Jalpaiguri Government Engineering College

UG Syllabus (2021-22)

Computer Science & Engineering

Third Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	HSMC	HSMC 301	Economics for Engineers	2	0	0	2
2	BSC	BS-CH301	Biology for Engineers	2	0	0	2
3	ESC	ESC301	Digital Electronics	3	0	0	3
4	PCC	PCC-CS301	Computer Organization	3	0	0	3
5	PCC	PCC-CS302	Data Structure & Algorithms	3	0	0	3
6	MC	MC301	Essence of Traditional Knowledge	3	0	0	0
7	ESC	ESC-CS391	Digital Electronics Lab	0	0	4	2
8	PCC	PCC-CS391	Computer Organization Lab	0	0	4	2
9	PCC	PCC-CS392	Data Structure & Algorithms Lab	0	0	4	2
10	PCC	PCC-CS393	IT Workshop (Python/R/Sci Lab/MATLAB)	0	0	4	2
				16	0	16	21

Fourth Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	BSC	BS-M401	Mathematics III	3	0	0	3
2	PCC	PCC-CS401	Computer Architecture	3	0	0	3
3	PCC	PCC-CS402	Design and Analysis of Algorithms	3	0	0	3
4	PCC	PCC-CS403	Object Oriented Programming	3	0	0	3
5	PCC	PCC-CS404	Formal Language and Automata Theory	3	0	0	3
6	MC	MC401	Environmental Sciences	3	0	0	0
7	PCC	PCC-CS491	Computer Architecture Lab	0	0	4	2
8	PCC	PCC-CS492	Design and Analysis of Algorithms Lab	0	0	4	2
9	PCC	PCC-CS493	Object Oriented Programming Lab	0	0	4	2
				18	0	12	21

UG Syllabus (2021-22)

Computer Science & Engineering

Fifth Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	PCC	CS501	Software Engineering	3	0	0	3
2	PCC	CS502	Discrete Mathematics	3	0	0	3
3	PCC	CS503	Database Management Systems	3	0	0	3
4	PCC	CS504	Operating System	2	0	0	2
5	PEC I	PEC-CS501 A/B/C/D	A. Advance Computer Architecture B. Soft Computing C. Advance Operating Systems D. Operation Research	3	0	0	3
6	PEC II	PEC-CS502 A/B/C/D	A. Computer Graphics B. Advance Algorithms C. Artificial Intelligence D. Pattern Recognition	3	0	0	3
7	PCC	CS-591	Database Management Systems Lab	0	0	4	2
8	PCC	CS-592	Operating System Lab	0	0	4	2
				17	0	8	21

Sixth Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	HUM	HU601	Principles of Management	2	0	0	2
2	PCC	CS601	Compiler Design	3	0	0	3
3	PCC	CS602	Computer Networks	3	0	0	3
4	PEC III	PEC-CS601 A/B/C	A. Data Warehousing and Data Mining B. Big Data C. Distributed Database D. Signals & Networks	3	0	0	3
5	PEC IV	PEC-CS602 A/B/C/D	A. Graph Theory B. Information Theory & Coding C. Image Processing D. Social Network Analysis	3	0	0	3
6	OEC	OEC-CS601	Soft Skills and Interpersonal Communication	2	0	0	2
7	PCC	CS691	Compiler Design Lab	0	0	4	2
8	PCC	CS692	Computer Network Lab	0	0	4	2
9	Project	PROJ-CS681	Project I	0	0	2	1
				16	0	10	21

UG Syllabus (2021-22)

Computer Science & Engineering

Seventh Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	ESC	ESC-CS701	Signal and Systems	3	0	0	3
2	PEC V	PEC-CS701 A/B/C/D	A. Adhoc and Sensor Networks B. Mobile Computing C. Neural Networks & Deep Learning D. Data Science	3	0	0	3
3	PEC VI	PEC-CS702 A/B/C/D	A. Natural Language Processing B. Human Computer Interaction C. Cloud Computing D. Machine Learning	3	0	0	3
4	OEC	OEC-CS701 A/B	A. Human Resource Development and Organizational Behaviour B. Indian Music System	3	0	0	3
5	OEC	OEC-CS702 A/B/C/D	A. Internet of Things B. Bio Informatics C. Introduction to GIS & Remote Sensing D. Robotics	3	0	0	3
6	Project	PROJ-CS781	Project II	0	0	12	6
				15	0	12	21

