TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
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4-Years B.Tech. Curriculum and Syllabus for Computer Science and Engineering (CSE)

Fourth Semester

S. No	Course Code	Course Title	Contact Hrs. / Week			Credit
			L	T	P	
THEORY						
1	TIU-UEN-T200	Career Advancement & Skill Development	2	0	0	3
2	TIU-UMA-T206	Mathematics-IV	3	1	0	4
3	TIU-UEC-T210	Microprocessor and Microcontroller	3	1	0	3
4	TIU-UCS-T202	Object Oriented Programming and Design-I	3	1	0	3
5	TIU-UCS-T204	Design and Analysis of Algorithms	3	1	0	3
6	TIU-UCS-T208	Automata Theory and Logic	3	1	0	3
PRACTICAL						
1	TIU-UCS-L206	Numerical Lab	0	0	3	2
2	TIU-UEC-L210	Microprocessor and Microcontroller Lab	0	0	3	2
3	TIU-UCS-L202	Object Oriented Programming and Design-I Lab	0	0	3	2
4	TIU-UCS-L204	Design and Analysis of Algorithms Lab	0	0	3	2
SESSIONAL						
1	TIU-UES-S298	Entrepreneurship Skill Development	0	0	3	2
TOTAL CREDIT						29

Approved By:
External Expert VC Registrar Dean of Academics Mentor of the Dept. HOD

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Syllabus

Career Advancement & Skill Development
TIU-UEN-T200
L-T-P: 2-0-0 **Credit: 3**

COMPUTER BASED STATISTICAL AND NUMERICAL TECHNIQUES

(Mathematics-IV)
TIU-UMA-T206
L-T-P: 3-1-0 **Credits: 4**

Module 1: Introduction to Probability Theory

Unit 1 - Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence.
Unit 2 - Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev's inequality.

Module 2: Numerical Methods

Unit 1 - Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.
Unit 2 - Interpolation: Newton's forward & backward interpolation, Lagrange's and Newton's divided difference Interpolation.
Unit 3 - Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
Unit 4 - Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Jacobi and Gauss-Seidel iterative methods.
Unit 5 - Numerical solution of Algebraic equation: Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method. Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

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Module 3. Computational Statistics

Unit 1: Raw data and its classification, Discrete frequency distribution, Sturge's rule, continuous frequency distribution, cumulative frequency distribution, histogram, frequency curve, frequency polygon.

Unit 2: Arithmetic Mean - Definition, effect of change of origin and scale, combined mean of a number of groups. Geometric Mean, Harmonic Mean, Weighted A.M., G.M. and H.M., Mode, Median, Empirical relation between mean, median and mode, Order relation between arithmetic mean, geometric mean, harmonic mean, Quartiles.

Unit 3: Mean deviation, Variance and standard deviation, Effect of change of origin and scale.

Unit 4: Raw moments for grouped and ungrouped data, Moments about an arbitrary constant for grouped and ungrouped data. Central moments for grouped and ungrouped data, Effect of change of origin and scale, Sheppard's correction. Relationships between central moments and raw moments, skewness, kurtosis.

Unit 5: Bivariate data, bivariate frequency distribution, Covariance, effect of change of origin and scale, Karl Pearson's and Spearman's coefficient of correlation for grouped and ungrouped data.

Unit 6: Correlation & Linear regression, Method of least squares.

Note: In practical classes the candidates should be exposed to the use of Statistical Software like Excel, SPSS, SAS, and Matlab Mathematics etc.

Recommended Books:

Main Reading:

1. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press
2. Balagurusamy, Numerical Methods, Scitech Publishers
3. K.S. Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, Prentice Hall India .
3. Srimanta Pal, Numerical Methods-Principles, Analyses and Algorithms, Oxford University Press.

Supplementary Reading:

1. Dutta and Jana,Introductory Numerical Analysis
2. J.B. Scarborough, Numerical Mathematical Analysis
3. Jain, Iyengar and Jain, Numerical Methods (Problems and Solution)
4. Irwin Miller and Marylees Miller, "Mathematical Statistics", Pearson

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MICROPROCESSOR AND MICROCONTROLLER

TIU-UEC-T210

L-T-P: 3-1-0 **Credit: 3**

Introduction to 8085A: CPU architecture-register organization, addressing modes and their features. Software instruction set and Assembly Language Programming. Pin description and features. Instruction cycle, machine cycle, Timing diagram.

