INTERNATIONAL INSTITUTE OF PROFESSIONAL STUDIES
DEVI AHILYA UNIVERSITY, INDORE

M. Tech. (IT) 5½ Years

VII SEMESTER

JULY-DECEMBER 2012

Sub. Code	Subject Name	Credit
IT-701	Computer Architecture	4
IT-702	Linear Systems	4
IT-703	Discrete Structure	4
IT-705A	Operating System	6
IT-708	Bio-Informatics	4
IT-707	Comprehensive Viva	4

INTERNATIONAL INSTITUTE OF PROFESSIONAL STUDIES, DAVV, INDORE
M. Tech. (IT) 5 ½ Years VII SEMESTER
IT-701: Computer Architecture

Aim of Course: To understand the concepts of design and analysis of the hardware of a computer system and its components such as control unit, arithmetic and logical (ALU) unit, input/output, and memory unit.

Objectives:

The course is designed to make students:

- Learn concepts of microprogramming in the design of the central processing unit of a computer system.
- Understand various ways for interconnecting I/O devices to the system.
- Understand basic concepts of parallel processing

Course Contents:

UNIT I

Introduction and vocabulary, History of computer architecture, Overview of computer organization, Difference between Computer architecture & organization, Introduction to digital logic, von Neumann/Turing, IBM 360 series, Moore's law, Performance measurement: IPC, CPI, MIPS, Amdahl's law, CPU performance equation, Speeding it up, Performance Mismatch & Solutions, Instruction cycle, Interrupt cycle, Bus interconnections: Types, Arbitration, PCI, Future bus, Future bus+.

UNIT II

CPU Structure, Registers, User Visible Registers, General Purpose Registers, accumulator organization, general register organization, stack organization of CPU, High level issues in CPU design, Memory: Location, Capacity, Unit of transfer, Access method, Performance (Access, cycle, transfer rate), Physical type (semi conductor or magnetic), Physical characteristics (volatile, erasable etc.), Locality of references, Cache mapping techniques, Cache write policies, Cache initialization, External memory, RAID organization of hard disks.

UNIT III

Input/Output: Programmed I/O, Interrupt Driven I/O, Direct Memory Access. Representing information digitally, Byte Ordering: Big-Endian & Little-Endian. Instruction sets, Elements of an Instruction, Instruction Representation, Instruction types, Number of Addresses, Design Decisions [CISC/RISC], Addressing Modes, Large Register File in RISC.

Register and data flow design, data fetch and instruction fetch in indirect instruction cycle, CPU control unit, Functions of Control Unit, Micro-Operations, Micro Programmed Control and Hardwired control unit and their advantages-disadvantages.

UNIT IV

Instruction level parallelism: Pipeline design, Synchronous & Asynchronous Pipeline conflicts: Resource conflict, Data dependency, and Branch difficulties. Solutions to deal with pipelining: Hardware interlocks, operand forwarding, Delayed load, Pre fetch target instruction, Branch target buffer, Loop buffer, Branch prediction, and Delayed branch. Super scalar design; Super pipelining, and VLIW processors.

UNIT V

Parallel Processing, Flynn's classification: SISD, SIMD, MISD, MIMD. Vector processor, Array Processor, Symmetric multi processing, NUMA, Cache coherence in parallel computing,

Clusters, Supercomputing and architecture of CRAY-1. Distributed computing and its models, Ubiquitous computing.

Reference Books:

1. William Stallings, Computer Organization and Architecture: Design for performance 8th Ed., Pearson Education.
2. Rajkamal, Computer Architecture, ISP 2006, Tata McGraw HILL.
3. Andrew Tanenbaum, Structured computer organization, 4th Ed., Prentice – Hall, Upper Saddle River, NJ, 2000. (Alternate reference)
4. M. Morris Mano, Computer System Architecture, 3rd Ed., Pearson Education.
5. Kai Hwang, Computer Architecture

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IT-702: Linear System

Aim of Course: To introduce concepts of Linear System dynamics through integro- differential equations

Objectives:

Objectives:

The course is designed to make students:

- Understand linear system dynamics
- Understand dynamics in the multi-loop multi-task programming
- Learn concepts of calculation of Eigen values and Eigen Vectors

Course Contents:

UNIT I

δ-Functions definitions and its properties. Applications δ-Functions to signals, definition of a linear system and its impulse response. Response by convolution basic idea and some examples. Graphical Evaluation of convolution integral and determination of the limits of integration.

UNIT II

Laplace Transform: Laplace Transform Theorem, Note on the Inversion integral, Region of convergence definition of unilateral and bilateral Laplace transforms, techniques of inversion of unilateral and bilateral Laplace transforms with some examples. Properties of Laplace Transform, Applications to networks and mechanical Systems.