Eighth Semester

Sl No	Category	Subject Code	Subject Name	Total number of contact hours/week			Credits
				L	T	P	
1	HUM	HU801	Financial Management	3	0	0	3
2	PEC VII	PEC-CS801 A/B/C	A. Cyber Security B. Cryptography & Network Security C. Introduction to Blockchain Technology	3	0	0	3
3	OEC	OEC-CS801 A/B/C	A. Cyber Law and Ethics B. Economic Policies in India C. E-Commerce and ERP	3	0	0	3
4	Project	PROJ-CS881	Project III	0	0	12	6
5		CS882	Viva-Voce	0	0	0	2
6		CS883	Internship Evaluation (All three)	0	0	0	0
				9	0	12	17
Total Credits:							

Jalpaiguri Government Engineering College

UG Syllabus (2021-22)

Computer Science & Engineering

Semester III

Economics for Engineers **Code: HSMC301** **Contact: 2L**			
Name of the Course:	**Economics for Engineers**		
Course Code:	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	
Practical: hrs./week		Attendance: 5 marks	
		End Semester Exam : 70 Marks	
Credit Points:	2		

Objective:	
1	Understand the role and scope of Engineering Economics and the process of economic
2	Understand the different concepts of cost and different cost estimation techniques
3	Familiarization with the concepts of cash flow, time value of money and different interest formula
4	Appreciation of the role of uncertainty future events and using different concepts from probability to deal with uncertainty
5	Understand the concept of Depreciation and Replacement analysis along with their methods of calculations
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering economics
7	Introduction to basic concepts of Accounting and Financial Management

Pre-Requisite			
1	Mathematics		

Unit	Content	Hours or lectures
1	Economic Decisions Making – Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power- Sizing Model, Improvement & Learning Curve, Benefits.	9

2	Cash Flow, Interest and Equivalence: Cash Flow –Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.	9
3	Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.	9
4	Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight- Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	9
Text book and Reference books:		
	1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill 2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP 3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley 4. Sullivan and Wicks: Engineering Economy, Pearson 5. R.Paneer Seelvan: Engineering Economics, PHI 6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub 7. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House (AICTE Recommended Textbook – 2018)	

Course Outcomes	
	On completion of the course students will be able to HSMC-301.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models. HSMC-301.2 Create cash flow diagrams for different situations and use different interest formulae to solve associated problems. HSMC-301.3 Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc. HSMC-301.4 Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation. HSMC-301.5 Understand the concepts of depreciation and replacement analysis and solve associated problems. HSMC-301.6 Understand the process of inflation and use different price indices to adjust for its effect. HSMC-301.7 Apply the various concepts of Accounting like balance sheet and ratio analysis. HSMC-301.8 Understand the scope of Finance and the role of financial planning and management.

Biology for Engineers **Code: BS-CH301** **Contact: 2L**		
Name of the Course:	**Biology for Engineers**	
Course Code:	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	2	
Objective:		
1	To introduce modern biology with an emphasis on evolution of biology as a multidisciplinary field.	
2	To make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.	
Pre-Requisite		
1		

Unit	**Content**	**Hours or lectures**
1	Introduction:	2

	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 18th 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. Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry	
2	**Classification:** 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) energy and Carbon utilization - Autotrophs, eterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic 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 Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.	3
3	**Genetics** 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. Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"	4
4	**Biomolecules** 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. Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine	4
5	Enzymes Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. 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

