WEST BENGAL COUNCIL OF HIGHER SECONDARY EDUCATION
SYLLABUS FOR CLASSES XI AND XII

SUBJECT : COMPUTER SCIENCE (COMS)

COMS

Course Overview:

This course covers the fundamental concepts of computer system organization, programming fundamental along with its theoretical analysis, data structure, computer networks, the value of technology in societies, e-commerce, python programming, database management system, and artificial intelligence for the students from science background only.

Course Objective:

This course enables students to-

- develop an understanding of how computer system works; the components of computer systems and how they interrelate, including software, data, hardware, communications and users.
- analyse a computing problem and to apply principles of computing to identify solutions.
- use of efficient data storing and retrieval technique along with basic programming skill.
- gather the fundamental knowledge on computer networks and web page designing.
- appreciate the ethical implications relating to the use of computing technology and information and identify the impact of technology on personal life and society.
- develop the knowledge, skills, and competencies needed to leverage the opportunities presented by the digital economy and to navigate the challenges and risks associated with online business operations.
- understand the basics of artificial intelligence and its subfields.
- develop an understanding of database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.

Class XI

Total Contact Hours: 200 (Theory & Practical: 180 ; Remedial & Home Assignment:20)

SEMESTER – I

Course Code: COMS (Theory)

Full Marks: 35 **Contact Hours: 100**

Unit – 1	**Computer System and Organisation** **15 Marks**	**Total 30 Hours**
	• Basic Computer Organisation ➢ CPU, Primary Memory (RAM, ROM, Cache), Secondary storage device, I/O devices, units of memory (bit, byte, KB, MB, GB, TB, PB). • Classification of Computers ➢ Super, Mainframe, Mini, PC.	**4 hours**
	• Concepts of Software ➢ Definition of software, types of software – System Software (Translator: assembler, interpreter, compiler, Loader, Linker, Operating System: Definition and functions, types of OS- Single use, Multiuse, Multiprogramming, Multiprocessing, Time sharing), Application Software (Definition and example), Utility Software, concept of GUI and CUI with examples using LINUX (Basic Commands).	**9 hours**
	• Number System ➢ Binary, Octal, Decimal, Hexadecimal number system, conversion between number system, Weighted Code (BCD, Binary, 84-2-1 code), non-weighted code (GREY, Excess-3), encoding schemes (ASCII, ISCII, unicode), 1's complement, 2's complement.	**7 Hours**
	• Boolean Algebra ➢ Postulates, logic gates: NOT, AND, OR, NAND, XOR, XNOR, truth tables, De Morgan theorem, SOP, POS, Simplifications using K-Map and Boolean algebra, logic circuits.	**10 Hours**
Unit – 2	**Programming Fundamentals** **10 Marks**	**Total 25 Hours**
	• Concept of Programming ➢ Instruction (Definition, Example), Program (definition, example), Programming Language (concept of high level, low level and assembly language), Procedural and Non-procedural programming, Concept of Structured Programming, Object Oriented Programming	**2 Hours**
	• Algorithm fundamentals ➢ Definition, characteristic of algorithm, recursive and non-recursive algorithms, representation of algorithm using flowchart, pseudo code, efficiency of algorithm, space complexity, time complexity, asymptotic notation- big O, big Omega, big Theta.	**18 Hours**
	• Introduction to Problem Solving ➢ Steps for Problem Solving (analysing the problem, developing an algorithm, coding, testing, debugging).	**5 Hours**

Unit – 3	**Introduction to C** **10 Marks**	**Total 45 Hours**
	• Basic Structure ➢ Character set, keywords, identifiers, constants, variables and type declaration, Sample programs, pre-processor.	**2 Hours**
	• Operators ➢ Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associatively; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O.	**3 Hours**
	• Branching and Looping ➢ if, if-else, while, do-while, for.	**3 Hours**
	• Arrays and Structure ➢ One-dimensional and Two-dimensional, Different types of uses. String handling with arrays – read and write, concatenation, comparison, string functions. ➢ Structures: Initialization; arrays of a structure, arrays within structures, structure within structure.	**12 Hours**
	• User defined functions ➢ Need, Call by Reference, call by value, return value and types, nesting of functions, recursion.	**10 Hours**
	• Pointers ➢ Declaration and initialization, operators, pointer arithmetic's, accessing variables, pointer & arrays, strings, functions.	**15 Hours**

SEMESTER – II

Course Code: COMS (Theory)

