JALPAIGURI GOVERNMENT ENGINEERING COLLEGE

JALPAIGURI- 735102

(An Autonomous Government College)

COURSE STRUCTURE AND SYLLABUS

FOR

FIRST SEMESTER TO EIGHTH SEMESTER B.TECH. DEGREE

IN

INFORMATION TECHNOLOGY

(Implemented for the new entry batch from the Academic Year 2021-22)

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Jalpaiguri Government Engineering College
Structure and syllabus of B.Tech. in Information Technology
from the entry batch of 2021-22
CC: Course Code, SC: Subject Code. Cr.: Credit, L-T-P-T: Lecture-Tutorial-Practical-Total

1st Year

CC	SC	Subject Name	Contact Hrs./Week		CC	SC	Subject name	Contact Hrs./Week	
			L–T- P-TO	Cr.				L–T-P-TO	Cr.
BSC	BS-CH101	Chemistry	3-1-0-4	4	BSC	BS-PH201	Physics	3-1-0-4	4
BSC	BS-M101A	Mathematics-IA	3-1-0-4	4	BSC	BS-M201A	Mathematics-IIA	3-1-0-4	4
ESC	ES-ES101	Basic Electrical Engineering	3-1-0-4	4	HUM	HM-HU201	English	2-0-0-2	2
BSC	BS-CH191	Chemistry Laboratory	0-0-3-3	1.5	ESC	ES-CS201	Programming for Problem Solving	3-0-0-3	3
ESC	ES-EE191	Basic Electrical Engineering Laboratory	0-0-2-2	1	ESC	ES-ME292	Workshop/Manufacturing Practice	1-0-4-5	3
ESC	ES-ME191	Engineering Graphics & Design	1-0-4-5	3	ESC	ES-CS291	Programming for Problem Solving Laboratory	0-0-4-4	2
Mandatory Induction Program- 3 weeks duration. It is to be done before initiation of classes (theoretical , laboratory & sessional) as per syllabus following guidelines of AICTE and MAKAUT			10-3-9-22	17.5	BSC	BS-PH291	Physics Laboratory	0-0-3-3	1.5
					HUM	HM-HU291	Language Laboratory	0-0-2-2	1
					Total			12-2-13-30	20.5

2nd Year

CC	SC	Subject Name	Contact Hrs./Week		CC	SC	Subject Name	Contact Hrs./Week	
			L –T-P-TO	Cr.				L–T-P-TO	Cr.
HUM	HM-HU(IT)301	Value & Ethics in Profession	2-0-0-2	2	PCC	PC-IT401	Discrete Mathematics	3-1-0-4	4
ESC	ES-IT301	Analog and Digital Electronics	3-0-0-3	3	BSC	BS-CH(IT)401	Biology	2-0-0-2	2
PCC	PC-IT301	Data Structure and Algorithms	3-0-0-3	3	PCC	PC-IT402	Computer Organization	3-1-0-4	4
PCC	PC-IT302	Computer Architecture	3-0-0-3	3	PCC	PC-IT403	Formal Language & Automata Theory	3-0-0-3	3
BSC	BS-M(IT)301	Mathematics-III (Differential Calculus)	2-0-0-2	2	PCC	PC-IT404	Design and analysis of Algorithm	3-1-0-4	4
ESC	ES-IT391	Analog and Digital Electronics Lab.	0-0-4-4	2	MC	MC-IT401	Environmental Science	3-0-0-3	0
PCC	PC-IT391	Data Structure & Algorithms Lab.	0-0-4-4	2	PCC	PC-IT491	Computer Organization Lab	0-0-4-4	2
PCC	PC-IT392	Computer Architecture Lab.	0-0-4-4	2	PCC	PC-IT492	Design and Analysis of Algorithms Lab	0-0-4-4	2
PCC	PC-IT393	IT Workshop (Sci Lab/MATLAB/Python/R)	0-0-4-4	2					
MC	MC-IT301	Essence of Traditional Knowledge	3-0-0-3	0					
Total			16-0-16-32	21	Total			17-3-8-28	21

3rd Year

CC	SC	Subject Name	Contact Hrs./Week		CC	SC	Subject Name	Contact Hrs./Week	
			L –T-P-TO	Cr.				L –T-P-TO	Cr.
ESC	ES-IT501	Signal & Systems	3-0-0-3	3	HUM	HM-HU(IT)601	Principles of Management	2-0-0-2	2
PCC	PC-IT501	Compiler Design	3-0-0-3	3	PCC	PC-IT601	Database Management System	3-0-0-3	3
PCC	PC-IT502	Operating Systems	3-0-0-3	3	PCC	PC-IT602	Computer Networks	3-0-0-3	3
PCC	PC-IT503	Object Oriented Programming	3-0-0-3	3	PEC	PE-IT601	Professional Elective-II a.Data Science b.Distributed Systems c.Software Engineering d.Image Processing & GIS	3-0-0-3	3
PEC	PE-IT501	Professional Elective-I a.Theory of Computation b.Artificial Integillence c.Advanced Computer Architecture d.Computer Graphics	3-0-0-3	3	PEC	PE-CS602	Professional Elective-III a.Parallel and Distributed Algorithms b.Data Mining c.Machine Learning d.Bioinformatics	3-0-0-3	3
PEC	PE-IT591	Compiler Design Lab	0-0-4-4	3	OEC	OE-IT601	Open Elective-I a.Numerical Analysis & Programming b.Theory Of Block Chain c.UX-UI Design	2-0-0-2	2

