Indian Institute of Information Technology Manipur

B.Tech Computer Science and Engineering

Course Syllabi Semesters I - IV

CS101	**Computer Programming**	**3-1-0-8**
Syllabus:		
Procedural programming through Language 'C': Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures, Simple I/O, Functions and parameter passing, Strings and string processing, Pointers and References, Structures, Recursion. Algorithm development: Techniques of problem solving, Stepwise Refinement, Simple numerical examples, algorithms for searching and sorting, merging order lists. Examples taken from real-world applications involving data manipulation.		
Texts:		
1. **Bryon Gottfried**, Programming with C, McGraw Hill, Third edition (ISBN: 9780070145900).		
References:		
1. **Horowitz, Sahni**, and **Anderson-Freed**, Fundamentals of Data Structures in C, Universities Press, Second edition (ISBN: 9788173716058). 2. **Kernighan** and **Ritchie**, The C Programming Language, PHI, Second edition, (ISBN:9788120305960).		

CS 110	**Computer Programming Lab**	**0-0-3**
Programming assignments on:		
Basic Assignment Statement, Conditional and Iterative Control Structures, Some Numerical Examples, Functions and parameter passing, Array and String, Pointer, Structure, Recursion, Dynamic Memory Allocation, File Handling, Linked List, Sorting, Command Line Arguments		

CS102	**IT Workshop I**	**2-0-3-7**
Aim: This is intended to act as an introductory course which aims to provide theory and hands on experience on general Linux system. This would enable the students to use Linux systems for their day to day activities. Also, the students will be able to create basic database backed web applications through simple tools like HTML, PHP, MySQL. The integrated development environment to be used is phpMyAdmin.		
Syllabus: Overview of Linux system and basic commands; Basic Linux Administration---logging, authentication, network setup, mail system, backup and archiving etc; Linux File system, vi editor, Open-office, Environment variables, Filters, Basic Shell Programming using Bash. Simple Database Driven Web Site: HTML, php, and MySQL (using phpMyAdmin)		
Texts: 1. **S. Das**, *Unix System V.4 Concepts and Applications*, 4th Edition, Tata McGraw-Hill, 2006.		

2. **Timothy Boronczyk**, **Elizabeth Naramore**, **Jason Gerner**,**Yann Le Scouarnec**, **Jeremy Stolz** and **Michael K. Glass**, *Beginning PHP6, Apache, MySQL Web Development*, Wiley India Pvt. Ltd., 2009.

References:

1. **Brian W. Kernighan** and **Rob Pike**, *The UNIX programming environment*, 1st Edition, PHI Learning, 1984, (Reprint 2011).
2. **Bruce Lawson** and **Remy Sharp**, *Introducing HTML5*, 2nd Edition, Pearson, 2012.

CS103	**Data Structures**	**3-1-0-8**

Syllabus : Performance of algorithms: space and time complexity, asymptotics; Fundamental Data structures: linked lists, arrays, matrices, stacks, queues, binary trees, tree traversals; Algorithms for sorting and searching: linear search, binary search, insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing; Search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.

Text:

1. Seymour Lipschutz, Data Structures with C, SCHAUM SERIES, Tata McGraw-Hill, 1st edition, 2010

References :

1. . M A Weiss, Data Structures and Problem Solving Using Java, Addison-Wesley, 1997.A M Tannenbaum, Y Langsam and M J Augenstein, Data Structures Using C++, Prentice Hall India, 1996.
2. A H Aho, J E Hopcroft and J Ullman, Data Structures and Algorithms, Addison-Wesley, 1987.
3. Robert Sedgewick, Algorithms in C++ Parts 1-4, Pearson Education, Third Edition, 1998.
4. Robert Sedgewick, Algorithms in C++ Part 5, Pearson Education, Third Edition, 2002.

CS 111	**Data Structure Lab**	**0-0-3-3**

Programming assignments on:

Using C Programming Language, Implementation of linked lists, stacks, queues, binary trees, tree traversals:

Implementation of algorithms for sorting: Insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Implementation of algorithms for searching: linear search, binary search

Assignments on Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing;

Assignments on search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.