UNIT III

Z-Transform: Sampling process, Frequency- domain Analysis of sampling process, Definition of Z-Transform, Properties of Z-transform. Inversion Integral for Z-Transform and techniques of inversion, solving the difference equations by Z-transform.

UNIT IV

Modeling of systems into integro-diffrential equations, analog simulation, signal flow graph, force-voltage and force-current analogy, concept of state conversion of integro- differential equations into state dynamics.

UNIT V

Concept of calculations of eigen-values and eigen-vectors, solution of Linear Vector matrix differential equations, Examples and applications. Controllability and Observability in time and frequency domains, stability

Reference Books:

1. I. J. Nagrath and M. Gopal, Control Systems Engineering, (Third Edition)
2. K Ogata, Modern Control Engineering. Fourth Edition, PHI
3. R A Gabel and R.A. Roberts, Signals and linear systems, Wiley International, John Wiley Eastern Pub.

INTERNATIONAL INSTITUTE OF PROFESSIONAL STUDIES, DAVV, INDORE
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IT-703: Discrete Structures

Aim of Course: To familiarize the students with mathematical concepts that underline much of computer science, and to help them develop the skills to solve problems using them, whether they are in a more advance course, doing research, or working.

Objectives:

The course is designed to make students:

1. Enhance mathematical reasoning of students
2. To understand Discrete Structures such assets, permutations, relations, graphs, trees and finite-state machines.
3. Enhance algorithmic thinking of students

Course Contents:

UNIT I

Set theory, function and relations: Set theory: Introduction, sets and elements, universal set and empty set, subsets, Venn diagrams, set operations, algebra of sets, power sets, partitions, ordered pair, Cartesian product. Relations: Introduction to relations, pictorial representation of relations, domain and range, types of relations, n-ary relations, equivalence relations, partially ordered relations.

Functions: Introduction to functions, functions in terms of ordered pairs, pictorial representation of relations, types of functions: surjective, bijective, injective etc, Recurrence relations with applications to algorithm analysis

UNIT II

Logic, Boolean algebra and lattices: Propositions and logic operations, existential and universal quantifiers, tautologies.

Boolean algebra: Combinatorial circuits and their properties, Boolean functions and synthesis of circuits, Lattices: Ordered sets, chains and anti chains, hasse diagrams, different types of lattices, related theorems and applications

UNIT III

Graph Theory: Definition and applications, finite and infinite graphs, incidence and degree, isolated vertex, pendent vertex and null graph.

Paths and circuits: Sub graphs, isomorphism, walks, paths and circuits, connected and disconnected graphs, Euler graphs, Hamiltonian paths and circuits.

Trees: Trees, properties of trees, pendant vertices in a tree, distance and center, rooted and binary trees, spanning trees, fundamental circuits

UNIT IV

Graph theory-II: Cut sets and cut vertices: Cut sets and their properties , connectivity and separability, network flows, 1 and 2 isomorphism Matrix representation of graphs: Incidence and adjacency matrices, Planar graphs, Diagraphs and shortest path algorithms applications of graphs-a general discussion

UNIT V

Automata, grammars and languages: Finite state automata, pushdown automata. Regular expressions, Regular languages, Turing machines and computable functions.

Reference Books:

1. J.P.Tremblay and R. Manohar . Discrete mathematical structures with applications to computer science, Tata McGraw Hill Publication
2. C.L.Liu . Elements of Discrete Mathematics, Tata McGraw Hill Publication
3. Llipschutz and Lipson. Discrete Mathematics, Schaum's outline series, Tata McGraw Hill Publication
4. K.A.Ross . Discrete Mathematics.
5. Bernard Kolman & Robert C. Busby. Discrete mathematical structures for Computer Science

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IT-704: Bio – Informatics

Aim of Course: This course provides an introduction to the analysis of biological data using computational methods, as well as investigating problems in molecular and biology from a computational perspective.

Objectives:

The course is designed to make students:

- Develop an understanding of the basic principles of molecular and cell biology.
- Become familiar with existing tools and resources for computational analysis of biological data, including sequences, phylogenies, microarrays, ontologies, and bio-molecular interactions.
4. Understand basic abstractions and computational approaches used for analysis including data warehouses, data mining, programming languages.

Course Contents:

UNIT I

What is bioinformatics? Definitions and concepts, Objectives/goals of Bioinformatics, Importance of Bioinformatics , Genome projects, DNA, RNA,DNA fingerprinting , types of RNA, functions of mRNA, tRNA, and rRNA, Amino Acids, Proteins, Central Dogma of Molecular Biology, Gene Coding,& Expression ,Genetic disorder , cloning.