PCC	PC-IT592	Operating Systems Lab	0-0-4-4	2
PCC	PC-IT593	Object Oriented Programming Lab.	0-0-4-4	2
Total			15-0-1227	21

PCC	PC-IT691	Database Management Systems Lab	0-0-4-4	2
PCC	PC-IT692	Computer Networks Lab	0-0-4-4	2
Proj	PR-IT691	Project-I	0-0-2-2	1
Total			16-0-10-26	21

4th Year

CC	SC	Subject Name	Contact Hrs./Week	
			L –T-P-TO	Cr.
HM	HU-IT701	Project Management and Entrepreneurship	2-1-0-3	3
PEC	PE-IT702	Professional Elective-IV a.Internet Technology b.Quantum Computing c. Cloud Computing d.Advanced Operating System	3-0-0-3	3
OEC	PC-IT701	Professional Elective-V a. Multimedia Technology b.Neural Networks and Deep Learning c.Soft Computing d. Ad-Hoc and Sensor Networks e.Information Theory and Coding f.Cyber Security	3-0-0-3	3
OEC	OE-IT701	Open Elective-II a.Human Computer Interaction b.Introduction to Philosophical Thoughts c. Soft Skill & Interpersonal Communication	3-0-0-3	3
OEC	OE-IT702	Open Elective-III a.Operations Research b. Mobile Computing c. Robotics d.Microwave	3-0-0-3	3
Proj	PR-IT781	Project-II	0-0-12-12	6
Total Credit			14-1-12-27	21

CC	SC	Subject Name	Contact Hrs./Week	
			L–T-P-TO	Cr.
HUM	HM-HU801	Financial Management and Accounts	3-0-0-3	3
PEC	PE-IT801	Professional Elective-VI a.Signals and Networks b.Cryptography & Network Security c. Speech and Natural Language Processing d.Internet of Things	3-0-0-3	3
OEC	OE-IT801	Open Elective-IV a.Big Data Analysis b.Cyber Law and Ethics c. E-Commerce and ERP d.Micro-electronics	3-0-0-3	3
Proj	PR-IT881	Project-III	0-0-12-12	6
Proj	PR-IT882	Viva	0-0-0-0	2
Proj	PR-IT883	Internship Evaluation	0-0-0-0	0
			9-0-12-21	17

SEMESTER - III

Theory

VALUES & ETHICS IN PROFESSION

HM-HU(IT)301
Contracts:3L
Credits- 2

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Appropriate Technology Movement of Schumacher; later developments

Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life

Psychological values: Integrated personality; mental health

Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Syllabus of Analog & Digital Electronics
Code: ES-IT301
Name of the Course: Analog & Digital Electronics

Course Code: ES-IT301, Semester**:** III **Duration:** 6 months Maximum, Marks**:**100

Teaching Scheme Examination Scheme: Theory: 3 hrs./**week Mid Semester exam:** 15

Tutorial: NIL Assignment and **Quiz:** 10 marks

Attendance: 5 marks

Practical: 3 hrs./week End Semester Exam :70 Marks, **Credit Points:** 3

1. COURSE OVERVIEW:

The course has been designed to introduce fundamental principles of analog and digital electronics.The students completing this course will understand basic analog and digital electronics, including semiconductor properties, operational amplifiers, combinational and sequential logic and analog-to - digital digital-to-analog conversion techniques. Finally, students will gain experience in with the design of analog amplifiers, power supplies and logic devices.

2. PREREQUISITS:

1. Basic Electronics
2. Number Systems

3. COURSE OBJECTIVES:

1.	To introduce different classes of amplifiers
2.	To give Understand of various types of amplifier circuits.
3.	To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
4.	To understand the concepts of combinational logic circuits and sequential circuits.

4. COURSE OUTCOMES:

S.No.	Outcomes
1.	Know the characteristics of various components.
2.	Understand the utilization of components.
3.	Design and analyze small signal amplifier circuits.
4.	Learn Postulates of Boolean algebra and to minimize combinational functions.
5.	Design and analyze combinational and sequential circuits.

6.	Know about the logic families and realization of logic gates.

Module -1:

1. Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency [2L]; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillator.
2. Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer.

Module – 2:

Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR.

Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic; Representation in SOP and POS forms;
Minimization of logic expressions by algebraic method.

Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor; Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.

Module - 3:

a. Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops,
b. Registers (SISO, SIPO, PIPO, PISO), Ring counter, Johnson counter. Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter

Module – 4:

a. A/D and D/A conversion techniques – Basic concepts (D/A: R-2-R only A/D: successive approximation
b. Logic families- TTL, ECL, MOS and CMOS - basic concepts.

