

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**SEMESTER – III**

**Analog & Digital Electronics**

**Code: ESC-301**

**Contact: 3L**

Name of the Course:	<b>Analog &amp; Digital Electronics</b>	
Course Code: ESC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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:	3	
<b>Objective:</b>		
1	To acquire the basic knowledge of different analog components and their applications	
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.	
3	To prepare students to perform the analysis and design of various digital electronic circuits	
<b>Pre-Requisite:</b>		
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.	
2	Basic concept of the working of P-N diodes, Schottky diodes,	
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback	

Unit	Content	Hrs/Unit	Marks/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer.	9	
2	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 (recapitulation); Representation in SOP and POS forms; Minimization of logic	11	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
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**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

	expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator		
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, 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	10	
4.	A/D and D/A conversion techniques - Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L])  Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6	

**Text book and Reference books:**

1. I.G.Nagrath, Analog Electronics, PHI
2. Analog Electronics, A.K. Maini, Khanna Publishing House
3. Microelectronics Engineering –Sedra & Smith-Oxford.
4. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
5. Digital Electronics – Kharate – Oxford
6. Digital Electronics – Logic & Systems by J.Bigmeil & R.Donovan; Cambridge Learning.
7. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP
8. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
9. Bell-Linear IC & OP AMP—Oxford
10. P.Raja- Digital Electronics- Scitech Publications
11. Morries Mano- Digital Logic Design- PHI
12. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
13. H.Taub & D.Shilling, Digital Integrated Electronics- McGraw Hill.
14. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
16. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
17. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
18. Floyed & Jain- Digital Fundamentals-Pearson.

**Course Outcomes:**

On completion of the course students will be able to

- ESC-301.1 Realize the basic operations of different analog components.
- ESC-301.2 Realize basic gate operations and laws Boolean algebra.

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

ESC-301.3 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

**Data Structure & Algorithm**

**Code: PCC-CS301**

**Contacts: 3L**

Name of the Course:	<b>Data Structure &amp; Algorithm</b>	
Course Code: PCC-CS301	Semester: III	
Duration: 6 months	Maximum Marks:100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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:	3	
<b>Objective:</b>		
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	
<b>Pre-Requisite:</b>		
1	CS 201 (Basic Computation and Principles of C	
2	M101 & M201 (Mathematics), basics of set theory	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	9	
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from	10	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.  Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis		
4.	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9	

**Text book and Reference books:**

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures" by R.S. Salaria, Khanna Publishing House
6. "Data Structures through C" by Yashwant Kanitkar, BPB House
7. "Data Structures Using C" by Reema Thareja.
8. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
9. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

**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.

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
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**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Computer Organization**  
**Code: PCC-CS302**  
**Contacts: 3L**

Name of the Course:	<b>Computer Organization</b>		
Course Code: PCC-CS302	Semester: III		
Duration: 6 months	Maximum Marks: 100		
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
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:	3		
<b>Objective:</b>			
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		
<b>Pre-Requisite:</b>			
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	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	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

PCC-CS302.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

PCC-CS302.2 Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.

PCC-CS302.3 Perform different operations with sequential circuits.

PCC-CS302.4 Understand memory and I/O operations.

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Mathematics-III (Differential Calculus)**

**Code: BSC-301**

**Contacts: 2L**

Name of the Course:	<b>Mathematics-III (Differential Calculus)</b>	
Course Code: BSC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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	
<b>Objective:</b>		
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	
<b>Pre-Requisite:</b>		
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	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
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**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	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 Calculus, 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.

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
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**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Economics for Engineers (Humanities-II)**

**Code: HSMC-301**

**Contacts: 3L**

Name of the Course:	<b>Economics for Engineers (Humanities-II)</b>	
Course Code: HSMC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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	
<b>Objective:</b>		
1	Understand the role and scope of Engineering Economics and the process of economic decision making	
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 formulas	
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty	
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation	
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	
<b>Pre-Requisite:</b>		
1	Mathematics	

Unit	Content	Hrs/Unit	Marks/Unit
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. 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	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of	9	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

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**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	<p>Money, Debt repayment, Nominal &amp; Effective Interest.</p> <p>4. Cash Flow &amp; 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 &amp; drawbacks.</p>		
3	<p>5. 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.</p> <p>6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation &amp; Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.</p> <p>7. 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.</p>	9	
4.	<p>8. Depreciation - Basic Aspects, Deterioration &amp; 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.</p> <p>9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.</p> <p>10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.</p>	9	

**Text book and Reference books:**

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

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. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
5. Sullivan and Wicks: Engineering Economy, Pearson
6. R.Paneer Seelvan: Engineering Economics, PHI
7. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

**Course Outcome:**

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.

