TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

3-Year Bachelor of Computer Application (BCA) Curriculum and Syllabus

Second Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UEN-T100	Career Advancement and Skill Development	2	1	0	3
TIU-UCA-T110	Computer Organization	2	1	0	3
TIU-UMA-T104	Basic Mathematics II	3	1	0	4
TIU-UCA-T112	Principles of System Software	2	0	0	2
TIU-UCA-T116	Data structures through C++	3	1	0	4
TIU-UMA-T106	Computer Oriented Numerical Methods	2	1	0	3
TIU-UCA-T108	Data Communication and Computer Networking	3	1	0	4
Practical					
TIU-UCA-L116	Programming in Data structure through C++ Lab	0	0	3	2
TIU-UCA-L106	Numerical Methods Lab	0	0	3	2
Sessional					
TIU-UES-S198	Entrepreneurship Skill Development	0	0	4	2
Total Credits					29

Approved by:

External Expert-1 (Prof. Subhadip Basu, J.U.)
External Expert-2 (Prof. Amlan Chakraborty, C.U.)
HOD - (Prof. A.B. Chaudhuri)

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Detailed Syllabus

Career Advancement and Skill Development
TIU-PEN-T100

L-T-P: 2-1-0 **Credit: 3**

Topics	Credit
English Language- Module 2	1
Advanced Aptitudes	1
Total	2

Computer Organization
TIU-UCA-T110

L-T-P: 2-1-0 **Credit: 3**

(1) Digital Computers

1- A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection.

2- Logic gates

3- Adders

4- Flip-Flops (as 1 bit memory device), Encoders, Decoders, Multiplexers, Registers, Shift Registers, Counters, RAM, ROM.

(2) Data Representation & Computer Arithmetic

Number systems, BCD, ASCII & EBCDIC Codes, Two's complement: Addition, subtraction, overflow, Floating point representation.

Addition and Subtraction with Signed Magnitude data, Multiplication Algorithms: Hardware Algorithm and Booth Algorithm, Division Algorithm.

(3) Processing Unit:

Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit. Machine instructions, Operands, addressing modes, Instruction formats, Instruction sets. , Software and Hardware interrupts (only brief introduction), Arithmetic and Instruction Pipelines.

(4) Input-Output Organization

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Access of I/O devices, I/O ports, I/O control mechanisms -
Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini band, I/O peripherals - Input devices, Output devices, Secondary storage devices.
Instruction level pipelining and Superscalar Processors, Multiple Processor Organizations, Closely and loosely coupled multiprocessors systems, Symmetric Multiprocessors, Clusters, UMA NUMA, Vector Computations, RISC: Instruction execution characteristics, RISC architecture and pipelining. RISC Vs CISC

(5) Memory Organization

Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM , Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management.

Recommended Books:

Main Reading:

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill, 2002.

2. Computer Organization and Design, David A. Patterson, John L. Hennessy, Morgan Kaufmann

3. Computer Organization, R. Govindarajan

Supplementary Reading

1. J. P. Hayes, Computer Architectures & Organization, Third Edition, 1998, McGraw Hill

BASIC MATHEMATICS-II
TIU-UMA-T104

L-T-P: 3-1-0 **Credit: 4**

MODULE I: Co-ordinate Geometry

Cartesian & Polar co-ordinate system, Equation of straight line, Angle between two straight lines – Condition for parallelism and perpendicularity, General equation of circle with a given centre and radius and simple problems, Standard equations of parabola, ellipse & hyperbola, Definition of focus, vertex, directrix, axes, eccentricity, Cartesian & Polar co-ordinate system in 3D, Equation of plane and simple problems, Equation of sphere and simple problems.

MODULE II: Complex Numbers

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Complex numbers, normal form, geometrical representation, Complex conjugate, Modulus of a complex number, Polar form, Integral and rational powers, Roots of a complex number, n^{th} roots of unity, De Moivre's theorem with applications.

MODULE III: Sequence and Series

Sequences and their limits, convergence of series, comparison test, Ratio test, Root test.

MODULE IV: Probability and Statistics

Basics of probability, Permutation, Combination, Axioms of probability, Independent events, Conditional probability, Bayes' theorem, Measures of central tendency – mean, median, mode, Measures of dispersion – standard deviation, variance, skewness, kurtosis, Moments, Correlation, Regression, Random variables, Distribution – Binomial, Poisson, Uniform, Normal.

Recommended Books:

Main Reading:

1. SL Loney, Elements of Co-ordinate Geometry, Macmillan and co
2. SK Mapa, Higher Algebra (Classical) 8^{th} edition, Levant Books-2011
3. Sheldon Ross, Probability and Statistics for Engineers and Scientists, Academic Press; 4 edition (February 13, 2009).