Textbooks:

Microelectronics Engineering - Sedra & Smith-Oxford.

Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand

Digital Electronics – Kharate – Oxford

Digital Electronics – Logic & Systems by J.Bigmell &
R.Donovan; Cambridge Learning. Digital Logic and State
Machine Design (3rd Edition) – D.J.Comer, OUP **Reference:**

Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI

Bell-Linear IC & OP AMP—Oxford

P.Raja- Digital Electronics- Scitech Publications

Morries Mano- Digital Logic Design- PHI

R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill

H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.

D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers

Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

J.Bignell & R.Donovan-Digital Electronics-5/e-
Cenage Learning. Leach & Malvino—Digital
Principles & Application, 5/e, Mc Graw Hill Floyed
& Jain- Digital Fundamentals-Pearson.

Syllabus of Data Structure & Algorithm

Code: PC-IT301,

Contacts: 3L

Name of the Course: Data Structure & Algorithm

Course Code: PC-IT301, Semester**:** III **Duration:** 6 months Maximum, Marks**:**100

Teaching Scheme Examination Scheme: Theory: 3 hrs./**week Mid Semester exam:** 15

Tutorial: NIL Assignment and **Quiz:** 10 marks

Attendance: 5 marks

Practical: 3 hrs./week End Semester Exam :70 Marks, **Credit Points:** 3

Objective:

1 To learn the basics of abstract data types.

2 To learn the principles of linear and nonlinear data structures.

3 To build an application using sorting and searching

Pre-Requisite:

1 CS 201 (Basic Computation and Principles of C)

2 M101 & M201 (Mathematics), basics of set theory

Unit Content Hrs/Unit Marks/Unit

Sl No.	Unit Content	Hrs
1.	Data, Information, Abstract Data Type, Data Structure, Relation between Abstract Data Type and Data structures, Algorithm, Characteristics of an Algorithm Introduction to Data Structure, Classification of Data Structures **Data Structure Operations:** insertion, deletion, traversal, sorting, merging etc.; **Different cases of Time Complexities:** Best case, Average case, Worst case, Example	8

	Asymptotic Notations (O, o, Ω, ω, Θ): Necessary of asymptotic notations in Data Structure, Big oh (O), Small oh (o), Big omega (Ω), Small omega (ω), Theta (Θ), Geometrical Interpretation of each Asymptotic Notation Properties of Big oh (O) Asymptotic Notations, Time-Space trade off.	
2	**Array Data Structure:** Representation Linear Array in Memory, Representation of Two-Dimensional Array in Memory, Representation of Multidimensional Array in Memory Operations on Array Data Structure: Traversing Linear Array, Insertion Operation (Time complexity Analysis :Best Case Analysis, Worst Case Analysis), Deletion Operation (Time complexity Analysis: Best Case Analysis, Worst Case Analysis), Binary Search Algorithm (Time complexity Analysis :Best Case Analysis, Worst Case Analysis), **Searching:** Linear Search and Binary Search Techniques and their complexity analysis. **Sparse Matrix:** Definition, Different Types of Sparse Matrices, Representation of Sparse Matrix using Array	5
3	**Linked List:** Classification of Linked List, Classification of Linked List with respect to Implementation (Static Linked List and Dynamic Linked List), Representation in memory, **Operations on Single Linked List:** Creation of Single Dynamic Linked List, Display the Linked List (Iterative and recursive Algorithms), Searching Operation, Insertion Operation, Deletion Operation, Reverse Print the Linked List (Iterative and Recursive Method), Reverse the Linked List. **Doubly linked list:** Operations on it and algorithmic analysis; **Circular Linked Lists:** all operations their algorithms and the complexity analysis	5
4	**Stacks and Queues:** **Stack:** ADT Stack and its operations, Algorithms and their complexity analysis, Application of stack: Transformation of Infix Arithmetic Expression into Equivalent Postfix Expression, Evaluation of Postfix Expression, Recursion, Tower of Hanoi Problem - corresponding Algorithms and Complexity Analysis. **Queue:** ADT queue, Classification of Queue: Linear Queue, Double ended Queue, Priority Queue and Circular Queue, **Queue Classification with respect to Implementation:** Static Queue (using array) & Dynamic Queue (using Dynamic Linked List), Representation Static Linear Queue, **Operations on Static Queue:** Insertion, Deletion, Display Representation Dynamic Linear Queue, **Operations on Dynamic Queue:** Insertion, Deletion, Display **Circular Queue:** Advantage of Circular Queue over Linear Queue, and Implementation (Insertion, Deletion & Display) using Array	5
5.	**Trees:** Definition of Tree, Binary Trees, Complete Binary Trees, Extended Binary Trees: 2-Trees, **Representation Binary Trees in Memory:** Linked Representation of Binary Trees, Sequential Representation of Binary Trees, **Different types of Binary Trees:** Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; **Traversing Binary Trees:** Preorder Traversal, Inorder Traversal , Postorder Traversal , **Threaded Binary Trees:** Inorder Threading (One Way / Two Way), Preorder Threading (One Way / Two Way),	9