	Purpose: To convey that without catalysis life would not have existed on earth	
6	Information Transfer Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA 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. Purpose: The molecular basis of coding and decoding genetic information is universal	4
7	Macromolecular analysis Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. Purpose: How to analyses biological processes at the reductionistic level	5
8	Metabolism Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge Purpose: The fundamental principles of energy transactions are the same in physical and biological world.	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 book and Reference books:		
	1) 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 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers	
Course Outcomes		
	After studying the course, the student will be able to: BS-CH301.1. Describe how biological observations of 18th Century that lead to major discoveries. BS-CH301.2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological	

	BS-CH301.3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring BS-CH301.4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine BS-CH301.5. Classify enzymes and distinguish between different mechanisms of enzyme action. BS-CH301.6. Identify DNA as a genetic material in the molecular basis of information transfer. BS-CH301.7. Analyse biological processes at the reductionistic level BS-CH301.8. Apply thermodynamic principles to biological systems. BS-CH301.9. Identify and classify microorganisms.

Digital Electronics
Code: ESC301
Contact: 3L

Name of the Course:	**Digital Electronics**	
Course Code: ESC301	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	3	

Objective:

1	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits
2	To prepare students to perform the analysis and design of various digital electronic circuits

Pre-Requisite

1	Basic Electronics learned in the First year

Unit	Content	Hours or lectures
1	**Fundamentals of Digital Systems and logic design** Digital signals, digital circuits, logic Gates, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, characteristics of digital ICs, examples of ICs for different logic gates. 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, Venn diagram, Boolean algebra; Minimization of logic	7

	expression using algebraic methods.	
2	**Combinational Digital Circuits** Standard representation for logic functions (SOP and POS forms), K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer /Decoders, Adders (Half & Full), Subtractors, BCD arithmetic, carry look ahead adder, serialadder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.	10
3	**Sequential circuits and systems** A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-types flipflops, J-K Master Slave flipflops, applications of flipflops, shift registers (SISO, SIPO, PISO, PIPO), applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.	10
4	**Digital logic families and conversion techniques** Digital logic families, TTL, TTL, ECL, MOS and CMOS logic (Basic Concept). Digital to analog converters: Different types of A/D and D/A conversion techniques (Basic concepts only)	5
5	**Programmable logic devices (PLD)** Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).	3
Text book and Reference books:		
	1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009. 2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016. 3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.	
Course Outcomes		
	At the end of this course, students will demonstrate the ability to ESC301.1. Understand working of logic families and logic gates. ESC301.2. Design and implement Combinational and Sequential logic circuits. ESC301.3. Understand the process of Analog to Digital conversion and Digital to Analog conversion. ESC301.4. Be able to use PLDs to implement the given logical problem.	

Computer Organization **Code: PCC -CS301** **Contact: 3L**		
Name of the Course:	**Computer Organization**	
Course Code: PCC-CS301	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	3	

Objective:

1	To prepare students to perform the analysis and design of various digital electronics 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	Basic knowledge about different components of digital computer, fundamental of computer programming, number systems and Boolean algebra.

Unit	Content	Hours or lectures
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] Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L]	8
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
Course Outcomes	
	At the end of this course, students will demonstrate the ability to PCC-CS301.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations. PCC-CS301.2 Understand basic structure of different combinational circuits multiplexer, decoder, encoder etc. PCC-CS301.3 Perform different operations with sequential circuits. PCC-CS301.4 Understand memory and I/O operations.

Data Structure and Algorithms Code: PCC -CS302 Contact: 3L		
Name of the Course:	**Data Structure and Algorithms**	
Course Code: PCC -CS302	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
Practical: hrs./week		Attendance: 5 marks
		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	Basic Computation and Principles of problem solving with C, basics of set theory

Unit	**Content**	**Hours or lectures**
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 tradeoff.	
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	5

	Implementation (Insertion, Deletion & Display) using Array	
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), **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 andRepresentations, Graph search and traversal algorithms (BFS & DFS) and complexity analysis.	9
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, SartajSahni, Susan Andersonfreed. 2. “Data Structures in C” by Aaron M. Tenenbaum. 3. “Data Structures” by S. Lipschutz.	
Course Outcomes		
	At the end of this course, students will demonstrate the ability to PCC-CS302.1 Differentiate how the choices of data structure & algorithm methodsimpact the performance of program. PCC-CS302.2 Solve problems based upon different data structure & also write	

	programs. PCC-CS302.3 Identify appropriate data structure & algorithmic methods in solvingproblem. PCC-CS302.4 Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing PCC-CS302.5 Compare and contrast the benefits of dynamic and static data structures implementations.

