



**3-Year Master of Computer Application (MCA) Curriculum and
Syllabus
Second Semester**

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-PEN-T100	Career Advancement and Skill Development	1	0	1	2
TIU-IMA-T102	Computer Based Statistical & Numerical Techniques	3	0	0	3
TIU-PCA-T102	Data Communication and Computer Networks	3	0	0	3
TIU-PCA-T114	Advanced Data Structures Algorithms through C++ Language ***	3	1	0	4
TIU-PCA-T216	Advanced Cyber security and ethical hacking	3	1	0	4
TIU-PCA-T110	Operating Systems	3	1	0	4
TIU-ICA-T102	Computer Organization	3	1	0	4
Practical					
TIU-PCA-L102	Computer Based Statistical & Numerical Techniques Lab using C	0	0	3	2
TIU-PCA-L114	Advanced Data Structure through C++ Lab ***	0	0	3	2
TIU-PCA-L216	Advanced Cyber security and ethical hacking Lab	0	0	3	2
TIU-PCA-L110	OS Lab	0	0	3	2
Sessional					
TIU-PES-S198	Entrepreneurship Skill Development	0	0	2	2
Total Credits					28/30

NOTE: Green-coloured row is only for IMCA1, coloured one is for both MCA1 & IMCA1

Approved by:

External Expert-1 (Prof. Subhadip Basu, J.U.)

External Expert-2 (Prof. Amlan Chakraborty, C.U.)

HOD - (Prof. A.B. Chaudhuri)



*** To be started from July-19

DETAILED SYLLABUS

Career Advancement and Skill Development
TIU-PEN-T100

L-T-P: 1-1-0

Credit: 2

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

Computer Based Statistical & Numerical Techniques
TIU-IMA-T102

L-T-P: 3-0-0

Credit: 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.

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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.

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: Concept of probability distributions, Standard Pdf and pmfs, Hypothesis testing.

Note: In practical classes the candidates should be exposed to the use of Statistical Software like Excel, SPSS, SAS, R 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 Networks
TIU-PCA-T102

L-T-P: 3-0-0

Credit: 3

(1) Fundamentals of Data Communications

Introduction, Communication Systems, Signal and data, Channel Characteristics, Transmission modes: Synchronous transmission, Asynchronous transmission.

(2) Transmission Media:

Guided Media (Twisted pair, Co-axial cable, and Optical fiber), Unguided Media (radio, VHF, microwave, satellite), Infrared Transmission.

(3) Data Modems:

Concept of Modulation, Pulse Code Modulation (PCM), Shift Keying [ASK, FSK, PSK, QPSK, DPSK], Encoding techniques and CODEC, Classification of Modems.

(4) Multichannel Data Communication:

Circuits, channels and multi-channelling, Multiplexing [FDM, TDM, CDM, WDM], Access Techniques (FDMA, TDMA, Spread Spectrum Techniques and CDMA).

(5) Networking Fundamentals:

An overview of networking, Switching techniques: Circuit Switching, Packet switching, Datagram, Virtual circuit and Permanent Virtual Circuit, Connectionless and connection oriented communication, communication, Message switching, Cell switching (ATM), Network Topologies

Bus Topologies: Examples of bus topology - Ethernet, Local Talk, Ring Topologies: Examples of token Ring Topology - IBM Token Ring, FDDI (Fiber Distributed Data Interface),

Star Topologies: Example of Star Network - ATM (Asynchronous Transmission Mode).

(6) OSI Model and TCP/IP Suite:

Network architectures, Layering the communication process, The need for layered solutions, Open Systems Interconnection (OSI) model, TCP/IP protocol, Data transmission by TCP and Ethernet. User Datagram Protocol (UDP), TCP/IP services and application protocols: File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Simple Network Management Protocol SNMP, Domain Name System (DNS), (HTTP).

(7) Data Link Protocol:

1- Asynchronous Protocols, Asynchronous Data Link Control (DLC) Protocols.

2- Character Oriented protocols (COP) Binary Synchronous Protocol (Bisync or BSC).

3- Synchronous Data Link Control Protocol (SDLC), High Level Data Control Protocol (HDLC),

(8) Local Area Network (LAN) & its Devices:

Repeaters, Bridges, Router, Gateways, Switching, Hubs, Virtual LANs.

(9) Wide area Network (WAN):

Internet Addressing, DHCP and Static IP, IP Address Classes, IP Subnets, IPV6, Routing Protocols - BGP, RIP, OSPF. Address resolution Protocol.