	Binary Search Trees (BST): Searching in BST, Inserting in BST, Complexity of the Searching Algorithm in BST, Deleting in a BST, Problems of BST, **AVL Search Trees:** Definition, Different types of rotations techniques, Insertion in an AVL Search Trees, Deletion Operation, Advantage of AVL Search tree over BST, Heap Trees (Max / Min Heap), Inserting into a Heap, Deleting the Root of a Heap tree, Tree operations on each of the trees and their algorithms with complexity analysis. **General Trees:** m- Way Search Trees, B Trees, B+ -Trees Applications of Binary Trees, BST, Heap Trees, B Tree, B+ Tree: definitions, algorithms and analysis **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms (BFS & DFS) and complexity analysis.	
6.	**Sorting:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Modified Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Radix Sort. Performance Analysis and Comparison among all the sorting methods, **Hashing:** Definition, Properties of good Hash function, Importance Hashing technique, Different Types of Hashing Technique	6

Text book and Reference books:

1. “Fundamentals of Data Structures of C” by Ellis Horowitz, Sartaj Sahni, Susan Andersonfreed.

2. “Data Structures in C” by Aaron M. Tenenbaum.

3. “Data Structures” by S. Lipschutz.

Course Outcomes:

On completion of the course students will be able to

PCC-CS301.1 Differentiate how the choices of data structure & algorithm methods impact the performance of program.

PCC-CS301.2 Solve problems based upon different data structure & also write programs.

PCC-CS301.3 Identify appropriate data structure & algorithmic methods in solving problem.

PCC-CS301.4 Discuss the computational efficiency of the principal algorithms for

sorting, searching, and hashing

PCC-CS301.5 Compare and contrast the benefits of dynamic and static data structures

implementations.

Syllabus of Computer Architecture

Code: PC-IT302

Contacts: 3L

Name of the Course: Computer Architecture

Course Code: PC-IT302, Semester**:** III **Duration:** 6 months Maximum, Marks**:**100

Teaching Scheme Examination Scheme: Theory: 3 hrs./**week Mid Semester exam:** 15

Tutorial: NIL Assignment and **Quiz:** 10 marks **Credit Points:** 3

Attendance: 5 marks

Learning Objectives: To understand the structure, function and characteristics of computer systems. • To understand the design of the various functional units and components of computers. • To identify the elements of modern instructions sets and their impact on processor design. • To explain the function of each element of a memory hierarchy, • To identify and compare different methods for computer I/O.

Introduction: Review of basic structure and arithmetic of computer

architecture.

9L

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards,

control

hazards, and structural hazards, techniques for handling hazards. Exception

handling.

Pipeline optimization techniques. Compiler techniques for improving

performance.

9L

Memory Management: Hierarchical memory technology: Inclusion, Locality

properties; Cache memory

organizations,

Techniques for reducing cache misses; Virtual memory organization, Mapping

and

management

techniques, Memory replacement policies.

4L

Array and vector processors.

7L

Multiprocessor architecture: Taxonomy of parallel architectures. Centralized

shared

memory

Architecture Synchronization, Memory consistency, Interconnection networks.

Distributed shared memory architecture. Model of memory consistency, Cache

coherency,

Multiprocessing snooping protocol, Multiprocessing directory protocol.

5L

Parallelism: Parallel processing challenges – Flynn ‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

Suggested readings:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.

2. Behrooz Parhami' s, Textbook on Computer Architecture

3. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.

4. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing

5. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.

Mathematics-III (Differential Calculus)
Code: BS-M(IT)301
Contacts: 2L

Name of the Course:	Mathematics-III (Differential Calculus)	
Course Code: BS-M(IT)301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory:2 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	2	
Objective:		
1	To know Convergence of sequence and series	
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function	
3	To know First Order Differential Equation, Exact, Linear and Bernoulli’s equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph	
Pre-Requisite:		

1	Concept Linear Algebra Determinant and its properties (up to third order)
2	Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric

Unit	Content	Hrs/Unit	Marks/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8	
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7	
3	Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems.	8	
4.	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. [5L]	9	
	Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]		
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8	

Text book and Reference books:

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
6. Advanced Engineering Mathematics, E Kreyszig,
7. Advanced Engineering Mathematics, Chandrika Prasad, Khanna Publishing House
8. Differential Calculas, Shanti Narayan, S.Chand Publications

Course Outcomes:

On completion of the course students will be able to

BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.

BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

BSC-301.3 Use tree and graph algorithms to solve problems

BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

Analog & Digital Electronics Lab.
Code: ES-IT391
Cr: 2

ANALOG: At least any two of the following

1. Design a Class A amplifier
2. Design a Phase-Shift Oscillator
3. Design of a Schmitt Trigger using 555 timer.

DIGITAL: At least any five of the following

1. Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
2. Construction of simple Decoder & Multiplexer circuits using logic gates.
3. Realization of RS / JK / D flip flops using logic gates.
4. Design of Shift Register using J-K / D Flip Flop.
5. Realization of Synchronous Up/Down counter. 6. Design of MOD- N Counter
7. Study of DAC.