Hardware Interfacing: Interfacing memory, peripheral chips (IO mapped IO & Memory mapped IO). Interrupts and DMA.

Peripherals: 8279, 8255, 8251, 8253, 8237, 8259, A/D and D/A converters and interfacing of the same. Typical applications of a microprocessor.

16 bit processors: 8086 and architecture, segmented memory has cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation, interrupt processing. Addressing modes and their features.

Software instruction set (including specific instructions like string instructions, repeat, segment override, lock prefizers and their use) and Assembly Language programming with the same.
Brief overview of some other microprocessors (eg. 6800 Microprocessor).

Recommended Books:

Main Reading:

1. Ramesh S. Gaonkar, Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book , Wiley inter science publications.
3. Adam Osborne and J. Kane, An introduction to micro computers Vol. 2 – some real Microprocessor – Galgotia Book Source, New Delhi
4. A. Pal, Microprocessors: Principles and Applications, Tata McGraw-Hill.

Supplementary Reading:

1. Ray and Bhurchandi, Advanced Microprocessors - TMH
2. Intel Corp. Micro Controller Handbook – Intel Publications, 1994.
3. Douglas V. Hall, Microprocessors and Interfacing, McGraw Hill International Ed. 1992
4. Alan R. Miller, Assembly Language Programming the IBM PC by, SubexInc, 1987
5. Bary B. Brey, The Intel Microprocessors: 8086/8088, 80186, 80286, 80386 & 80486, Prentice Hall, India

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OBJECT ORIENTED PROGRAMMING AND DESIGN - I

TIU-UCS-T202

L-T-P: 3-1-0 **Credits: 3**

Introduction: Object Oriented Paradigm, Need of object oriented, Drawbacks of Procedure Oriented Programming, Features of object-oriented languages, POP Vs OOP, Benefits & Applications of OOP, Difference between C and C++.

Basic Concepts of Object-Orientation: Class, Object, Data abstraction, Encapsulation, Inheritance, Polymorphism, Message Passing, Dynamic binding.

Fundamentals of OOPs: Class & Objects, Constructors & Destructor. Different perspectives on inheritance, Types of inheritance, Polymorphism: Compile Time & Run time Polymorphism, Virtual functions, Virtual table construction, Overloading, Overriding, Abstract Class, Virtual Class, Templates: Class and Function Templates & Exceptions Handling.

Unified Modeling Language (UML): Class diagram, Object diagram, Sequence diagram, Use case diagram, Collaboration diagram, Statechart diagram, Activity diagram, Component diagram, Deployment diagram.

Recommended Books:

Main Reading:

1. Scott Ambler , The Object Primer -The Application Developer's Guide to Object Orientation and the UML.
2. Robert Lafore,Object-Oriented Programming in *C*++,Galgotia Publications Pvt. Ltd.

Supplementary Reading:

1. Brad. J. Cox, Object Oriented Programming - An Evolutionary Approach
2. Grady Booch , Object Oriented Design with Applications
3. J. Rambaugh et.al.,Object-Oriented Modeling and Design

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DESIGN AND ANALYSIS OF ALGORITHMS

TIU-UCS-T204

L-T-P: 3-1-0 **Credit: 3**

Formal introduction to algorithmic paradigms: Asymptotic notations and their significance, introduction to RAM model of computation, complexity analysis of algorithms, worst case and average case. Basic introduction to algorithmic paradigms like divide and conquer, recursion, greedy, etc.

Searching: binary search trees, balanced binary search trees, AVL trees and red-black trees, B-trees, skip lists, hashing. Priority queues, heaps, Interval trees, tries.

Sorting: comparison based sorting - quick sort, heap sort, merge sort: worst and average case analysis. Decision tree model and (worst case) lower bound on sorting. Sorting in linear time - radix sort, bucket sort, counting sort, etc.

String matching

Graph Algorithms: BFS, DFS, connected components, topological sort, minimum spanning trees, shortest paths - single source and all pairs.

Advanced data structures: Fibonacci heap, union-find, splay trees.

Reducibility between problems and NP-completeness: discussion of different NP-complete problems like satisfiability, clique, vertex cover, independent set, Hamiltonian cycle, TSP, knapsack, set cover, bin packing, etc.

