



**REVISED (DETAILED) SYLLABUS FOR 2-YR. M.Sc. 4 SEMESTERS EACH OF 6 MONTHS
DURATION IN COMPUTER AND INFORMATION SCIENCE
UNIVERSITY OF CALCUTTA**

First Semester

CISM101: ADVANCED COMPUTER ARCHITECTURE

Full Marks:- 100

Introduction: Computer Architecture & Organization. Basic Parallel Processing Architecture, Taxonomy- SISD, MISD, SIMD, MIMD structures, Serial, Parallel & Concurrent Computation, CISC Vs RISC, Structure of Instruction of instruction sets and Desirable Attributes.

Pipelining: Basic Concepts of pipelining, Instruction Pipelining. Hazards, Reservation Tables, Collision, Latency, Dynamic pipeline, Vector processing & Vector processors.

Memory Systems: Cache Memory & Virtual Memory: Structure, Analysis & Design.

I/O Systems: Design Issues, Performances Measures.

Multiprocessor Architecture: Loosely Coupled & Tightly Coupled Systems, Concurrency & Synchronization, Scalability, Models of Consistency, Application of SIMD Structure.

Interconnection Network: Definition. Types of Interconnected Networks; Baselines, Shuffle- Exchange, Omega, Cuba, Comparison & Application.

Systolic Architecture: Mapping Algorithm to array structures, Systolic processors. Mapping design & Optimization, Wave Front Array processor.

Data Flow Architecture: Data Flow Graphs, Petri nets, Static & Dynamic DFA.

Programming Environment: Different Models, Languages, Compilers, dependency Analysis. Message Passing, Program mapping to Multiprocessors, Synchronization.

Case Study: Basic Features of Current Architectural Trends. DSP Processor, Dual core Technology

CISM 102: DATABASE MANAGEMENT SYSTEM

Full Marks:- 100

Overview of Database & Relational Database Design:

Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms. **Transaction**

Processing: Transaction concepts, Recovery and Concurrency Control, Locking and Timestamp based protocols, Multiversion and Optimistic Concurrency Control schemes,

Database security: Threats and countermeasures. **Advanced Topics:** Object-oriented and Object Relational Databases, Distributed Databases, Data Warehouse and Data Mining.

CISM 103: DATA STRUCTURE

Full Marks: 100

Fundamentals of Linear and Non-Linear Data Structures

Basic concepts about Algorithms, Data Structures, Recursion, Iteration, Big-O Notation, Brief Foundations and Applications of Stacks, Queues, Arrays, Linked Lists – Singly, Doubly, and Circular Linked Lists, Trees – Definitions, Representations, Binary Tree and Its Usefulness, Binary Search Tree, Tree Traversal, Threaded Binary Trees, Binary Tree Representation of any Tree other than Binary Tree, Decision Trees, Balanced Tree Schemes – AVL Trees, 2-3 Trees.

Searching- Basic concepts about Searching, B-Trees, Hashing.

Sorting- Different Sorting Algorithms and their complexity issues.

Advanced Data Structures- Binomial Heaps, Fibonacci Heaps, Amortized Analysis of Algorithms, Disjoint Set Maintenance Techniques.

CISM 104: DATA COMMUNICATION

Full Marks: 100

Introduction to communication systems, Data, signal and Transmission: Analog and Digital, Transmission modes, Transmission Impairments, Performance criteria of a communication system

Goals of computer Network, Networks: Classification, Components and Topology, Layered architecture of a Network software, OSI and TCP/IP model

Encoding: Line coding and Block coding, Error detection codes, Modulation: Digital to Analog and Analog to Analog conversion techniques

Bandwidth utilization techniques: Multiplexing: Frequency division, Time division and Wave division multiplexing, Spread spectrum concepts

Transmission Media: Guided and Unguided: Architecture, Transmission characteristics and application

Switched Networks: Circuit switching and Packet Switching, Circuit Switching principle and the Modems used in a Telephone network, Connection oriented and Connection-less approach in packet switching network

Information Theory: Measure of Information, Entropy, Discrete and Continuous channel, Shannon's encoding algorithms

CISM 105(P): DATA STRUCTURE LABORATORY

Full Marks: 100

Programming with C: Control statements, array and pointers, functions, scope of variables, parameter passing, structures, union, files.

General assignments on C programming language before the students start their work on Data Structure.

Assignments on developing programs and functions related to the theoretical paper coverage on Data Structures.

CISM 106(P): DATABASE LABORATORY

Full Marks: 100

Database Schema Design, Database Creation, SQL Programming and Report Generation using a RDBMS. Students are to be exposed to front-end development tools, ODBC; Internet based access to databases and database administration.

Second Semester

CISM 201: - COMPUTER NETWORK

Full Marks:- 100

Review on Computer Networks Basis

Data Link control: Line discipline, Flow and error control protocols, Physical addressing, HDLC

MAC Protocols: Dynamic channel allocation, Random access and Controlled access techniques, IEEE Standards.

LAN Interconnection technologies and High Speed LANs, Virtual LANs. Virtual Circuit approach in WANs.

Internetworking: IP address – subnetting, NAT, IP datagrams address mapping, error reporting and multicasting in network layer

Routing Protocols:- Static and Adaptive routing, Distance vector and Link-State routing, Broadcast routing, Unicast routing protocols: interior and exterior routing protocol. RIP, OSPF and BGP, Multicast routing protocols – Source-Based tree and Group-Shared tree approach.

Reliable and Unreliable transport service, Flow and error control mechanism in transport layer.

Congestion control and Quality of Service

Internet applications: DNS, Electronic mail, FTP.