Any one experiment specially designed by the college.

Name of the Course: Data Structure & Algorithm Lab

Course Code: PC-IT391, **Semester:** III , **Duration:** 6 months

Maximum Marks: 100, Teaching Scheme: Theory: hrs./week Continuous

Internal Assessment Tutorial: NIL External Assessment: 60 Practical: 4 hrs./week

Distribution of marks: 40, **Credit Points**: 2 Course

Outcomes:

1 PCC-CS301.1

2 PCC-CS301.2

3 PCC-CS301.3

4 PCC-CS301.4

5 PCC-CS301.5

Pre-Requisite: Pre-requisites as in PCC-CS301

Laboratory Experiments:

- **Revision Basic Computation and Principles of C Language**

Day 1:

Problem 1:

Write a program in C language to generate first n Fibonacci numbers using:

1. For loop

2. While loop
3. Do-while loop

where the value of n is taken as input dynamically.

Problem 2:

Write a menu driven program in C language to perform the following operations:

1. To check whether a given number is prime or not?
2. To check whether a given number is Armstrong or not?
3. Find out the largest among three numbers.
4. Exit
5.

Problem 3:

Write a program in C language to store all elements in an array and display them and search the position of a given item in functional way.

Problem 4:

Write a program in C language to take a String as an input having length n (dynamically) and generate all possible strings from the n symbols of your given string and display the total number of strings.

Problem 5:

Write a program in C language to calculate the length of given string and reverse this given string without using any string library function.

Day 2:

Problem 1:

Write a menu driven program in C to create the diagrams of the Circle, Rectangle and Triangle using functions and perform the following operations on your created diagrams:

1. Translation operation.
2. Rotation operation with respect to a given point.
3. Scaling operation.

Day 3:

Problem 1:

Write a program in C to implement an Analogue Clock and a Digital Clock where the time will be set by the user according to his/her choice (manually or system clock).

Problem 2:

Write a menu driven program in C to implement the following basic operations of FILE:

1. Reading a file.
2. Writing a file.
3. Closing a file.
4. Reading and writing strings to file.
5. Reading and writing binary files.

Problem 3:

Write a menu driven program in C to read name and marks of n number of students from user and stores them in a file and perform the following operations using functions:

1. Append new record of a student to the existing file.
2. Delete a record of a specific student.
3. Update a field of student.
4. Display all records.

Day 4:

Problem 1:

Write a menu driven program in C to implement the following basic operations of a FILE:

1. Print the contents of file
2. Copy contents of one file to another file
3. Merge contents of two file into a third file
4. Delete a specific file

Problem 2:

Write a program in C to convert a given gray level image file(*.pgm) into negative image.

Problem 3:

Write a program in C to implement a student database (*.csv File) and perform the insertion , deletion , updating and searching operation on your created CSV file.

- ## Assignments on Linear Data Structures

Day 5:

Problem 1:

Write a program in C to perform the following operations in Array data structure:

1. Creation
2. Display
3. Linear Search
4. Binary Search
5. Insertion Operation
6. Deletion by a given position
7. Deletion by a given item

Day 6:

Problem 1:

Write a program in C to perform the following operations in Array data structure:

1. Creation
2. Display
3. Selection Sort
4. Bubble Sort
5. Modified Bubble Sort
6. Insertion Operation

7. Merge Sort

Day 7:

Problem 1:

Write a program in C to perform the following operation of single Dynamic Linked list :

1. Creation
2. Display
3. Display using recursive function
4. Searching
5. Insertion
6. Deletion
7. Reverse print
8. Reverse the linked list

Day 8:

Problem 1:

Write a program in C to perform the following operation of Dynamic Double Linked list:

1. Creation
2. Display
3. Display using recursive function
4. Searching
5. Insertion
6. Deletion
7. Reverse print
8. Reverse the linked list

Day 9:

Problem 1:

Write a program in C to implement the following operations on circular Linked lists:

1. Creation
2. Display
3. Insertion
4. Deletion
5. Searching

Problem 2:

Write a program in C to implement the following functions in stack:

1. Push
2. Pop
3. Display

Day 10:

Problem 1:

Write a program in C to convert a given infix expression into an equivalent postfix expression.

Problem 2:

Write a program to implement the postfix evaluation algorithm.

Day 11:

Problem 1:

Write a program in C to implement:

1. Static queue
2. Dynamic queue
3. Circular queue

to perform the following operations:

a. Insert
b. Delete
c. Display

Problem 2: Write a program in C to implement tower of Hanoi problem.