Backtracking, branch and bound

Approximation algorithms: Constant ratio approximation algorithms.

Miscellaneous: Introduction to external memory algorithms, parallel algorithms.

Recommended Books:

Main Reading:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
3. Harry R. Lewis and Larry Denenberg, Data Structures and their Algorithms, Harper Collins.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press.
5. D. E. Knuth, The Art Of Computer Programming-Vol-III, Narosa Publication.

Supplementary Reading:

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1. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley.
2. R. Sedgewick, Algorithms in C (Parts 1-5), Addison Wesley.
3. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific.
4. Gilles Brassard and Paul Bratley, Algorithmics : theory and practice, Prentice-Hall.
5. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley.
6. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley.

AUTOMATA THEORY AND LOGIC

TIU-UCS-T208

L-T-P: 3-1-0 **Credit: 3**

Introduction: Alphabet, Languages and Grammars, Productions and Derivation, Chomsky Hierarchy of Languages.

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.

Context-Free Languages and Pushdown Automata: 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 Pushdown Automata, Closure Properties of CFLs.

Context-Sensitive Languages: Context-Sensitive Grammars (CSG) and Languages, Linear Bounded Automata and Equivalence with CSG.

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.

Undecidability: Church-Turing Thesis, Universal Turing Machine, The Universal and Diagonalization Languages, Reduction Between Languages and Rice's Theorem, Undecidable Problems About Languages.

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Recommended Books:

Main Reading:

1. John E. Hopcroft, Rajeev Motwani And Jeffrey D. Ullman, Introduction To Automata Theory, Languages, And Computation, Pearson Education Asia.
2. Michael Sipser, Introduction To The Theory Of Computation, Pws Publishing.

Supplimentary Reading:

3. Dexter C. Kozen, Automata And Computability, Undergraduate Texts In Computer Science, Springer.
4. John Martin, Introduction To Languages And The Theory Of Computation, Tata Mcgraw Hill.
5. Harry R. Lewis And Christos H. Papadimitriou, Elements Of The Theory Of Computation, Pearson Education Asia.

COMPUTER BASED STATISTICAL AND NUMERICAL TECHNIQUES LAB
TIU-UCS-L206

L-T-P: 0-0-3 **Credits: 2**

1. Implementation of all Algorithms discussed in the theoretical class on Numerical Methods and Computational Statistics.

2. Programming Solutions to the Assignments given by the Faculty concerned.

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MICROPROCESSOR AND MICROCONTROLLER LAB

TIU-UEC-L210

L-T-P: 0-0-3 **Credit: 2**

1. Familiarization with 8085 register level architecture and trainer kit components, including the memory map. Familiarization with the process of storing and viewing the contents of memory as well as registers.

2. a) Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical)
b) Assignments based on above.

3. a) Familiarization with 8085 simulator on PC.
b) Assignments based on above topics
c) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.

4. Programming using kit/simulator for
a) table look up
b) Copying a block of memory
c) Shifting a block of memory
d) Packing and unpacking of BCD numbers
e) Addition of BCD numbers
f) Binary to ASCII conversion
g) String Matching
h) Multiplication using Booth's Algorithm

5. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit eg, subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc.

6. Interfacing any 8-bit Latch (e.g., 74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding.

7. Interfacing with I/O modules:
a) ADC

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b) Speed control of mini DC motor using DAC
c) Keyboard
d) Multi-digit Display with multiplexing
e) Stepper motor

8. Writing programs for 'Wait Loop (busy waiting)' and ISR for vectored interrupts (eg, counting number of pulses within specified time period)

9. Study of 8051 Micro controller kit and writing programs for the following tasks using the kit
a) Table look up
b) Basic arithmetic and logical operations
c) Interfacing of Keyboard and stepper motor

10. Familiarization with EPROM programming and Erasing

OBJECT ORIENTED PROGRAMMING AND DESIGN – I LAB

TIU-UCS-L202

L-T-P: 0-0-3 **Credits: 2**

Assignments given by the concerned faculty are to be solved.

DESIGN AND ANALYSIS OF ALGORITHMS LAB

TIU-UCS-L204

L-T-P: 0-0-3 **Credits: 2**

Basic knowledge of programming language like C/C++ or Java

Assignments given by the concerned faculty are to be solved.