CS104	Computer Organization	3-1-0-8
Syllabus: Basic Computer Architecture; ARM Instruction Set and Assembly Language Programming; Computer Arithmetic: integer addition (carry look-ahead), multiply (booth's algorithm), division (restoring and non-restoring), floating point arithmetic; Processor Design – single cycle, multi-cycle; pipelined design; memory architecture (static and Dynamic RAM; row and column addressing; interleaving, banks), cache memory (direct, set-associative, multi-level); storage basics: disks, tapes, printers, displays, flash memory; Buses (daisy chaining; synchronous and asynchronous; point-to-point; PCI, PCIe); Intel Sandy Bridge Archtecture; Intel X86 instruction set introduction.		
Text: David A. Patterson and John L. Hennesy, Computer Organization and Design: The Hardware Software Interface, ARM Edition, 4th edition, Elesevier India, 2010.		

CS201	Algorithms	3-0-0-6
Syllabus : Models of Computation: space and time complexity measures, lower and upper bounds; Design techniques: the greedy method, divide-and-conquer, dynamic programming, backtracking, branch and bound; Lower bound for sorting; Selection; Graph Algorithms: connectivity, topological sort, shortest paths, minimum spanning trees, network flow; The disjoint set union problem; String matching; NP-completeness; Introduction to approximate algorithms and Randomized algorithms.		
Texts : 1. T H Cormen, C E Leiserson, R L Rivest and C Stein, Introduction to Algorithms, MIT Press, 2001.		
References : 1. Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley, 2005 2. A Aho, J E Hopcroft and J D Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974. 3. S Sahni, Data Structures, Algorithms and Applications in C++, McGraw-Hill, 2001. 4. M T Goodrich and R Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons, 2001.		

CS 241	Operating Systems	3-0-0-6
Syllabus : Process Management: process, thread, scheduling; Concurrency: mutual exclusion, synchronization, semaphores, deadlocks; Memory Management: allocation, protection, hardware support, paging, segmentation; Virtual Memory: demand paging, allocation, replacement, swapping, segmentation, TLBs; File Management: naming, file operations and their implementation; File Systems: allocation, free space management, directory management, mounting; I/O Management: device drivers, disk scheduling, Basics of Security		
Text : 1. Silberschatz, A. and Galvin, P. B. Operating System Concepts. 8/e. Wiley, 2008.		
References : 1. Stalling, W. Operating Systems: Internals and Design Principles. 6/e. Pearson, 2008. 2. Tanenbaum, A. S. Modern Operating System. 3/e. Pearson, 2007. 3. Dhamdhere, D. M. Operating SystemsA Concept Based Approach, McGrawHill, 2008		

CS 242	Operating Systems Lab	0-0-4-4

Programming assignments on

1. Linux Programming with System Calls
2. Critical Section Problems
3. Scheduling
4. Memory Management
5. File Systems

Alternative, to build parts of an OS kernel. Use of a teaching package such as Nachos, Pintos.

CS 251	IT Workshop II	2-0-3-7

Syllabus: Programming in Java;

Java Basic: Why Java, Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures;

Object Oriented Programming with Java:objects and classes, methods and messages, abstraction and encapsulation, inheritance, Interfaces, abstract classes, polymorphism, access specifiers, static members, constructors, finalize method

Java concept: Exception handling, Threads, packages, Array and String, Handling I/O, Files, Networking

Database Programming with Java: JDBC architecture, Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements, Working with Result Set

JSP: java server pages (JSP); SQL basics; Use of Mysql and a web server using JSP for assignments.

Texts:

1. **Harvey Deitel, Paul Deitel**: Java How to Program, 9/e, Prentice Hall India

References:

1. **The online Java tutorial** http://docs.oracle.com/javase/tutorial/
2. **Y. Daniel Liang**: Introduction to Java Programming, 9/e, Pearson Publishing
3. **Herb Schildt**: Java The Complete Reference 8/e Tata Mcgraw Hill Education

CS 210	Formal Languages and Automata	3-0-0-6

Prerequisites: MA 204 or equivalent: Elementary discrete mathematics including the notion of set, function, relation, product, equivalence relation etc.

Alphabets, language, grammars; Finite Automata, regular language, regular expression; Context free grammars, Push Down Automata; Context Sensitive grammars, Linear Bounded Automata; Turing Machines, design of Turing Machine, Universal Turing Machine, Halting Problem; Operations on formal language and their properties; Chomsky hierarchy.