Essence of Traditional Knowledge
Code: MC301
Contact: 3L

Name of the Course:	**Essence of Traditional Knowledge**	
Course Code: MC301	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	0	

Objective:

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

Pre-Requisite

Unit	Content	Hours or lectures
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge	6
2	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.	6
3	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.	6
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of	8

	traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	
5	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	8

Text book and Reference books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

Web Links:

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

Course Outcomes

MC301.1: Identify the concept of Traditional knowledge and its importance.
MC301.2: Explain the need and importance of protecting traditional knowledge.
MC301.3: Illustrate the various enactments related to the protection of traditional knowledge.
MC301.4: Interpret the concepts of Intellectual property to protect the traditional knowledge.
MC301.5: Explain the importance of Traditional knowledge in Agriculture and Medicine.

Digital Electronics Lab
Code: ESC-CS391
Contact: 4P

Name of the Course:	**Digital Electronics Lab**	
Course Code: ESC-CS391	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	

Pre-Requisite

Pre-requisites as in ESC-CS301

Laboratory Experiments:

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 10 Study of DAC
Course Outcomes	
	ESC301.1.
	ESC301.2.
	ESC301.3.
	ESC301.4.

Computer Organization Lab Code: PCC-CS391 Contact: 4P		
Name of the Course:	**Computer Organization Lab**	
Course Code: PCC-CS391	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Continuous Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	

Pre-Requisite	
	Pre-requisites as in PCC-CS301
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.
Course Outcomes	

	PCC-CS301.1
	PCC-CS301.2
	PCC-CS301.3
	PCC-CS301.4

Data Structure & Algorithms Lab **Code: PCC-CS392** **Contact: 4P**		
Name of the Course:	**Data Structure & Algorithms Lab**	
Course Code: PCC-CS392	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	

Pre-Requisite	
	Pre-requisites as in PCC-CS302
Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation
8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.
Course Outcomes	
	PCC-CS302.1
	PCC-CS302.2
	PCC-CS302.3

	PCC-CS302.4
	PCC-CS302.5

IT Workshop (Python/R/Sci Lab/ MATLAB)
Code: PCC-CS393
Contact: 4P

Name of the Course:	**IT Workshop (Python/R/Sci Lab/MATLAB)**	
Course Code: PCC-CS393	Semester: III	IT Workshop (Python/R/Sci Lab/MATLAB)
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Continuous Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 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

	Knowledge of Programming Logic.
	Experience with a high level language (C/C++) is suggested.
	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

A) 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, R- Vector 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. **Text book and Reference books:** Dr. Jeeva Jose, Begineer's Guide for Data Analysis Using R Programming, Khanna Publishing House, New Delhi.
B)	**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.
C)	**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

Jalpaiguri Government Engineering College

UG Syllabus (2021-22)

Computer Science & Engineering

Semester IV

Mathematics III **Code: BS-M401** **Contact: 3L**		
Name of the Course:	**Mathematics III**	
Course Code: BS-M401	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	**3**	

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**	**Hours or lectures**
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	9

	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] 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 & Reena Garg, Khanna Publishing House (AICTE Recommended Textbook -2018)	
Course Outcomes		
	On completion of the course students will be able to BS-M401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives. BS-M401.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction. BS-M401.3 Use tree and graph algorithms to solve problems BS-M401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.	

Computer Architecture Code: PCC-CS401 Contact: 3L		
Name of the Course:	**Computer Architecture**	
Course Code: PCC-CS401	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	3	
Objective:		
1	To learn the basics of stored program concepts.	
2	To learn the principles of pipelining.	
3	To learn mechanism of data storage.	

