

# St. Xavier's College (Autonomous), Kolkata

Postgraduate and Research Department of Computer Sc.

## Proposed syllabus - July 2021 onwards

SEM NO	PAPER NO	PAPER TYPE	PAPER	TYPE	MARKS	CREDITS	CLASSES PER WEEK (13 weeks)		
							TH	PR	TUT
1	1	CORE - 1	Design and Analysis of Algorithms	Composite	60+40	4+2=6	4	4	X
	2	CORE - 2	Advanced Database System and Data warehousing	Composite	60+40	4+2=6	4	4	X
	3	CORE - 3	Advanced Operating System	Composite	60+40	4+2=6	4	4	X
	4	CORE - 4	Advanced Computer Architecture	Theory	100	6	5	X	1
2	1	CORE - 5	Microcontroller and Embedded Systems	Composite	60+40	4+2=6	4	4	X
	2	CORE - 6	Advanced Computer Networks	Theory	100	6	5	X	1
	3	CORE - 7	Compiler Design	Theory	100	6	5	X	1
	4	CORE - 8	Internet Technology	Practical	100	6	X	8	2
3	1	CORE - 9	Software Engineering & Design	Composite	60+40	4+2=6	4	4	X
	2	CORE - 10	Artificial Intelligence	Composite	60+40	4+2=6	4	4	X
	3	DSE-1	<b>Discipline Specific Electives</b>			6			
	4	DSE-2	<b>Discipline Specific Electives</b>			6			
4	1 a	CORE - 11	Network Security	Theory	50	3	3	X	X
	1 b	CORE - 12	VLSI Design	Theory	50	3	3	X	X
	2	DSE-3	<b>Discipline Specific Electives</b>			6			
	3	DSE-4	<b>Discipline Specific Electives</b>			6			
	4	PROJECT	Project	Project	100	6	X	X	X

**Total Marks: 1600**

**Core Papers: 12**

**Discipline Specific Electives: 4 out of 10**

**Total Credits: 96**

**Discipline Specific Electives:**

DSE i: Digital Image Processing

DSE ii: Data Science

DSE iii: Soft Computing

DSE iv: Machine Learning and Data Mining

DSE v: (a) Ecommerce  
(b) Cyber Law

DSE vi: Graphics and Multimedia

DSE vii: Internet of Things

DSE viii: Cryptography

DSE ix: Cloud Computing

DSE x: Mobile Computing

## **CMSM CORE 1 Composite**

### **Design and Analysis of Algorithms (Theory – 60 marks)**

Review of basic algorithmic analysis: Asymptotic analysis of upper and average complexity bounds; best, average, and worst case behaviors; big-Oh, big-Omega and big-Theta; standard complexity classes; empirical measurements of performance; time and space tradeoffs in algorithms; recurrence relations

Divide and Conquer: Merge Sort, Quick Sort, Selection Problem, Median and Order Statistics, Strassen's Matrix Multiplication, Convex Hull Algorithms.

Greedy Algorithm: Knapsack algorithm, Huffman Codes, Task Scheduling

Dynamic Programming: Chained matrix multiplication

Backtracking Algorithms: 8 queens problem

Branch and Bound: Travelling Salesperson problem.

Graph and Tree Algorithms: BFS, DFS, Topological Sort, Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Dijkstra's Algorithm, Bellman Ford Algorithm, Bipartite Graphs, Binary Search Tree, AVL tree, 2-3 Tree, Red Black Tree, Binomial Heaps.

Complexity Theory: Tractable and intractable problems, Concepts of computable functions; Polynomial reducibility: P and NP: Definition of the classes P and NP, NP-completeness (Cook's theorem), Standard NP complete problems.

### **LAB: Design and Analysis of Algorithms (40 marks)**

Books and References:

1. T. H. Cormen et al -Introduction to Algorithms , PHI
2. E. Horowitz, S. Sahani - Fundamentals of Computer Algorithms – Galgotia
3. Bratley et al - Fundamentals of Algorithms-PHI

## **CMSM Core 2 Composite**

### **Advanced Database Management System and Data Warehousing (Theory – 60 marks)**

Transaction Management and Concurrency Control: States of Transaction, ACID properties, consistency model, storage model, cascading rollback, recoverable schedules. Concurrency: Schedules, testing for serializability, Lock-based protocols-Two-phase locking protocol, Timestamp based protocol, optimistic techniques, deadlock handling. Recovery: Failure classification, storage hierarchy, log-based recovery, shadow paging. Query processing and optimization: Steps of query processing, query interpretation, equivalence of expression, estimation of cost, join strategies

Distributed Database: Principles of distributed database, levels of distribution transparency, data fragmentation, replication and allocation techniques.

Data warehousing: Basic Concepts, OLTP, Advantages and Drawbacks of Data Warehouse, Data Warehouse Architecture. Data Warehouse Schema: Star, Snowflake, Fact Constellation. Data Marts: Basic concepts, Advantages and drawbacks, Components. Data Warehouse Design: Different views of designs, processes of design. On-line Analytical Processing: Concepts of OLAP, Multidimensional Data Model; OLAP Operations.