Supplementary Reading:

1. Engineering Mathematics, Vol: 1 & Vol: 2, Sastry, PHI.

Principles of System Software

TIU-UCA-T112

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

1. Overview of System Software:

Introduction, Software, Software Hierarchy, Systems Programming, Machine Structure, Interfaces, Address Space, Computer Languages, Tools, Life Cycle of a Source Program, Different Views on the Meaning of a Program, System Software Development, Recent Trends in Software Development, Levels of System Software

2. Overview of Language Processors:

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Programming Languages and Language Processors, Language Processing Activities, Program Execution, Fundamental of Language Processing, Symbol Tables Data Structures for Language Processing: Search Data structures, Allocation Data Structures.

3. Assemblers:

Elements of Assembly Language Programming, Design of the Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, Single pass Assembler for Intel x86 Algorithm of Single Pass Assembler, Multi-Pass Assemblers, Advanced Assembly Process, Variants of Assemblers Design of two pass assembler.

4. Macro and Macro Processors:

Introduction, Macro Definition and Call, Macro Expansion, Nested Macro alls, Advanced Macro Facilities, Design Of a Macro Pre-processor, design f a Macro Assembler, Functions of a Macro Processor, Basic Tasks of a Macro Processor, Design Issues of Macro Processors, Features, Macro Processor Design Options, Two-Pass Macro Processors, One-Pass Macro Processors

5. Linkers and Loaders:

Introduction, Relocation of Linking Concept, Design of a Linker, Self-Relocating Programs, Linking in MSDOS, Linking of Overlay Structured Programs, Dynamic Linking, Loaders, Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, Practical Relocating Loaders, Linking Loaders, Relocating Linking Loaders, Linkers v/s Loaders

6. Scanning and Parsing:

Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatical Specification, Scanning, Parsing, Top-Down Parsing, Bottom up Parsing, Language Processor Development Tools, LEX, YACC.

7. Compilers:

Causes of Large Semantic Gap, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization

8. Interpreters & Debuggers:

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Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic/Interactive Debugger.

Text Books:

1. System Programming , D M Dhamdhere McGraw Hill Publication ,
2. System Programming, Srimanta Pal , OXFORD Publication
3. System Programming and Compiler Construction, R.K. Maurya & A. Godbole
4. System Software, Santanu Chattopadhyay , Prentice - Hall India,2007

Data Structures through C++
TIU-UCA-T116

L-T-P: 3-1-0 **Credits: 4**

Module 1: Basic Concepts of Data Representation: Abstract and system defined types, primitive data structures.

Module 2: Linear data structures and their sequential representation: array, stack, queue, circular queue, Deque, priority queue and their operations and applications.

Module 3: Linear data structures and their linked representation: linear linked lists, doubly linked lists, circular linked list, linked stack, linked queue and their operations and applications.

Module 4: Non-Linear Data Structures: Binary trees, binary search trees, representations and operations, thread representations, sequential representations, graphs and their representation.

Module 5: **Searching Techniques**: Linear search, Binary search, Concept of hashing.

Module 6: Sorting Techniques: Insertion Sort, Bubble sort, Selection sort, Quick sort

Recommended Books:

Main Reading:

1. **"Schaum's Outline of Fundamentals of Computing with C++" by John R Hubbard,** Publisher: McGraw-Hill Education;
2. **"Data Structure and Algorithm in C++" by Adam Drozdek,** Thomson Press (India) Ltd; 3rd edition (1 December 2006)
3. **"Data Structures and Algorithm Analysis in C++ – Anna University" by Mark Allen Weiss,** PHI; 4 edition (13 June 2013)
4. **"Data Structures, Algorithms and Applications in C++" by S Vaidyanathan,** CBS Publishers; 1ST edition (2013)
5. **"Data Structures in C++" by Kutty and Padhya,** Prentice Hall India Learning Private Limited; New title edition (1998)
6. S. Chottopadhyay, D. Ghoshdastider& M. Chottopadhyay, Data Structures though C Language, First Edition, 2001, BPB Publication.
7. Lipshutz, Data Structures with C, McGraw Hill.

Supplementary Reading:

1. Y. Kanitkar, Let Us C
2. Robert Lafore, Data Structures and Algorithms in Java, Sams.
3. A.M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.

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4. Standish, Data Structure, Addison-Wesley.
5. B. Salzberg, File Structures - An Analytic Approach, Prentice-Hall.
6. A.L. Tharp, File Organization and Processing, John Wiley and Sons.
7. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
8. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.

Computer Oriented Numerical Methods

TIU-UMA-T106

L-T-P: 2-1-0 **Credits: 3**

Numerical Techniques:

Module 1: Errors and approximations: Error type, Analysis and Estimation, Error Propagation.