- **Assignments on Non-Linear Data Structures**

Day 12:

Problem 1:

Write a program in C to implement Binary Search Tree (BST) to perform the following operations:

1. Creation
2. In order traversal
3. Post order traversal
4. Pre order traversal
5. Searching
6. Insertion
7. Deletion

Day 13:

Problem 1:

Write a program in C to implement Heap Tree (Max Heap) using Array to perform the following operations:

1. Creation
2. In order traversal
3. Post-order traversal
4. Pre-order traversal
5. Sorting
6. Display the original list and sorted list

Computer Architecture Lab

Course Code: PC-IT392 , **Semester:** III , **Duration:** 6 months

Maximum Marks: 100, Teaching Scheme: Theory: hrs./week Continuous

Internal Assessment Tutorial: NIL External Assessment: 60 Practical: 4 hrs./week

Distribution of marks: 40, **Credit Points**: 2

1. Performance evaluation. Amdahl's law.

2. Instruction set measurements.

3. Pipelined design.

4. Instruction pipeline design.

5. Programming pipelined computers.

6. Increasing ILP with compilation techniques. 7. Dynamic scheduling:

Tomasulo's algorithm. 8. Speculation.

9. Vector computer programming.

10. Multicomputer programming.

IT Workshop (Sci Lab/MATLAB/Python/R)
Code: PC-IT393
Contacts: 4P

Name of the Course:	IT Workshop (Sci Lab/MATLAB/Python/R)
Course Code: PC-IT393	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	To master an understanding of scripting & the contributions of scripting languages
2	Design real life problems and think creatively about solutions
3	Apply a solution in a program using R/Matlab/Python.
4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
Pre-Requisite:	
1.	Knowledge of Programming Logic
2.	Experience with a high level language (C/C++,) is suggested
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Practical Syllabus

Programming in R

1. Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc. Operators in R.

2. R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, RVector Function, Recursive Function in R.

3. R Packages (Install and Use), Input/Output Features in R, Reading or Writing in File. Data Manipulation in R. Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution, Decision tree

4. Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.

Programming in Matlab

Introduction

Why MATLAB?, History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB

Basics

Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables

Programming-I

Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept

Programming-II

Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file

Conditional statements and Loop

Relational and Logical Operators, If-else statements, Switch-case statements, For loop,
While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database

2D Plotting

In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface

3D Plotting

Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

Programming with Python

Introduction

History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator

Conditional Statements

If, If- else, Nested if-else, Looping, For, While, Nested loops

Control Statements

Break, Continue, Pass

String Manipulation
Accessing Strings, Basic Operations, String slices, Function and Methods

Lists
Introduction, accessing list, Operations, Working with lists, Function and Methods

Tuple
Introduction, Accessing tuples, Operations, Working, Functions and Methods

Dictionaries
Introduction, accessing values in dictionaries, Working with dictionaries, Properties

Functions
Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

Modules
Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions

Exception Handling
Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

Laboratory Experiments:	
1	Practical Assignments related with implementation of PCC-CS393

Essence of Traditional Knowledge
Code: MC-IT301
Contacts: 2L

Name of the Course:	Essence of Traditional Knowledge	
Course Code: MC-IT301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory:2 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	0	

Learning Outcomes

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life

Course Outcomes:

1. At the end of the Course, Student will be able to:
2. Identify the concept of Traditional knowledge and its importance.
3. Explain the need for and importance of protecting traditional knowledge.

4. Illustrate the various enactments related to the protection of traditional knowledge.
5. Interpret the concepts of Intellectual property to protect the traditional knowledge.

Explain the importance of Traditional knowledge in Agriculture and Medicine.

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lectures
Unit I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge(Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Uttarakhand	07
Unit II	Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	07
Unit III	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	06
Unit IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	04
Unit V	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06

Suggested Reading:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:
Web Links:
1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/121106003/

SEMESTER – IV

Discrete Mathematics
Code: PC-IT401
Contacts: 3L+1T

Name of the Course:	Discrete Mathematics	
Course Code: PC-IT401	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hour/week		Assignment and Quiz : 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	4	

Objective:	
1	Use mathematically correct terminology and notation.
2	Construct correct direct and indirect proofs.
3	To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees
4	Use counterexamples. Apply logical reasoning to solve a variety of problems.
Pre-Requisite:	
1	Some concepts from basic math – algebra, geometry, pre-calculus

Unit	Content	Hrs/Unit	Marks/Unit
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The WellOrdering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	8	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	5	

3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables,	8	
	Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Biconnected component and Articulation Points, Shortest distances.	8	

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.