### **LAB: Advanced Database Management System and Data Warehousing (40 marks)**

Books and References:

1. Elmasri, Navathe, Fundamentals of Database System, 3/e, Pearson Education.
2. Korth, Silberschatz : Database System Concepts, McGrawHill ,
3. Ceri and Pelagatti, Distributed Databases: Principles and System: McGrawHill
4. "Data Mining: Concepts and techniques", J Han and M Kamber, Third Edition, Elsevier.

## **CMSM Core 3 Composite**

### **Advanced Operating System (Theory – 60 marks)**

Introduction to distributed Systems: Definition, goals, Advantages– Disadvantages, Hardware and Software concepts, Design issues.

Synchronization in distributed systems: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems.

Distributed File Systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, different protocols of DSM. Naming Overview, Features, Basic concepts, System oriented names, Object locating mechanisms.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC.

Processes and processors in distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues

Distributed Web-based Systems Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications

Case Study Java RMI.

### **LAB: Advanced Operating System (40 marks)**

Books and References:

1. Tanenbum,A.S.,Distributed Operating Systems ,Pearson Education.
2. Singhal,Shivaratri,Advanced Concepts in Operating Systems,TMH.
3. P.K.Sinha,Distributed Operating Systems,PHI

## **CMSM4 Core 4 Theory**

### **Advanced Computer Architecture (Theory – 100 marks)**

Introduction: Elements of Modern Computers, Performance, The Switch from Uniprocessors to Multiprocessors

Parallel Processing: Parallel Computer Structures, Architectural Classification, Parallel Processing Applications

Principles of Pipelining and Vector Processing: Pipelining, Instruction and Arithmetic Pipelines, Principles of designing pipelined processors, vector processing requirements

Structures and Algorithms of Array Processors (SIMD Computers): SIMD Array Processors, SIMD Interconnection networks, Parallel Algorithms for Array Processors

Multiprocessor Architecture and Programming: Functional Structures, Interconnection Networks, Multistage Interconnection Networks, Parallel Memory Organizations

Memory and I/O sub-systems: Hierarchical Memory Structures, Cache Memories and Management, I/O sub-systems

Books and References:

1. Kai Hwang, Advanced Computer Architecture, Tata Mc Graw Hills
2. Kai Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, Tata Mc Graw Hills
3. Hennessy Patterson, Computer Architecture, A quantitative Approach , 5th ed, Elsevier.
4. Dongarra, Foster, Fox & others, Source Book of parallel Computing, Elsevier.
5. M.J Quinn, Designing Efficient Algorithms for Parallel Computers, Mc Graw Hill

## **CMSM Core 5 Composite**

### **Microcontroller and Embedded Systems (Theory – 60 marks)**

Introduction to embedded systems, definition of embedded system, classification of embedded systems, Overview of Embedded System Architecture, skills required for an embedded system designer, processor in the system, memories and I/O Interfaces, Linking and interfacing buses (GPIB(IEEE 488)) Link, software embedded into a system, Real Time O.S. & embedded system, embedded system on-chip(SOC) and in VLSI circuit. Application areas (exemplary cases). Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM and DSP.

Introduction to Microprocessors, Microcontrollers and Embedded Processors, Microcontrollers survey-four bit, eight bit, sixteen bit, thirty two bit Microcontrollers, Comparing Microprocessors and Microcontrollers-Overview of the 8051 family.

The 8051 Architecture, Hardware, Oscillator and clock-program counter, data pointer, registers, stack and stack pointer, special function registers, memory organization, program memory, data memory, Input / Output Ports, External memory counter and timer-serial data Input / output-Interrupts.

8051 Assembly Language Programming, Structure of Assembly language Assembling and running an 8051 program- Addressing modes, accessing memory using various addressing modes, Instruction set, Arithmetic operations and Programs, Logical operations and programs, Jump and Call instructions and Programs -I /O Port, Single bit instructions, Timer and counter, delay Programs.

8051 Serial Communication, Serial Communication Programming, Interrupts Programming.

Microcontroller Interfacing, Peripherals: Keyboard, Displays, Basic concept of PIC microcontroller, PIC16F Family.

### **LAB: Microcontroller and Embedded Systems (40 marks)**

Books and References:

1. Ray, Bhurchandi ,Advanced Microprocessors and Peripherals, Tata Mc Graw Hill.
2. Mazidi, McKinlay, The 8051 Microcontroller and Embedded

## **CMSM Core 6 Theory**

### **Advanced Computer Networks (Theory – 100 marks)**

**Network Architecture:** Layered architecture and protocol hierarchy TCP/IP protocol suite, Services and important functions of each layer

**Local Area Networks:** Aloha and Carrier Sense Protocols, Ethernet, Token Ring, FDDI

**Connecting Devices:** Bridges, Backbone Networks, Virtual LAN

**Internetworking:** Virtual Circuits and datagrams, IP addressing, IPv4 and IPv6 datagrams, Subnetting, CIDR

**Routing Algorithms:** Shortest path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multicast Routing, Routing for mobile hosts