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**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)  
**PRACTICAL SYLLABUS**  
**Semester III**

**Analog & Digital Electronics Lab**

**Code: ESC-391**

**Contacts: 4P**

Name of the Course:	<b>Analog &amp; Digital Electronics Lab</b>
Course Code: ESC-391	Semester: III
Duration: 6 months	Maximum Marks: 100
<b>Teaching Scheme:</b>	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
1	ESC-301.1
2	ESC-301.2
3	ESC-301.3
<b>Pre-Requisite:</b>	
Pre-requisites as in ESC-301	

<b>Laboratory Experiments:</b>	
<b>Analog Electronics</b>	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
<b>Digital Electronics</b>	
4	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Any experiment specially designed by the college

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

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Information Technology  
(Applicable from the academic session 2018-2019)

**Data Structure & Algorithm Lab**

**Code: PCC-CS391**

**Contacts: 4P**

Name of the Course:	<b>Data Structure &amp; Algorithm Lab</b>
Course Code: PCC-CS391	Semester: III
Duration: 6 months	Maximum Marks: 100
<b>Teaching Scheme:</b>	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
1	PCC-CS301.1
2	PCC-CS301.2
3	PCC-CS301.3
4	PCC-CS301.4
5	PCC-CS301.5
<b>Pre-Requisite:</b>	
Pre-requisites as in PCC-CS301	

<b>Laboratory Experiments:</b>	
<b>Linear Data Structure</b>	
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
<b>Non Linear Data Structure</b>	
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.

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

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
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**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Computer Organization Lab**  
**Code: PCC-CS392**  
**Contacts: 4P**

Name of the Course:	<b>Computer Organization Lab</b>
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
<b>Teaching Scheme:</b>	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
1	PCC-CS302.1
2	PCC-CS302.2
3	PCC-CS302.3
4	PCC-CS302.4
<b>Pre-Requisite:</b>	
Pre-requisites as in PCC-CS302	

<b>Laboratory Experiments:</b>	
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)

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

**IT Workshop (Sci Lab/MATLAB/Python/R)**

**Code: PCC-CS393**

**Contacts: 4P**

Name of the Course:	<b>IT Workshop</b>
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
<b>Teaching Scheme:</b>	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
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.
<b>Pre-Requisite:</b>	
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, 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.

## **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

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

**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

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)  
**SEMESTER – IV**

**Discrete Mathematics**

**Code: PCC-CS401**

**Contacts: 3L+1T**

Name of the Course:	<b>Discrete Mathematics</b>		
Course Code: PCC-CS401	Semester: IV		
Duration:6 months	Maximum Marks:100		
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
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		
<b>Objective:</b>			
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.		
<b>Pre-Requisite:</b>			
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 Well-Ordering 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	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	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, Bi-connected 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. Umavparvathi, 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

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

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. Umapparvathi, 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

PCC-CS401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PCC-CS401.3 Classify its algebraic structure for a given a mathematical problem,

PCC-CS401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PCC-CS401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

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**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Computer Architecture**  
**Code: PCC-CS402**  
**Contacts: 3L**

Name of the Course:	<b>Computer Architecture</b>	
Course Code: PCC-CS402	Semester: IV	
Duration: 6 months	Maximum Marks:100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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:	3	
<b>Objective:</b>		
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.	
<b>Pre-Requisite:</b>		
1	Basic Structure of Computers, Functional units, software, performance issues software, machine instructions	
2	RAM, ROM, Memory management	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) 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)	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	6	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	and vector processors. (6L)		
4.	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)	7	

**Text/Reference Books:**

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.
5. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
6. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
8. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.
9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.

**Course Outcomes:**

On completion of the course students will be able to

PCC-CS402.1 Learn pipelining concepts with a prior knowledge of stored program methods

PCC-CS402.2 Learn about memory hierarchy and mapping techniques.

PCC-CS402.3 Study of parallel architecture and interconnection network

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Formal Language & Automata Theory**

**Code: PCC-CS403**

**Contacts: 3L**

Name of the Course:	<b>Formal Language &amp; Automata Theory</b>	
Course Code: PCC-CS403	Semester: IV	
Duration: 6 months	Maximum Marks:100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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	
<b>Objective:</b>		
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	
<b>Pre-Requisite:</b>		
1	Grammar and its classification (Context Free Grammar)	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6	
2	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	7	
	Context-free languages and pushdown automata:		

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

3	Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.	6	
4.	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
5	Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators	6	
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages	6	

**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

- PCC-CS403.1 Write a formal notation for strings, languages and machines.
- PCC-CS403.2 Design finite automata to accept a set of strings of a language.
- PCC-CS403.3 For a given language determine whether the given language is regular or not.
- PCC-CS403.4 Design context free grammars to generate strings of context free language.
- PCC-CS403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

PCC-CS403.6 Write the hierarchy of formal languages, grammars and machines.