(10) Data Transmission Networks:

Telephone networks: Dial up Telephone networks, Leased Line, X.25, The Integrated Services Digital Network (ISDN): Narrow band ISDN, Broadband ISDN Services Frame, Relay, Congestion Control, Cell Relay.

Recommended Books:

Main Reading:

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

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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.Schwartz, 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.

Advanced Data structures and Algorithms through C++ language

TIU-PCA-T114

L-T-P: 3-1-0

Credit: 4

Introduction to Algorithms:

- Algorithm Development, Complexity analysis
- Recursion, divide-and-conquer paradigm
- Assembly Notations

Linear Data Structures:

• Stacks: Operations and Applications, Queues: Operations and Applications, Circular Queues: Operations and Applications, Priority queues and heaps

Links Lists:

- Operation – Creations, insertion, Deletion, Circular Lists, Doubly Linked List
- **Sorting:**
 - Insertion Sort, Selection sort, Merge Sort, Quick Sort, Heap Sort: Method and Complexity, Analysis of Sorting Techniques.

Bucket and radix sort, topological sorting. Searching: Sequential & Binary Search

Binary Trees

- Representation
- Operations: Insert, Delete
- Traversal: Preorder, In order, Post order

Search Trees

- AVI-trees
- B-tree, B+ tree
- External Search

Graphs I: Representation and Traversal

- Representation: Matrix, Adjacency list
- Traversal: Depth First Search, Breadth First Search

Graphs II: Basic Algorithms

- Minimum Spanning Tree
- Shortest Path
- All pairs Shortest Path, Transitive Closer

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Graphs III: Basic Algorithms

- Minimum Spanning Tree
- Shortest Path
- All pairs Shortest Path, Transitive Closer

Tables

- Hashing Techniques.

Dynamic programming

Concepts and algorithms.

Recommended Books:

Main Reading:

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.
8. S. Chottopadhyay, D. Ghoshdastider & M. Chottopadhyay, Data Structures though C Language, First Edition, 2001, BPB Publication.
9. 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.
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, The art of computer programming-Vol-I & Vol-II, Narosa Publication.
8. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.

Advanced Cyber security and ethical hacking

TIU-PCA-T216

L-T-P: 3-1-0

(1) Introduction to Cybercrime

Credit: 4

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Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime

(2) Cyber offenses & Cybercrime

How criminal plan the attacks, Social Engg, Cyber stalking, Cybercafe and cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues.

(3) The Legal Perspectives of cyber security

Why do we need Cyberlaw: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario

(4) Tools and Methods Used in Cyber line

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)

(5) Cybersecurity: Organizational Implications

Cost of Cybercrimes and IPR Issues: Lesson for Organizations, Web Treats for Organizations: The Evils and Perils, Security and Privacy Implications from Cloud Computing, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling: An Essential Component, Intellectual Property in the Cyberspace of Cybersecurity, Importance of Endpoint Security in Organizations.

(6) Ethical Hacking Methodology

Introduction, Steps of Ethical Hacking: Planning, Reconnaissance, Scanning, Exploitation, post exploitation and result reporting. Ethical Hacking Tool: Metasploit.

(7) Computer Forensics

Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics

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Investigation, Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to the Computer Forensics and Social Networking Sites: The Security/Privacy Threats, Forensics Auditing, Anti Forensics.

(8) Mobile Device Forensics

Crime and mobile phones, evidences, forensic procedures, files present in SIM cards, device data, external memory dump, and evidences in memory card, operator's networks.

Text Book: (1) Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi

(2) Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

(3) Patrick Engebretson, "The Basics of Hacking and Penetration Testing, Second Edition:

Ethical Hacking and Penetration Testing Made Easy", 2nd Edition, Syngress.

References:

3. Nina Godbole, Information Systems Security, Wiley India, New Delhi

4. Kenneth J. Knapp, Cyber Security & Global Information Assurance
Information Science Publishing.

5. William Stallings, Cryptography and Network Security, Pearson Publication

Operating Systems **TIU-PCA-T110**

L-T-P: 3-1-0

Credit: 4

1. Overview:

Introduction: Operating Systems, Multi programmed Batched systems, Time sharing systems, Parallel and Distributed Systems, Real Time Systems, Computer System Structures: I/O structure, Storage Structure, Storage Hierarchy, Hardware, Protection, and General System Architecture.