**Routing Protocols:** ARP, RARP, ICMP, RIP, OSPF, BGP

**Process to Process Delivery:** TCP and UDP

**Congestion Control and Quality of Service:** Congestion control Techniques, Congestion control in TCP. Techniques for improving the QoS

**Application Layer:** An overall idea of socket and DNS; Detailed working principles of two application layer protocols - SNMP and SMTP

**Wireless LAN:** IEEE Standards for Wireless Networks Wireless Networks Applications, Types of Wireless Networks, Benefits of Wireless Networks, Bluetooth – Architecture and Protocol Stack

**Software Defined Networks (SDN):** Definition, Layers and Applications

Books and References:

1. B.Forouzan – Data Communication and Networking, TMH
2. A Tanenbaum – Computer Networks, PHI
3. Computer Networks by Behrouz A. Forouzan
4. TCP/IP Protocol Suite by Behrouz A. Forouzan



## **CMSM Core 7 Theory**

### **Compiler Design (Theory – 100 marks)**

Review: Concepts and Types of Translators: Assembler, Cross-Assembler, Pre-Processor, Interpreter, Simulator, Loader; Linker.

Grammars, Languages – types of grammars and their recognizers, Basic concepts of translators: boot strapping, cross compiler, Different phases of compilation.

Lexical analyzer: Concepts, Tokens, Schemas, Design using FSM.

Syntax Analysis: Top down and Bottom-up parser; Operator precedence; Recursive descent; LL (1); LR (1);LALR (1).

Intermediate code generation: Three Address Code, Representation of three address code – Quadruples, Triples and Indirect Triples.

Syntax directed translation: Attributes, Semantic Actions, Translation schemes.

Code Optimization: Basic blocks, loop optimization, flow graph, DAG representations of basic blocks.

Code generation: Object Programs, Problems in Code Generation.

Error handling: detection, reporting, recovery and repair

Symbol tables: Organization and management techniques.

Runtime storage management: static allocation; dynamic allocation, activation records; heap allocation, recursive procedures

Books and References:

1. Alfred V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Narossa Publication
2. Aho, Sethi and Ullman, Compilers – Principles, Techniques and Tools, Narossa Publication
3. Peter Linz ,Formal Language and Automata Theory, Narossa Publication
4. Systems Programming and Operating System, D. M. Dhamdhere, Tata McGraw Hills
5. Systems Programming, John J Donovan, Tata McGraw Hills

## **CMSM4 Core 8 Practical**

### **Internet Technologies (Practical – 100 marks)**

HTML Preview, Forms: elements, attributes, actions and methods.

**CSS (Cascading Style Sheets)** -Introduction, Benefits of CSS, CSS Syntax, Value Lengths and Percentages, Internal Style sheets, Inline and External Style sheets. CSS2-Selectors: ID Selectors, Class Selectors, Grouping Selectors, Descendant / Child Selectors, Attribute Selectors, CSS - Pseudo Classes CSS2- Color, Background and Cursor: background-image, background-repeat, background-position, linear and radial gradient, CSS Cursor CSS2-Text Fonts: color, background-color, text-decoration, text-align, vertical-align, text-indent, text-transform, letter-spacing, word-spacing, line-height, font-family, font-size, font-style, font-variant, font-weight. CSS2-Lists and Tables: list-style-position, list-style-image, list-style, CSS Tables. CSS2-Box Model: Borders & Outline, Margin & Padding, Height and width, CSS Dimensions. CSS2-Display Positioning and Floats: CSS Visibility, CSS Display, CSS Scrollbars, CSS Positioning (Static Positioning, Fixed Positioning, Relative Positioning, Absolute Positioning), Float property, Clear Property, Advanced CSS: CSS Images, Responsive CSS, CSS Effects, CSS Animations, CSS Media, CSS Slideshows.

**Java Script:** Introduction in JS, DOM (Document Object Model), Function Call and return statements in JavaScript, Form Handling and Applications using JS.

**PHP:** PHP introduction, important tools and software requirements (like Web Server, Database, and Editors). scope of PHP → Basic Syntax, PHP variables and constants. Types of data in PHP, Expressions, scopes of a variable (local, global), PHP Operators. Handling HTML form with PHP: Capturing Form Data, GET and POST form methods, Dealing with multi value fields. Redirecting a form after submission. PHP conditional events and Loops: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop Break, Continue and exit. PHP Functions: Need of Function, declaration and calling of a function PHP Function with arguments, Function argument with call by value, call by reference Scope of Function Global and Local. PHP String Manipulation: Creating and accessing String, Searching & Replacing String Formatting, joining and splitting String, String Related Library functions. Use of different string functions like strlen(), strtolower(), strpos(), split() etc. PHP Arrays: Anatomy of an Array, creating index based and Associative array, Accessing array. Looping with Index based array, with associative array using each () and foreach (), Sorting Arrays. PHP Advanced Topics: PHP Date and Time, Browser and system configurations, Database connection and handling records using PHP and using MySQL.

**JSP:** MVC (Model View Controller Architecture) JSP scripting elements, Servlets, JSP vs Servlets

Introduction to **WordPress**