Texts:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and computation, 3rd Edition, Pearson / Addison Wesley, 2011. (ISBN 978021455369)

References:

1. H. R. Lewis and C. H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, PHI Learning, 2009. (ISBN 9788120322332)

2. M. Sipser, Theory of Computation, Cengage Learning India Private Limited, 2008. (ISBN 9788131505137)

CS 240	**Database Management Systems**	**3-1-0-8**

Databases: Introduction, Introduction to the Relational Model, Introduction to SQL, Intermediate SQL, Advanced SQL, Formal Relational Query Languages;

Database Design: ER Model, Functional Dependencies, Schema Design, Normal Forms;

Data Storage and Querying: Storage and File Structure, Indexing and Hashing, Query Processing, Query Optimization;

Transaction Management: Transactions, Concurrency Control, Recovery System,

System Architecture: Database System Architecture, Parallel Databases, Distributed Databases;

Advanced Topics: Data Warehousing and Mining, Information Retrieval, XML.

Texts:

Database System Concepts - Silberschatz, Korth & Sudarshan. (6th Edition).

References:

An Introduction to Database Systems - CJ Date (8th Edition)
Database Systems: The Complete Book - Gracia-Molina, Ullman, Widom. (2nd Edition)

CS 241	**Database Management Systems Lab**	**0-0-3-3**

Exercise to create simple tables and table with constraints, insert data into tables
Exercise on different forms of select statement.
Exercise on updating and deleting data using different conditions.
Exercise on group by and having clause.
Exercise on queries based joining different tables.
Exercise on nested queries and correlated Queries.
Exercise on data functions, group and scalar functions.
Exercise on Indexes, views and sequences.
Exercises on creation of PL/SQL blocks.
Exercises on cursor management in PL/SQL.
Exercise on trigger statement.
Exercise to write C program to create own database based on file, parse different basic queries and output them.

CS 252	Computer Networks	3-0-0-6

Network Basics: Evolution of computer networks; Network Models, Network Media, LAN, MAN and WAN, needs and goals of networking topology, network architecture, need for protocols, OSI Reference Model, layer services, primitives and service access points
Data link layer: Framing, HDLC, PPP, sliding window protocols, medium access control, Token Ring, Wireless LAN; Virtual circuit switching: Frame relay, ATM;
Network Layer: Internet addressing, IP, ARP, ICMP, CIDR, routing algorithms (RIP, OSPF, BGP);
Transport Layer: UDP, TCP, flow control, congestion control; Introduction to quality of service;
Application Layer: DNS, Web, email, authentication, encryption.

Texts:

Andrew S. Tanenbaum, "Computer Networks", 4th ed., Prentice Hall, 2003.

References:

Forouzan, *Data Communications and Networking,* 4th Ed., Tata Mcgraw Hill, 2006.

CS 253	Computer Networks Lab	0-0-4-4

Linux network configuration, measurement and analysis tools, Wireshark,

Socket programming using C++ - TCP and UDP, peer-to-peer applications; reliable communications using unreliable datagrams; client-server using RPC;concurrent servers using threads or processes.

Assignment on simulation of LAN, Wi-Fi etc using NS3 simulator

References:

http://tldp.org/
http://www.nsnam.org/documentation/

Mathematics

Course Syllabi Semesters I – III

MA101	Mathematics I	3-1-0-8

Syllabus

Linear Algebra: Systems of linear equations and their solutions; vector space R^n and its subspaces; spanning set and linear independence; matrices, inverse and determinant; range space and rank, null space and nullity, eigenvalues and eigenvectors; diagonalization of matrices; similarity; inner product, Gram-Schmidt process; vector spaces (over the field of real and complex numbers), linear transformations.

Single Variable Calculus: Convergence of sequences and series of real numbers; continuity of functions; differentiability, Rolle's theorem, mean value theorem, Taylor's theorem; power series; Riemann integration, fundamental theorem of calculus, improper integrals; application to length, area, volume and surface area of revolution.

Texts:

1. **G. Strang**, *Linear Algebra and Its Applications*, 4th Edition (South Asian Edition), Wellesley-Cambridge Press, 2009 (ISBN: 9788175968110).
2. **S. R. Ghorpade** and **B. V. Limaye**, *An Introduction to Calculus and Real Analysis*, Springer India, 2006 (ISBN: 9788181284853).

