques to ensure system reliability.	K3
CO3	Develop IPC mechanisms using pipes, FIFOs, and semaphores to enable process communication.	K1,K2,K3
CO4	Implement and evaluate memory management techniques such as paging, segmentation, and allocation strategies.	K2,K3
CO5	Demonstrate the use of page replacement techniques to optimize memory performance.	K1,K2,K3
CO6	Design and implement file allocation methods for efficient data storage and retrieval.	K2,K3

COURSE CONTENT:

MODULE 1:	OS Overview	2 Hours
Introduction to Operating System Lab, Basics of C Programming for OS Implementation		
MODULE 2:	**Scheduling**	**4 Hours**
CPU Scheduling Algorithms: FCFS, SJF,SRTF and Round Robin (Theory + Implementation)		
MODULE 3:	**Deadlock**	**3 Hours**
Deadlock Handling: Banker's Algorithm (Theory + Implementation)		

MODULE 4:	**Process Synchronization**	**3 Hours**
Process Synchronization: Producer-Consumer Problem using Semaphores		
MODULE 5:	**IPC Mechanisms**	**3 Hours**
Inter-Process Communication (IPC) Mechanisms: Pipes and FIFOs		
MODULE 6:	**Memory Management**	**3 Hours**
Memory Management Techniques: Paging and Segmentation		
MODULE 7:	**Contiguous Memory Allocation**	**3 Hours**
Contiguous Memory Allocation: Best Fit, First Fit Techniques		
MODULE 8:	**Classical Synchronization Problems**	**3 Hours**
Classical Synchronization Problems: Dining Philosophers Problem		
MODULE 9:	**Page Replacement Algorithms**	**3 Hours**
Page Replacement Techniques: FIFO Algorithm		
TOTAL LECTURES		**27 Hours****

Recommended Books:
Main Reading:

1. Operating System Concepts (Silberschatz, Galvin, Gagne)
- Covers CPU scheduling (FCFS, SJF, Round Robin), memory management (Paging, Segmentation, Contiguous Allocation), and process synchronization (Dining Philosophers, Producer-Consumer).
- Provides clear explanations of Banker's Algorithm and IPC mechanisms.

2. Modern Operating Systems (Andrew S. Tanenbaum, Herbert Bos)
- Explains fundamental OS concepts with examples.
- Discusses process synchronization, deadlocks, and memory management in depth.

3. Operating Systems: Internals and Design Principles (William Stallings)
- Focuses on OS internals and practical implementation details.
- Covers CPU scheduling, deadlock handling, memory management, and file systems.

4. Advanced Programming in the UNIX Environment (W. Richard Stevens, Stephen A. Rago)
- Essential for IPC mechanisms like Pipes, FIFOs, and semaphores.
- Detailed explanations of system calls used in OS experiments.

5. The C Programming Language (Brian W. Kernighan, Dennis M. Ritchie)
- A must-have for writing efficient C programs, including OS-related implementations.

6. Linux System Programming (Robert Love)
- Helps in writing system-level C programs related to process management, IPC, and synchronization.

TECHNO INDIA UNIVERSITY

WEST BENGAL

OOP Using Java Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: OOP Using Java Lab	**Subject Code:** TIU-SEC-UCA-L12101
Contact Hours/Week: **L-T-P: 0-0-4**	**Credit:** 2

COURSE OBJECTIVE:

To understand object-oriented programming concepts, and apply them in solving problems.

To introduce the implementation of packages and interfaces

COURSE OUTCOME:

On completion of the course, the student will be able to:

Course Outcomes	Description	Bloom's Level
CO1	Develop simple Java programs using variables, data types, operators, and control structures.	K3
CO2	Implement classes, objects, constructors, inheritance, polymorphism, encapsulation, and abstraction.	K3, K4
CO3	Apply exception handling mechanisms and perform file input/output operations...	K3
CO4	Develop Java applications using multithreading, thread synchronization, and inter-thread communication.	K4
CO5	Use Java Collection Framework (List, Set, Map) and connect Java programs with databases using JDBC.	K4
CO6	Design interactive Java applications using AWT, Swing, and event-handling techniques.	K5

COURSE CONTENT:

MODULE 1:		**12 Hours**
Introduction to Java Programming Language, Data Types and Operations, Structured Programming, Selection Statements, Loops, Methods, Method Abstraction and Stepwise Refinement, Arrays, Object-Oriented Programming: Classes and Objects, Constructors, Implementing & Designing Classes, Use of Keywords: static, final, this, Class Abstraction and Encapsulation, Strings and Text I/O, Inheritance and Polymorphism, use of super keyword, Overriding vs. Overloading, Object: The Cosmic Super class, Abstract Classes and Interfaces, Packages, Exception Handling, Thread, Multithreading.		
MODULE 2:		**12Hours**
GUI Programming: GUI Basics, Graphics, Event-Driven Programming, Creating User Interfaces, Applets and Multimedia, Binary I/O, Files & Streams, Recursion, Dynamic Binding, , Algorithm Efficiency, Searching & Sorting.		
MODULE 3:		**12Hours**
Generics & Generic Programming, Java Collections Framework, Networking, JDBC, and Internationalization, Advanced GUI Programming: MVC, JavaBeans and Bean Events, Containers, Layout Managers, and Borders, Menus, Toolbars, Dialogs and Swing Models, JTable and JTree, New Features of Java		
TOTAL LECTURES		**36Hours**

Recommended Books:

Main Reading:

1. Y. Daniel Liang, "Introduction to Java Programming: Comprehensive Version", 7th Edition, 2009, Pearson Education Inc., New Delhi.
(Book Chapters: 1 to 24, 26, 29 to 37)
2. Cay S. Horstmann, "Big Java", 3rd Edition, Wiley India Pvt. Ltd., New Delhi**.**

Supplementary Reading:

1. Richard A. Johnson, "An Introduction to Java Programming and Object Oriented Application Development", First Edition, 2007, CENGAGE Learning India Pvt. Ltd., New Delhi.
2. E. Balagurusamy, "Programming with Java: A Primer"

Web Technologies Lab

Program: B.C.A.	**Year, Semester:** 1st Yr., 2nd Sem.
Course Title: Web Technologies Lab	**Subject Code**: TIU-SEC-UCA-L12102
Contact Hours/Week: **L-T-P: 0-0-3**	**Credit:** 1.5

COURSE OBJECTIVE:

This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

COURSE OUTCOME:

After completion of this course the student should be able to:

CO	Description	Bloom's Taxonomy
CO1	Implement interactive web page(s) using HTML, CSS and JavaScript.	K3
CO2	Design a responsive web site using HTML5 and CSS3	K3
CO3	Demonstrate Rich Internet Application	K3
CO4	Build Dynamic web site using server side PHP Programming and Database connectivity.	K3
CO5	Describe and differentiate different Web Extensions and Web Services.	K3
CO6	Demonstrate web application using Python web Framework.	K3

COURSE CONTENT :

MODULE 1:		**18 Hours**
Designing web pages: Forms, CGI scripts and clickable maps		
MODULE 2:		**9 Hours**
JAVA applets, JAVAscript, JAVA servlets		
MODULE 3:		**9Hours**
Perl. DHTML, XML.		
TOTAL LECTURES		**36Hours**

Recommended Books:
Main Reading:

1. Jennifer Niederst Robbins, Learning Web Design Paperback – 3 Nov 2012 , Shroff; Fourth edition (3 November 2012)

Supplementary Reading:

1.Jennifer Niederst Robbins,Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics [Kindle Edition], O'Reilly Media