4	To distinguish between the concepts of serial, parallel, pipeline architecture.
Pre-Requisite	
1	Fundamentals of computer organization and digital electronics

Unit	Content	Hours or lectures
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (2L) 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 (4L) Non-linear pipelining: Basic concepts, reservation table, permissible and forbidden latencies, state transition diagram, simple cycle, greedy cycle, MAL, throughput, efficiency computation (6L)	12
2	Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)	8
3	Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super- pipelined and VLIW processor architectures. Array and vector processors. (6L)	6
4	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared- memory architecture. Cluster computers (6L). Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures (4L)	10

Text book and Reference books:	
	1. Kai Hwang, Advanced Computer Architecture, Tata McGraw Hill, 2012 2. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011. 3. Rajaraman – "Computer Organization & Architecture", PHI 4. B.Ram – "Computer Organization & Architecture", Newage Publications
Course Outcomes	
	On completion of the course students will be able to PCC-CS401.1 Learn pipelining concepts with a prior knowledge of stored program methods PCC-CS401.2 Learn about memory hierarchy and mapping techniques. PCC-CS401.3 Study of parallel architecture and interconnection network

Design and Analysis of Algorithms
Code: PCC-CS402

Contact: 3L		
Name of the Course:	**Design and Analysis of Algorithms**	
Course Code: PCC-CS402	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	3	
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 behaviours of algorithms and the notion of tractable and intractable problems will be understood.
Pre-Requisite	
1	To know data-structure and basic programming ability

Unit	**Content**	**Hours or lectures**
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy Method, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, TSP. Heuristics– characteristics and their application domains.	8
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6
4	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4

Text book and 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, Udi Manber, Addison-WesleyReading, MA. 7. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018). 8. Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai .
Course Outcomes	
	On completion of the course students will be able to PCC-CS402.1: For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms. PCC-CS402.2: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms. PCC-CS402.3: 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. PCC-CS402.4: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the dynamic-programming algorithms. PCC-CS402.5: Develop the dynamic programming algorithms, and analyze it to determine its computational complexity. PCC-CS402.6: For a given engineering problem model it using graph and write the corresponding algorithm to solve the problems. PCC-CS402.7: Explain the ways to analyze randomized algorithms (expected running time, probability of error). PCC-CS402.8: Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

Object Oriented Programming
Code: PCC-CS403
Contact: 3L

Name of the Course:	**Object Oriented Programming**	
Course Code: PCC-CS403	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
Practical: hrs./week		Attendance: 5 marks
		End Semester Exam : 70 Marks
Credit Points:	3	
Objective:		

1	To understand concepts and basic characteristics of Object Oriented Programming
2	To know the principles of packages, inheritance and interfaces
3	To define exceptions and use I/O streams
4	To develop a java application with threads and generics classes
5	To design and build simple Graphical User Interfaces

Pre-Requisite

1	Basic knowledge of programming language and data structure

Unit	Content	Hours or lectures
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	8
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	8
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	6
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management	6
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6

Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcomes

On completion of the course students will be able to

PCC-CS403.1. Specify simple abstract data types and design implementations, using abstraction functions to document them.

PCC-CS403.2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

PCC-CS403.3. Name and apply some common object-oriented design patterns and give examples of their use.

PCC-CS403.4. Design applications with an event-driven graphical user interface.

Formal Language and Automata Theory
Code: PCC-CS404
Contact: 3L

Name of the Course:	**Formal Language and Automata Theory**

Course Code: PCC-CS404	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
Practical: hrs./week		Attendance: 5 marks
		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 andPost machines

Pre-Requisite	
1	Grammar and its classification (Context Free Grammar)