References:

1. **D. Poole**, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
2. **K. Hoffman** and **R. Kunze**, *Linear Algebra*, 2nd Edition, Prentice Hall India, 2009 (ISBN: 9788120302709).
3. **R. G. Bartle** and **D. R. Sherbert**, *Introduction to Real Analysis*, 3rd Edition, Wiley India, 2007 (ISBN: 9788126511099).

MA102	**Mathematics II**	**3-1-0-8**

Syllabus

Multi Variable Calculus: Vector functions of one variable – continuity, differentiation and integration; functions of several variables - continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; tangent planes and normals, maxima and minima, Lagrange multiplier method; repeated and multiple integrals with applications to volume, surface area, moments of inertia, change of variables; vector fields, line and surface integrals; Green's, Gauss' and Stokes' theorems and their applications.

Ordinary Differential Equations: First order differential equations - exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem, applications; higher-order linear differential equations - solutions of homogeneous and non-homogeneous equations, method of variation of parameters, series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds. Laplace and inverse Laplace transforms; properties, convolutions; solution of ODE by Laplace transform. Systems of first-order equations, two-dimensional linear autonomous system, phase plane, critical points, stability.

Texts:

1. **G. B. Thomas, Jr.** and **R. L. Finney**, *Calculus and Analytic Geometry*, 9th Edition, Pearson Education India, 1996.
2. **S. L. Ross**, *Differential Equations*, 3rd Edition, Wiley India, 1984.

References:

1. **H. Anton**, **I. C. Bivens** and **S. Davis**, *Calculus*, 10th Edition, Wiley, 2011.
2. **T. M. Apostol**, *Calculus*, Volume 2, 2nd Edition, Wiley India, 2003.
3. **W. E. Boyce** and **R. C. Di Prima**, *Elementary Differential Equations and Boundary Value Problems*, 9th Edition, Wiley India, 2009.
4. **E. A. Coddington**, *An Introduction to Ordinary Differential Equations*, Prentice Hall India, 1995.

MA203	Mathematics III	3-0-0-6

Syllabus

Introduction to probability: mathematical background - sets, set operations, sigma and Borel fields; classical, relative-frequency and axiomatic definitions of probability; conditional probability, independence, total probability, Bayes rule; repeated trials;

Random variables: cumulative distribution function, continuous, discrete and mixed random variables, probability mass function, probability density functions; functions of a random variable; expectation - mean, variance and moments; characteristic and moment-generating functions; Chebyshev, Markov and Chernoff bounds; special random variables-Bernoulli, binomial, Poisson, uniform, Gaussian and Rayleigh; joint distribution and density functions; Bayes rule for continuous and mixed random variables; joint moments, conditional expectation; covariance and correlation- independent, uncorrelated and orthogonal random variables; function of two random variables; sum of two independent random variables; random vector- mean vector and covariance matrix, multivariate Gaussian distribution; Vector-space representation of Random variables, laws of large numbers, central limit theorem;

Random process: discrete and continuous time processes; probabilistic structure of a random process; mean, autocorrelation and autocovariance functions; stationarity- strict-sense stationary and wide-sense stationary (WSS) processes: autocorrelation and cross-correlation functions; time averages and ergodicity; spectral representation of a real WSS process-power spectral density, cross-power spectral density, Wiener Khinchin theorem, linear time-invariant systems with WSS process as an input- time and frequency domain analyses; spectral factorization theorem;

Examples of random processes: white noise, Gaussian, Poisson and Markov processes, Basics of Queuing Theory, Characteristics of queuing systems.

Texts:

1. **Papoulis and S.U. Pillai**, *Probability Random Variables and Stochastic Processes, 4/e, McGraw-Hill, 2002.*
2. **A. Leon Garcia**, *Probability and Random Processes for Electrical Engineering, 2/e, Addison-Wesley, 1993.*

References:

1. **H. Stark and J.W. Woods**, *Probability and Random Processes with Applications to Signal Processing, Prentice Hall, 2002.*
2. **John J. Shynk**, *Probability, Random Variables, and Random Processes: Theory and Signal Processing Applications, Wiley publications.*