Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
B. Tech. in Computer Science and Business Systems
(Applicable from the Academic Session 2020-2021)

Curriculum Structure
Second Year Third Semester

Theory

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1	Engineering Science Course	ESC-301	Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-CSBS301	Data Structure & Algorithms	3	0	0	3
3	Professional Core Courses	PCC-CSBS302	Discrete Mathematics	3	1	0	4
4	Humanities & Social Sciences including Management courses	HSMC-301	Economics for Engineers	3	0	0	3
5	Basic Science course	BSC-301	Computational Statistics	3	0	0	3
				15	1	0	
						Total credits	**16**

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Practical

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1	Engineering Science Course	ESC-391	Digital Electronics Lab	0	0	2	1.5
2	Professional Core Courses	PCC-CSBS391	Data Structure & Algorithms Lab	0	0	4	3
3	Basic Science course	BSC-391	Computational Statistics Lab	0	0	2	1.5
				0	0	8	
			Total credits				**6**
			TOTAL CREDITS(Theory+Practical)				**22**

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Digital Electronics
Code: ESC-301
Contact: 3L

Name of the Course:	**Digital Electronics**	
Course Code: ESC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam : 70 Marks
Credit Points:	3	

Objective:	
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
Pre-Requisite:	
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

Module	
1	a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD,ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. [5] b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method [6]
2	a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator. [5] b) Memory Systems: RAM, ROM, EPROM, EEROM [4] c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs) [4]

3	Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology. [6]
4	a) Different types of A/D and D/A conversion techniques. [4] b) Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. [6]

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DATA STRUCTURES AND ALGORITHMS (PCC-CSBS301)

Name of the Course:	**DATA STRUCTURES AND ALGORITHMS**	
Course Code: **PCC-CSBS301**	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: 2 hrs/week		End Semester Exam: 70 Marks
Credit Points:	4	
Objective:		
1		
2		
3		
4		
5		
6		
7		
Pre-Requisite:		
1		

Basic Terminologies and Introduction to Algorithm & Data Organisation: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection

Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heapsort, Introduction to Hashing

File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books:

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures, R.S. Salaria, Khanna Book Publishing, Delhi.
3. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. UIlman, Pearson.
4. Expert Data Structures with C, R.P. Patel, Khanna Publishing House.

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Design and Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing
3. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
4. Open Data Structures: An Introduction (Open Paths to Enriched Learning), (Thirty First Edition), Pat Morin, UBC Press.

Discrete Mathematics (PCC-CSBS302)

Boolean algebra: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

Abstract algebra: Set, relation, group, ring, field.

Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

Logic: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Text Books:

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore.
6. Discrete Structures, S.B. Singh, Khanna Publishing House.

Reference Books:

1. Introduction to linear algebra. Gilbert Strang.
2. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4. Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.

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Economics for Engineers (Humanities-II) Code: HSMC-301
Contacts: 3L

Name of the Course:	**Economics for Engineers (Humanities-II)**		
Course Code: HSMC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
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		
Pre-Requisite:			
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	

COMPUTATIONAL STATISTICS (BSC-301)

Name of the Course:	**COMPUTATIONAL STATISTICS**		
Course Code: **(BSC-301)**	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
		End Semester Exam: 70 Marks	
Credit Points:	4		
Objective:			
1			
2			
3			
4			
5			
6			
7			
Pre-Requisite:			
1			

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multiple Linear Regression Model: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Factor Analysis: Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

Cluster Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

Text Books:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.
7. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing House.
8. Data Science and Analytics, V.K. Jain, Khanna Publishing House.

Reference Books:

1. Regression Diagnostics , Identifying Influential Data and Sources of Collinearety, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

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Name of the Course:	**COMPUTATIONAL STATISTICS**	
Course Code: **(BSC-391)**	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Practical: 3 hrs/week	Continuous Internal Assessment: 40	
	External Assesement: 60	
Credit Points:	1.5	
Objective:		
1		
2		
3		
4		
5		
6		
7		
Pre-Requisite:		
1		

Laboratory

Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing

Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches

Multivariate data analysis: Multiple regression, multivariate regression, cluster analysis with various algorithms, factor analysis, PCA and linear discriminant analysis. Various datasets should be used for each topic

Name of the Course:	**DATA STRUCTURES AND ALGORITHMS Lab**	
Course Code: **PCC-CSBS391**	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Practical: 4 hrs/week		Continuous Internal Assessment: 40
		External Assesement: 60
Credit Points:	2	

Objective:	
1	
2	
3	
4	
5	
6	
7	

Pre-Requisite:	
1	**PCC-CSBS301**

Laboratory Experiments:	
1	Towers of Hanoi using user defined stacks.
2	Reading, writing, and addition of polynomials.
3	Line editors with line count, word count showing on the screen.

4	Trees with all operations.
5	All graph algorithms.
6	Saving / retrieving non-linear data structure in/from a file

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Digital Electronics Lab (ESC-391)

Name of the Course:	**Digital Electronics Lab**	
Course Code: ESC-391	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Practical: 3 hrs/week		Continuous Internal Assessment: 40
		External Assesement: 60
Credit Points:	1.5	

Objective:

1	
2	
3	
4	
5	

Pre-Requisite:

1	ESC-301

1	Realization of basic gates using Universal logic gates.
2	Code conversion circuits- BCD to Excess-3 and vice-versa.
3	Four-bit parity generator and comparator circuits.
4	Construction of simple Decoder and Multiplexer circuits using logic gates.
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.

6	Construction of simple arithmetic circuits-Adder, Subtractor.
7	Realization of RS-JK and D flip-flops using Universal logic gates.
8	Realization of Universal Register using JK flip-flops and logic gates.
9	Realization of Universal Register using multiplexer and flip-flops.
10	Construction of Adder circuit using Shift Register and full Adder.
11	Realization of Asynchronous Up/Down counter.
12	Realization of Synchronous Up/Down counter.
13	Design of Sequential Counter with irregular sequences.
14	Realization of Ring counter and Johnson's counter.
15	Construction of adder circuit using Shift Register and full Adder.