UNIT II

Molecular Biology, RNA, DNA , Protein structure, DNA Sequencing, Base Pairs,Mutations and its type, Sequence Alignment, Dot plots, Simple Alignment. Scoring Matrices. Algorithms Pair wise sequence alignment - NEEDLEMAN and Wunsch, Smith Waterman algorithms; Multiple sequence alignments - CLUSTAL, PRAS; Patterns, motifs and Profiles in sequences.

UNIT III

Biological Databanks, Data Mining, Data warehousing, data capture, data analysis; Introduction to Nucleic Acid and Protein Sequence Data banks; Nucleic acid sequence data banks: Genbank, EMBL nucleotide sequence data bank, Protein sequence data banks: NBRF-PIR, SWISSPROT, Signal peptide data bank; Database Similarity Searches: BLAST, FASTA, PSI-BLAST algorithms.

UNIT IV

Programming Languages, Programming in C: Pointers, pointers to functions, macro and programming in C, graphs, data structure– linked list, stack, queue, binary trees, threaded binary trees, File and exception handling in C.

PERL: Strings, Numbers, and Variables. Variable Interpolation, Basic Input and Output, File handles, Making Decisions, Conditional Blocks, Loops, Combining Loops with Input, Standard Input and Output, Finding the Length of a Sequence File, Pattern Matching, Extracting Patterns, Arrays, Arrays and Lists, Split and Join, Hashes, A Real-World Example, BioPERL; Applications.

UNIT V

Bioinformatics medicine, Preventative medicine , Gene therapy ,Drug development | Alternative energy sources, personalized medicine, crop improvement, forensics analysis, Biotechnology etc. Machine learning overview, Neural networks, , Phylogenetic trees

Reference Books:

1. Pierre Baldi and Søren Brunak, Bioinformatics, The Machine Learning Approach, second edition, MIT Press, Cambridge, MA, 2001.
2. Dan E. Krane, Michael L. Raymer , Fundamental Concepts of Bioinformatics.
3. James Tisdall, Beginning Perl for Bioinformatics.
4. Cynthia Gibas, Per Jambeck , Developing Bioinformatics Computer Skills.
5. Arthur M. Lesk , Database Annotation in Molecular Biology: Principles and Practice.

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IT-705: Operating System

Aim of Course: Aim of Course: To make the students familiar with design of operating systems as resource manager of a computer system.

Objectives:

The course is designed to make students:

- To present basic concepts of operating system architecture
- Understand the concepts of processor management and memory management techniques
- Study deadlock handling and inter-process communication
- Study file systems and device management.

Course Contents:

UNIT I

Introduction to Operating System:- Objectives and functions and the services provided by OS.
Evolution of operating system:- Concepts of batch processing, multiprogrammed batched system, time-sharing systems, Parallel Systems, Distributed systems. Operating system structure: -System calls and system programs.

UNIT II

Process Management: -Process concept, Process states, Process scheduling , Operations on processes , Co-operating processes and IPC.
CPU scheduling: - Basic concept and scheduling criteria, Long term, short term medium term schedulers, Scheduling algorithms, Multi-Processors Scheduling, Measurement of performance of processor.

UNIT III

Process synchronization: - Critical section problem, Mutual exclusion and synchronization, Concept of semaphores, Classical IPC problems. Deadlocks: - Characterization of deadlock, Methods of handling prevention, detection and avoidance, Recovery from deadlock.

UNIT IV

Memory management:-Logical and physical address spaces, Swapping and paging, Contiguous, allocation and its drawbacks, Non-contiguous allocation. Virtual memory: - Demand paging and its need, Performance of demand paging, Page replacement and its need, Thrashing and allocation of frames.
File system interface: - File concept, access methods, Directory structure, protection and consistency. File system structure, Allocation methods, Free space management, Efficiency and performance, Coincidence, protection and sharing.

UNIT V

I/O system: - Various i/o devices, Device drivers, structure of I/O software, Transforming
I/O request of h/w operation. Secondary storage structure:- Disk structure, Disk Scheduling, Disk management, Swap space management and Disk reliability.

Note:- Case study of windows and Unix operating system is to be done as assignment.

Reference Books:

1. Silberschatz Galvin, Operating System concept, 5th edition.
2. D. M. Dhamdhare, System Programming and operating system, Tata McGraw Hill, 2nd edition.
3. Milan Milenkovi'c, Operating System concept and design, Tata McGraw Hill.