PCC-CS403.7 Distinguish between computability and non-computability and Decidability and undecidability

**Design and Analysis of Algorithms**

**Code: PCC-CS404**

**Contacts: 3L**

Name of the Course:	<b>Design and Analysis of Algorithms</b>	
Course Code: PCC-CS404	Semester: IV	
Duration: 6 months	Maximum Marks:100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
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:	3	
<b>Objective:</b>		
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.	
<b>Pre-Requisite:</b>		
1	To know data-structure and basic programming ability	

Unit	Content	Hrs/Unit	Marks/Unit
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, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
	Graph and Tree Algorithms: Traversal algorithms:		

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**  
(Applicable from the academic session 2018-2019)

3	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 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

PCC-CS404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

PCC-CS404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

PCC-CS404.3 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-CS404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PCC-CS404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

PCC-CS404,6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

PCC-CS404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PCC-CS404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**  
(Applicable from the academic session 2018-2019)

**Biology**

**Code: BSC 401**

**Contacts: 2L+1T**

Name of the Course:	<b>Biology</b>		
Course Code: BSC-401	Semester: IV		
Duration: 6 months	Maximum Marks:100		
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
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:	3		
<b>Objective:</b>			
1	Bring out the fundamental differences between science and engineering		
2	Discuss how biological observations of 18 <sup>th</sup> Century that lead to major discoveries		
<b>Pre-Requisite:</b>			
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 <sup>th</sup> 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	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic 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	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	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 exergonic 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:**

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
6. Biology for Engineers, McGraw Hill (ISBN: 978-11-21439-931)

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

**Course Outcomes:**

On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18<sup>th</sup> Century that lead to major discoveries.

BSC-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

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material

from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as

diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level

BSC-401.8 Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

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**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)

**Environmental Sciences**

**Code: MC-401**

**Contacts: 1L**

Name of the Course:	<b>Environmental Sciences</b>		
Course Code: MC-401	Semester: IV		
Duration:6 months	Maximum Marks:100		
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
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:	1		
<b>Objective:</b>			
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		
<b>Pre-Requisite:</b>			
1	Basic knowledge of Environmental science		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Basic ideas of environment, basic concepts, man, society &amp; environment, their interrelationship (1L)</p> <p>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)</p> <p>Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L)</p> <p>Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic</p>	6	

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)		
2	<p>Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L)</p> <p>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)</p> <p>Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)</p> <p>Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.( 2L)</p>	6	
3	<p>Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)</p> <p>Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.( 1L)</p> <p>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)</p> <p>Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)</p> <p>Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)</p> <p>Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria</p>	11	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	<p>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)</p> <p>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)</p>		
4.	<p>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)</p> <p>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)</p> <p>Lake: Eutrophication [Definition, source and effect]. (1L)</p> <p>Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L)</p> <p>Standard and control: Waste water standard [BOD, COD, Oil, Grease],</p> <p>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)</p> <p>Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)</p>	9	
5	<p>Lithosphere; Internal structure of earth, rock and soil (1L)</p>	3	

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Tech in Information Technology**  
(Applicable from the academic session 2018-2019)

	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", Prentice-Hall 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

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.

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for B. Tech in Information Technology**  
 (Applicable from the academic session 2018-2019)  
**PRACTICAL SYLLABUS**  
**Semester IV**

**Computer Architecture Lab**  
**Code: PCC-CS492**  
**Contacts: 4P**

Name of the Course:	<b>Computer Architecture Lab</b>
Course Code: PCC-CS492	Semester: IV
Duration: 6 months	Maximum Marks:100
<b>Teaching Scheme:</b>	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
<b>Pre-Requisite:</b>	
1	The hardware based design has been done in 1.the Analog & Digital Electronics laboratory
2	Computer Organisation laboratory

<b>Laboratory Experiments:</b>	
1	HDL introduction.
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	Memory unit design and perform memory operations.
6	8-bit simple ALU design
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.

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

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Information Technology  
(Applicable from the academic session 2018-2019)

**Design & Analysis Algorithm Lab**

**Code: PCC-CS494**

**Contact: 4P**

Name of the Course:	<b>Design &amp; Analysis Algorithm Lab</b>
Course Code: PCC-CS494	Semester: IV
Duration:6 months	Maximum Marks:100
<b>Teaching Scheme:</b>	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
<b>Course Outcomes:</b>	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
<b>Pre-Requisite:</b>	
Pre-Requisite as in : PCC-CS404	

<b>Laboratory Experiments:</b>	
<b>Divide and Conquer:</b>	
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)
<b>Brunch and Bound:</b>	
6	Implement 15 Puzzle Problem
<b>Backtracking:</b>	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
<b>Greedy method</b>	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
<b>Graph Traversal Algorithm:</b>	
11	Implement Breadth First Search (BFS)

**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Information Technology**

(Applicable from the academic session 2018-2019)

	Implement Depth First Search (DFS)
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(Detailed instructions for Laboratory Manual to be followed for further guidance)