Unit	**Content**	**Hours or 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 book and Reference books:	
	1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to AutomataTheory, 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, TataMcGrawHill., PEARSON. 6. Dr. R.B.Patel, Theory of Computation, Khanna Publishing House
Course Outcomes	
	On completion of the course students will be able to PCC-CS404.1 Write a formal notation for strings, languages and machines. PCC-CS404.2 Design finite automata to accept a set of strings of a language. PCC-CS404.3 For a given language determine whether the given language is regular or not PCC-CS404.4 Design context free grammars to generate strings of context free language. PCC-CS404.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars PCC-CS404.6 Write the hierarchy of formal languages, grammars and machines. PCC-CS404.7 Distinguish between computability and non-computability and Decidability and undecidability

Environmental Science **Code: MC401** **Contact: 3L**		
Name of the Course:	**Environmental Science**	
Course Code: MC401	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
Practical: hrs./week		Attendance: 5 marks
		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**	**Hours or lectures**
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 degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)	6
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,	11

	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 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) , Land. Noise pollution control. (1L)	2
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2
Text book and Reference books:		
	1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTERecommended Textbook – 2018) 2. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991. 3. De, A. K., "Environmental Chemistry", New Age International	
Course Outcomes		
	On completion of the course students will be able to MC-401.1 To understand the natural environment and its relationships with human activities. MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk. MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations. MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise & land pollution.	

Computer Architecture Lab **Code: PCC-CS491** **Contact: 4P**		
Name of the Course:	**Computer Architecture Lab**	
Course Code: PCC-CS491	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	
Pre-Requisite		

1	The hardware based design has been done in the Digital Electronics laboratory and Computer Organisation laboratory
Laboratory Experiments:	
Experiments with HDL	
1	HDL introduction. 2 3 4 5 6 7 8
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	8-bit simple ALU design
6	Memory unit design and perform memory operations.
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.
Experiments with programming language C and Python	
9	Design a program in C or Python for non linear pipelining to derive ICV from a given reservation table.
10	Design a program in C or Python for non linear pipelining to derive Simple and greedy cycle, and MAL from a state transition diagram derived with ICV.
11	Design a program in C or Python to derive page fault for different types of page replacement policies (FIFO, LRU, Optimal)
Course Outcomes	
	PCC-CS401.1
	PCC-CS401.2
	PCC-CS401.3

Design and Analysis of Algorithms Lab **Code: PCC-CS492** **Contact: 4P**		
Name of the Course:	**Design and Analysis of Algorithms Lab**	
Course Code: PCC-CS492	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	
Pre-Requisite		
1	Pre-Requisite as in : PCC-CS402	
Laboratory Experiments:		
Divide and Conquer:		
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach	

2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Implement Graph Coloring Problem
	Implement Hamiltonian Problem
Greedy method	
9	Implement Knapsack Problem, Implement Job sequencing with deadlines
10	Implement Minimum Cost Spanning Tree by Prim Algorithm and Minimum Cost Spanning Tree by Kruskal Algorithm
Graph Traversal Algorithms:	
11	Implement Breadth First Search (BFS) and Implement Depth First Search (DFS)
Course Outcomes	
	PCC-CS402.1
	PCC-CS402.2
	PCC-CS402.3
	PCC-CS402.4
	PCC-CS402.5
	PCC-CS402.6
	PCC-CS402.7
	PCC-CS402.8

Object Oriented Programming Lab **Code: PCC-CS493** **Contact: 4P**		
Name of the Course:	**Object Oriented Programming Lab**	
Course Code: PCC-CS493	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:		**Distribution of marks**
Tutorial: NIL		Internal Assessment: 60
Practical: 4hrs./week		External Assessment: 40
Credit Points:	2	
Pre-Requisite		
1	Pre-Requisite as in : PCC-CS403	

Laboratory Experiments:	
Use Java for programming	
1	Assignments on class, constructor, overloading, inheritance, overriding
2	Assignments on wrapper class, arrays
3	Assignments on developing interfaces- multiple inheritance, extending interfaces
4	Assignments on creating and accessing packages
5	Assignments on multithreaded programming
6	Assignments on applet programming
Course Outcomes	
	PCC-CS403.1
	PCC-CS403.2
	PCC-CS403.3
	PCC-CS403.4