Module 2: Interpolation with Equal and Unequal Intervals: Newton's Forward and Backward interpolation formula, Lagrange's formula

Module 3: Numerical differentiation, Numerical integration – Trapezoidal Rule, Simpson's Rule

Module 4: Numerical Solution of Algebraic & Transcendental Equations: Bisection Method, Regula Falsi Method, Newton- Raphson Method

Module 5: Solution of simultaneous algebraic equations by Gauss elimination method, Gauss-Jordan method, Gauss- Siedel method.

Statistical Techniques:

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

Module 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.

Module 3: Range, Semi-interquartile range, Mean deviation, Variance and standard deviation, effect of change of origin and scale

Module 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. Relations between central moments and raw moments, skewness, kurtosis.

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Module 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

Module 6: Correlation & Linear regression, Method of least squares.
Module 7. Discrete and continuous Probability Distributions, Binomial, Poison, Normal, t and chi-square distributions, Testing of Hypothesis.

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

Recommended Books:

Main Reading:

1. K.S. Trivedi – Probability and Statistics with reliability, Queuing and Computer Science Applications – Prentice Hall India – 2001.
2. A.M. Mood, F. Graybil and Boes – Introduction to Mathematical Statistics – McGraw Hill – 1974.
3. Terrence J. Akai, "Applied Numerical Methods for Engineers", J. Wiley, 1994
4.Irwin Miller and Marylees Miller, "Mathematical Statistics", Prentice Hall
5. Srimanta Pal, Numerical Methods: Principle, Analysis, and Algorithms Oxford University Press.

Supplementary Reading:

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd., 2005.

2. Sheldon Ross, "A First Course in Probability", Pearson; 9th edition (December 31, 2012).

3. Robert J. Schilling & Sandra L. Harries, "Applied Numerical Methods for using MATLAB and C"

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Data Communication and Computer Networking

TIU-UCA-T108

L-T-P: 3-1-0 **Credits: 4**

Introduction: concept of signal, Uses of Computer Networks, Types of Computer Networks, OSI Reference Model, Example Networks.

Physical Layer: Data and signal fundamentals, Transmission impairments, Attenuation, Distortion, Noise, Data rate limits for noisy and noiseless channels, Performance
Digital Transmission – Problems with digital transmission, Different line coding schemes, Block coding schemes, Scrambling techniques, Analog to digital encoding. Analog Transmission.
Transmission Media- Guided (wired) media–Twisted pair cable, Coaxial cable and Fibre optic cable, unguided (wireless) media–Different propagation modes, Radio waves, Terrestrial microwaves, Satellite communication.
Concept of multiplexing, Frequency division multiplexing, Time division multiplexing –Synchronous and Statistical time division multiplexing, Handling variable length data, Pulse stuffing. Concept of spreading spectrum, Frequency hopping spread spectrum and Direct sequence spread spectrum.

Data Link Layer: Link Layer Services, Error detection and Correction Techniques, Multi Access Protocols, Link Layer Addressing, Ethernet, Hubs, Switches and Switches, Point to Point Protocol, Asynchronous Transfer Mode, Multiprotocol Label Switching.

Network Layer: Introduction, Virtual Circuit and Datagram Networks, IP Addressing, Subnetting, Routing Algorithms (Link State, Distance Vector, Hierarchical), Routing in the Internet (RIP, OSPF, BGP), Broadcast and Multicast Routing Algorithms, Routers, ICMP, IPv6.

Transport Layer: Introduction to Transport Layer Services, Connectionless Transport: UDP, Principles of Reliable Data Transfer, and Connection Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control, Sockets, Quality of services (QOS).

Application Layer: Web and HTTP, Domain Name Space (DNS), Electronic Mail (SMTP, MIME, IMAP, POP3), File Transfer Protocol

Recommended Books:

Main Reading:

1. B. A. Forouzan, Data Communications and Networking, TMH, 2003.
2. A.S.Tanenbaum, Computer Networks, PHI.

Supplementary Reading:

1. W.Stallings, Data and Computer Communication, McMillan.
2. J. Martin, Computer Network and Distributed Data Processing, Prentice Hall.
3. W.Stallings, Local Networks, McMillan.
4. M.Schwertz, Computer Communication Network Design and Analysis, Prentice Hall.
5. Keshav, An Engineering Approach to Computer Networks, Addison-Wisley.
6. Peterson and Davie, Computer Networks, Morgan and Kaufmann, 2000.

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Programming in Data structure through C++ Lab

TIU-UCA-L116

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

Lab to complement theoretical paper as per assignment given.

Numerical Methods Lab

TIU-UCA-L108

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

Lab to complement theoretical paper as per assignment given.

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