CISM 202: - DESIGN & ANALYSIS OF ALGORITHMS

Full Marks:- 100

Review :Algorithms,Complexity,Order. Divide and Conquer : Multiplications of Large integers , Strassen's Matrix Multiplication algorithm. Dynamic Programming :shortest path, chained matrix multiplication, optimal binary search trees, Travelling salesman problem. Greedy Algorithm Knapsack problem. Computational Complexity and Intractability. Review : NP-complete problems. Approximation Algorithms.Amortised Analysis. Backtracking: n-queen's problem. Parallel Algorithms.

CISM 203: - COMPUTER GRAPHICS & IMAGE PROCESSING

Full Marks:- 100

Introduction to Computer Graphics & Graphics Systems

Overview of CG, definitions of CG, types of CG, storage tubes displays, CRT technologies - Raster Scan Display, Computer graphics software.

Scan Conversion - Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

2D Transformation -Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.

Viewing -Viewing pipeline, Window to Viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

3D Transformation & Viewing -3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space; reflection through an arbitrary plane; general parallel projection transformation; clipping, Viewport clipping, 3D viewing, perspectives & Depth Cueing.

Curves and Fractals -Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden Surfaces -Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color & Shading Models- Introduction, Modeling Light Intensities and Sources, Diffuse Reflection, Lambert's Cosine Law, Specular Reflection, Halftoning, Color Models - RGB Color, CMY Color..

CISM 204: - SOFTWARE ENGINEERING

Full Marks:- 100

Software Engineering – a generic view. Review of Software Development stages-analysis , design, implementation, testing .Program verification. Module relationship-Coupling, Cohesion. Effort Estimation models . Project Scheduling .Software Maintenance. Software Quality Models. Software Reliability –Basics, Time-dependent and Time-independent models. Software metric. Software Configuration management . Object- oriented software Engineering. Unified Modelling Languages – features and case study.

Practical

CISM 205(P): - GRAPHICS LABORATORY

Full Marks:- 100

2D Algorithms: Different Line Drawing algorithms. Different Circle generating algorithms. Different Filled Area primitives.

3D Algorithms: Representation & viewing of three dimensional objects. Implementation of Planar Geometric Projections.

Problems of GUI design – Representation of a region into Quadtree.

Different image transformation algorithms. Algorithms on Image enhancement, segmentation and restoration.

CISM 206(P): - SOFTWARE ENGINEERING LABORATORY

Full Marks:- 100

Design and development of Softwares- Application and System Softwares.

e.g. Railway Reservation System , Examination System, Student Registration System, Problems on compilation, Entity relationship.

Designing of test data for testing procedural and object-oriented programs.

Design and development of software for measurement of quality attributes of software.

Implementation of use-case diagrams and related notations

Third Semester

CISM 301: - Object Oriented Design

Full Marks:- 100

Object Model - Abstraction, Encapsulation, Modularity, Links and Association, Generalization, Inheritance, Aggregation, Polymorphism, using Instantiation, Metadata & Metaclass, Typing, Concurrency, Persistence

Dynamic Model - Events & States, Concurrency, Advanced Dynamic Model, Relation of Object and Dynamic Model.

Functional Model - DFD, Constraints, Relation of Functional to Object and Dynamic Model.

Object Oriented Design - Analysis using Object, Dynamic and Functional Model.

System Design: Subsystems, Concurrency, Allocating Subsystems to Processors & Tasks, Software Control Implementation, System Architecture

Object Design: Combining three Models, Designing Algorithms, Design Optimization, Control Implementation, Design of Association, Packaging.

Design Modeling using UML

Object Oriented Programming using C++: -Pointers, Enumeration, Overloading, Object and Classes, Inheritance, Template, Exception handling, Associations

Object Oriented Languages- OO Languages Features, Survey of OO Languages, Multimethod vs Object Based vs Class based languages, Java and C++

Object Oriented Data Structure using C++:- Lists, Stacks, Queue, Trees, Sorting, Searching, Graphs.

Object Oriented Database- Relational Database Design – Mapping Object Models to tables

OODB Features - OO Data Model, Complex Object, Persistence, Transaction, Concurrency Control, OODB Architecture, Query Language for OO Relational Databases, Gemstone / O₂ / Orion

Object Oriented Testing - Unit Testing, Integration testing, System testing

Distributed Object Oriented System - CORBA – A

Case Study

Reference:-

1. Object Oriented Analysis and Design - by Grady Booch
2. Object Oriented Modeling and Design - Ram Baugh el al, PHI
3. The C++ Programming Languages – B Stroutstrup, Addison Werelay
4. Database System Concepts – H. Korth el al, The Mc Graw Hill Companies, Inc.
5. Data Structure Using C and C++ - A.M Tannenbaum el al PHI
6. Data Structure and Software Development in Object Oriented Domain – J. P. Trembley el al, Pearson Education Asia
7. Unified Modeling Language User Guide – Booch, Rambaugh., Jacobson, Addison Wereley.
8. Inside CORBA – Mowbray & Ruh, Addison Wereley
9. Object Oriented Programming in C++ - R.lafore, Galgotia Publication
10. Foundation Of Object Oriented Languages – Kim Bruce PHI
11. Object Oriented databases – B. R. Rao, Mc. Graw Hill Inc

Set of Elective Papers: (M.Sc.)

Elective-I:

1. Distributed system
2. Cryptography
3. Soft Computing
4. Modeling and Simulation
5. Embedded System

Elective-II:

1. Parallel Computing
2. Information Security
3. Cognitive Computing
4. Computational Geometry
5. Principles of Programming Language