Operating System Structures: System components, Operating System Service, System Calls, System programs, System Structure, System Design and Implementation, System Generation, Virtual Machines.

2. Process Management:

Processes: Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Interprocess Communication.

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CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real Time Scheduling, Algorithm Evaluation.

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling.

3. Storage Management:

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, paging, Segmentation, Segmentation with paging.

Virtual Memory: Demand Paging, Performance of Demand Paging, Page Replacement Algorithms, Thrashing, Demand Segmentation.

File System Interface: Access Methods, Directory Structure, Protection, Consistency Semantics.

File System Implementation: File System Structure, Allocation Methods, Free Space Management, Directory Implementation, Efficiency and Performance, Recovery.

4. I/O Systems:

I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations, Performance.

Secondary-Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability, Stable Storage Implementation.

Tertiary-Storage Structure: Tertiary-Storage Devices, Operating-System Jobs, Performance Issues.

5. Distributed Systems:

Network Structures: Topology, Network Types, Communication, Design Strategies.

Distributed System Structures: Network Operating Systems, Distributed Operating Systems, Remote Services, Robustness, and Design Issues.

Distributed File Systems: Naming and Transparency, Remote File Access, Stateful versus Stateless Service, File Replication.

Distributed Coordination: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement

6. Protection & Security:

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Protection: Goals of Protection,-Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights.

Security: The Security Problem, Authentication, One-Time Passwords, Program Threats, System Threats, Threat Monitoring, Encryption, Computer-Security Classifications.

7. Case Studies:

Windows NT.

Recommended Books:

Main Reading:

1. Silberschatz Galvin, "Operating System Concepts", John Wiley & Sons, Inc.

Supplementary Reading:

1. A. S. Godbole, "Operating Systems", Tata McGraw-Hill Education, 2005.

2. Andrew S.Tanenbaum, Albert S. Woodhull, "Operating Systems: Design & Implementation", Prentice-hall of India Pvt.

3. D. M. Dhamdhare, "Operating Systems: A Concept Based Approach", Tata McGraw-Hill Education, 2006.

Computer Organization

TIU-ICA-T102

L-T-P: 3-1-0

Credit: 4

Computer Evolution & Arithmetic

A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection, Scalar Data Types, Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm, Hardware Implementation, Division, Restoring and Non Restoring algorithms, Floating point representations, IEEE standards, Floating point arithmetic.

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.

Memory Subsystem:

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.

Input/Output Subsystem:

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

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- Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Parallel Organization:

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

References

1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill, 2002.
2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002.
3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann, 1998.
4. J. P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.

Computer Based Statistical & Numerical Techniques Lab Using C

TIU-PCA-L102

L-T-P: 0-0-3

Credit: 2

Practice of Probabilistic & statistical methods according to assignment. Factorial program using functions and recursion method. Fibonacci series using functions and recursion method Roots of equations Bisection, Bracketing methods; open methods like Newton- Raphson, secant etc. Solutions of simultaneous linear algebraic equations, Gauss Elimination; Matrix inversion Forward differences; back ward differences Numerical integration Numerical solutions for ordinary differential equations Euler; Modified Euler; Runge-Kutta

All the above modules are to be implemented through C++ language.

Advanced Data Structure through C++ Language Lab

TIU-PCA-L114

L-T-P: 0-0-3

Credit: 2

Suggested assignments on the following topics:

1. Stacks
2. Queues
3. Circular Queues
4. Operation Creations, Insertion, Deletion
5. Circular Linked List
6. Doubly Linked List
7. Graphs

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8. Trees
9. Linear Search
10. Binary Search
11. Bubble Sort
12. Insertion Sort
13. Selection Sort
14. Merge Sort
15. Quick Sort
16. Recursion

Advanced Cyber security and ethical hacking Lab
TIU-PCA-L216

L-T-P: 0-0-3

Credit: 2

1. Install and study chkrootkit security audit tool
2. Install and study Nessus network vulnerability audit tool
3. Simulate DOS attack using your favorite programming language.
4. Simulate IP spoofing attack.
5. Simulate Buffer overflow problem.
6. Write a program to hide text data in image file (Steganography).
7. Write a program to implement RSA algorithm.
8. Install and study PGP using Mozilla Thunderbird.

OS Lab
TIU-PCA-L110

L-T-P: 0-0-3

Credit: 2

Assignments will be given by the faculty teaching the subject.

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