14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
19. S.B. Singh, Discrete Structures, KPH
20. S.B. Singh, Combinatorics & Graph Theory, Khanna Book Publishing Co. (P) Ltd. Delhi

Course Outcome(s)

On completion of the course students will be able to

PC-IT401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PC-IT401.3 Classify its algebraic structure for a given a mathematical problem,

PC-IT401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PC-IT401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

PC-IT401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

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Biology

Code: BS-CH(IT)401

Contacts: 2L+1T

Name of the Course:	Biology	
Course Code: BS-CH(IT)401	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory: 2hrs./week		Mid Semester exam: 15
Tutorial: 1 hour		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	2	
Objective:		
1	Bring out the fundamental differences between science and engineering	
2	Discuss how biological observations of 18_{th} Century that lead to major discoveries	
Pre-Requisite:		
1	Basic knowledge of Physics, Chemistry and mathematics	

Unit	Content	Hrs/Unit	Marks/Unit

1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18_{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2	
2	The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)	3	
	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus		

3	To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4	

4.	Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.	4	
5	Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4	
6	Information Transfer: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA	4	
	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.		
7	Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
8	Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of $K_{eq}$and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4	
9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	

Text books/ reference books:

Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

1. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
2. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
3. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
4. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
5. Biology for Engineers, McGraw Hill (ISBN: 978-11-21439-931)

Course Outcomes:

On completion of the course students will be able to

BS-CH(IT)401.1 Describe how biological observations of 18_{th} Century that lead to major discoveries.

BS-CH(IT)401.2 Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological

BS-CH(IT)401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring

BS-CH(IT)401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine

BS-CH(IT)401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BS-CH(IT)401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BS-CH(IT)401.7 Analyse biological processes at the reductionistic level

BS-CH(IT)401.8 Apply thermodynamic principles to biological systems.

BS-CH(IT)401.9 Identify and classify microorganisms.

Computer Organization

Code: PC-IT402 Contacts: 3L

Name of the Course:	Computer Organization	
Course Code: PC-IT402	Semester: IV	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	4	
Objective:		
1	To prepare students to perform the analysis and design of various digital electronic circuits.	

2	To know how Computer Systems work & its basic principles
3	To know how I/O devices are being accessed and its principles etc
Pre-Requisite:	
1	Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Boolean Algebra
2	Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming
3	Boolean Algebra

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers.[1L]	8	
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication -Booth's algorithm. [1L]	8	
	Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L]		
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L]	10	
4.	Design of control unit - hardwired and microprogrammed control. [3L] Introduction to instruction pipelining. [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L]	10	

Text book and Reference books:

1. Mano, M.M., “Computer System Architecture”, PHI.
2. Behrooz Parhami “Computer Architecture”, Oxford University Press

3. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
4. Hamacher, “Computer Organisation”, McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers” OUP
6. Chaudhuri P. Pal, “Computer Organisation & Design”, PHI,
7. P N Basu- “Computer Organization & Architecture” ,Vikas Pub
8. B. Ram, “Computer Organization & Architecture”, Newage Publications
9. I. Singh – “Computer Organization & Architecture”, Khanna Publishing House

Course Outcomes:

On completion of the course students will be able to

PC-IT402.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

PC-IT402.2 Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.

PC-IT402.3 Perform different operations with sequential circuits. PCC-CS302.4 Understand memory and I/O operations.

Formal Language & Automata Theory

Code: PC-IT403

Contacts: 3L

Name of the Course:	Formal Language & Automata Theory	
Course Code: PC-IT403	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	Be able to construct finite state machines and the equivalent regular expressions.	
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions	

3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines
Pre-Requisite:	
1	Grammar and its classification (Context Free Grammar)

Module / Sl. No.	**Module Name and Topics**	**No. of Lectures**
1	**Introduction:** Computations, Different models of computation, Language recognizer and generator	2
2	**Regular Languages:** Finite Automata – Deterministic and non determininstic,Regular expression, regular grammar, Equivalence of regular languages, Pumping lemma, Myhill-Nerode Theorem, Minimization of FSM, Properties of the class of Regular languages, Decision algorithm for regular sets.	12
3	**Context Free Language:** Context free grammers (CFG) and languages (CFL), Parse trees, Ambiguous, unambiguous and inherently ambiguous grammars, Normal Forms (Chomsky and Greibach), simplification of CFG, Pushdown automata (deterministic and non determininstic), Acceptance of language by empty stack, final state and their equivalence, Properties of the class of CFLs, Proving a language to be CFL or not, Pumping lemma for CFG, Decision algorithm for CFG	12
4	**Recursive and Recursively enumerable Language:** Unrestricted grammar, Computable function, Turing Machines (deterministic and non determininstic), Equivalence of deterministic and non deterministic TM, Extensions og TM and their simulations, Universal TM, Halting problem of TM, Decidability, Non-computability, Complexity classes, notion of reductions	10

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B. Patel, Theory of Computation, Khanna Publishing House
7. Mishra, Theory of Computers, PHI Publications

Course Outcomes:

On completion of the course students will be able to

PC-IT403.1 Write a formal notation for strings, languages and machines.
PC-IT403.2 Design finite automata to accept a set of strings of a language.
PC-IT403.3 For a given language determine whether the given language is regular or not.
PC-IT403.4 Design context free grammars to generate strings of context free language.
PC-IT403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
PC-IT403.6 Write the hierarchy of formal languages, grammars and machines.
PC-IT403.7 Distinguish between computability and non-computability and Decidability and undecidability

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Design and Analysis of Algorithms
Code: PC-IT404
Contacts: 3L

Name of the Course:	Design and Analysis of Algorithms
Course Code: PC-IT404	Semester: IV
Duration: 6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks

Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	4	
Objective:		
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them	
2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.	
Pre-Requisite:		
1	To know data-structure and basic programming ability	

	Module Name and Topics	No. of Lectures
1	**Mathematical Foundations and Basic of Complexities:** Time and Space complexity, Asymptotic growth of functions, Recurrences and methods of solving recurrences (substitution, iteration, recursion tree, Master method). Worst, Average and Amortized complexities.	4
2	**Design and Analysis techniques:** Divide and Conquer, Dynamic programming, Greedy Algorithms	4
3	**Sorting and Order Statistics:** Quicksort and Mergesort Complexity analysis as divide and conquer strategy, Lower bound for comparison based sorting, Sorting in linear time (Counting, Radix and Bucket sort), Selection of Medians and ranked elements and their complexity	4
4	**Example Algorithms for dynamic programming (selective list, not exhaustive):** Matrix chain multiplication, Longest common subsequence, Polygon triangulation.	4
5	**Example Algorithms for greedy strategy (selective list, not exhaustive):** Data compression, Matroid based formulation, Scheduling algorithm	4
6	**Advanced Data Structures and applications:** Data structures for dynamic sets, Hashing and associated search complexity, Data structures for disjoint sets, Complexity of union and find operations.	4
7	**Graph algorithms (selective list, not exhaustive):** Minimum Spanning Trees of graph , Connected components of graph, Single source and all-pair shortest paths	4
8	**Number theoretic algorithm:** Fast exponentiation, GCD algorithm, Primality testing algorithm, Handling large size integers, Algorithms for public key cryptography	4
9	**Concept of NP-Completeness:** Polynomial-time verification, Concept of NP-hard and NP-completeness, Notion of approximation	4

	Algorithms for NP- complete problems	
	Total	36

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
7. Gajendra Sharma, Design & Analysis of Algorithms, Khanna Publishing House, Delhi

Course Outcomes

On completion of the course students will be able to

PC-IT404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

PC-IT404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

PC-IT404.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

PC-IT404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PC-IT404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

PC-IT404.6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

PC-IT404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PC-IT404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

Environmental Sciences
Code: MC-IT401
Contacts: 1L

Name of the Course:	Environmental Sciences		
Course Code: MC-IT401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:1hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	0		
Objective:			
1	Be able to understand the natural environment and its relationships with human activities.		
2	Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.		
3	Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.		
4	Be able to solve scientific problem-solving related to air, water, noise & land pollution		
Pre-Requisite:			
1	Basic knowledge of Environmental science		

Unit	Content	Hrs/Unit	Marks/Unit

1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic	6	

	degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)		
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6	

3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria	11	

	pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)		

4.	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)	9	
5	Lithosphere; Internal structure of earth, rock and soil (1L)	3	
	Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)		

6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	3	
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2	

Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", PrenticeHall of India Pvt. Ltd.,1991.
2. Erach Bharucha, Environmental Studies, University Press
3. M.P. Poonia, Environmental Studies, Khanna Publishing House
4. De, A. K., "Environmental Chemistry", New Age International
5. Rajagopalan, Environmental Studies, Oxford University Press

Course Outcomes:

On completion of the course students will be able to

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MC-IT401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-IT401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-IT401.4 Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

MC-IT401.1 To understand the natural environment and its relationships with human activities

PRACTICAL SYLLABUS
Semester IV

Computer Organization Lab
Code: PC-IT491
Contacts: 4P

Name of the Course:	Computer Organization Lab
Course Code: PC-IT491	Semester: IV

Duration:6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PC-IT402.1
2	PC-IT402.2
3	PC-IT402.3
4	PC-IT402.4
Pre-Requisite:	
Pre-requisites as in PC-IT402	

Laboratory Experiments:	
1	Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2	Design an Adder/Subtractor composite unit.
3	Design a BCD adder.
4	Design of a ‘Carry-Look-Ahead’ Adder circuit.
5	Use a multiplexer unit to design a composite ALU
6	Use ALU chip for multibit arithmetic operation
7	Implement read write operation using RAM IC
8	8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Design & Analysis Algorithm Lab

Code: PC-IT492

Contact: 4P

Name of the Course:	Design & Analysis Algorithm Lab
Course Code: PC-IT492	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PC-IT404.1
2	PC-IT404.2
3	PC-IT404.3
Pre-Requisite:	
Pre-Requisite as in : PC-IT404	

Module / Sl. No.	Module Name and Topics	No. of Lectures
1	Experimentation of Various comparison sort algorithms (Bubble sort, insertion sort, selection sort, merge sort, randomized quick sort) and comparing their efficiencies	6
2	Experimentation of Linear time sorting algorithms (Bucket sort)	3
3	Experimentation of k-th smallest element of an array	6
4	Applications of Dynamic Programming	3
5	Applications of Greedy algorithms	6
6	Implementation of graph algorithms (minimum spanning tree)	6
7	Implementation of graph algorithms (connected components)	3
	Total	36

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)