Full Marks: 35 **Contact Hours: 80**

Unit – 1	**Data Structure** **15 Marks**	**Total 45 Hours**
	• Definition, types of data structure-linear and non-linear.	**1 Hour**
	• Abstract Data types.	**1 Hour**
	• Arrays: 1D, 2D and their applications.	**7 Hours**
	• Linked List: Single, circular and double link list.	**10 Hours**
	• Stack ➢ Stack operations (push and pop), implementation using array and list, application of Stack.	**6 Hours**
	• Queue ➢ Queue operation implementation using array and list, circular queue, de-queue, priority queue.	**6 Hours**
	• Recursion ➢ Definition. ➢ Advantages and limitations of recursion. ➢ Understanding what goes behind recursion (internal stack implementation), tail recursion.	**4 Hours**
	• Searching and Sorting ➢ Linear Search, Binary Search and their comparison. ➢ Bubble Sort and its implementation.	**10 Hours**
Unit – 2	**Computer Networks** **10 Marks**	**Total 20 Hours**
	• Introduction to Networking ➢ Analogue and digital Communication. ➢ Mode of Communication- Simplex, half duplex and full duplex. ➢ Network Architecture- Client server, Peer to Peer. ➢ Serial and Parallel Communication. ➢ Measuring Capacity of Communication Media (bandwidth, channel capacity, baud). ➢ Synchronous and asynchronous Transmission Mode. ➢ Baseband and Broadband network.	**6 Hours**

	• Transmission Media ➢ Wired Communication Media (Twisted Pair, Co-axial cable, Fiber Optic). ➢ Wireless Communication Media (Radio wave, Microwave, Infrared, Satellite).	**3 Hours**
	• Network Connecting Devices ➢ Modem, Ethernet Card, RJ45, Repeater, Hub, Switch, Router, Gateway, Wifi card.	**2 Hours**
	• Network Type and Topologies ➢ Types of Network-LAN, MAN, WAN. ➢ Network Topologies- Bus, Star, Ring, Tree.	**3 Hours**
	• Network Protocols -HTTP, FTP, PPP, SMTP, TCP/IP, POP3, TELNET, HTTPS, VoIP.	**2 Hours**
	• Referential Model- OSI Model (Basic Concept, use of devices and protocols at different layers).	**1 Hour**
	• Introduction to Web Services: WWW, HTML, XML, IP Addresses, Domain names, URL, ISP, Website, Web browser, Web Server, Web Hosting.	**3 Hours**
Unit – 3	**Ethics** **10 Marks**	**Total 15 Hours**
	• Digital Footprints.	**1 Hour**
	• Data Protection: Intellectual property rights (copyright, patent, trademark), violation of IPR (plagiarism, copyright infringement, trademark infringement), open-source software and licensing (Creative Commons, GPL and Apache).	**5 Hours**
	• Cyber Crime: Definition, hacking, eavesdropping, phishing and fraud emails, ransomware, cyber trolls, cyber bullying.	**3 Hours**
	• Cyber safety: Safely browsing the web, identity protection, confidentiality.	**2 Hours**
	• Malware: Viruses, trojans, adware.	**1 Hour**
	• E-waste management: Proper disposal of used electronic gadgets.	**2 Hours**
	• Information Technology Act: (IT Act).	**1 Hour**

Class XII

Total Contact Hours: 200 (Theory & Practical: 180; Remedial & Home Assignment:20)

SEMESTER – III

Course Code: COMS (Theory)

Full Marks: 35 **Contact Hours: 100**

Unit – 1	**Python Programming** **25 Marks**	**Total 80 Hours**
	• **Familiarization with the basics of Python programming** ➢ Introduction to Python, Features of Python, executing a simple "hello world" program, execution modes: interactive mode and script mode, Python character set, Python tokens (keyword, identifier, literal, operator, punctuator), variables, concept of l-value and r-value, use of comments.	**2 Hours**
	• **Knowledge of data types** ➢ Number(integer, floating point,complex), boolean, sequence(string, list, tuple), None, Mapping(dictionary), mutable and immutable data types.	**1 Hour**
	• **Operators** ➢ Arithmetic operators, relational operators, logical operators, assignment operators, augmented assignment operators, identity operators (is, is not), membership operators (in not in).	**2 Hours**
	• **Expressions, statement, type conversion, and input/output** ➢ Precedence of operators, expression, evaluation of an expression, type-conversion (explicit and implicit conversion), accepting data as input from the console and displaying output.	**3 Hours**
	• **Errors: S**yntax errors, logical errors, and run-time errors.	**2 Hours**
	• **Flow of Control** ➢ Introduction, use of indentation, sequential flow, conditional and iterative flow.	**4 Hours**
	• **Conditional statements** ➢ if, if-else, if-elif-else, flowcharts, simple programs: e.g.: absolute value, sort 3 numbers and divisibility of a number.	**5 Hours**
	• **Iterative Statement** ➢ For loop, range(), while loop, flowcharts, break and continue statements, nested loops, suggested programs: generating pattern, summation of series, finding the factorial of a positive number, etc.	**7 Hours**
	• **Strings** ➢ Introduction, string operations (concatenation, repetition, membership and slicing), traversing a string using loops, built-in functions/methods–len(), capitalize(), title(), lower(), upper(), count(), find(), index(), endswith(), startswith(), isalnum(), isalpha(), isdigit(), islower(), isupper(), isspace(),lstrip(), rstrip(), strip(), replace(), join(), partition(), split().	**10 Hours**

	• **Lists** ➢ Introduction, indexing, list operations (concatenation, repetition, membership and slicing), traversing a list using loops, built-in functions/methods–len(), list(), append(), extend(), insert(), count(), index(), remove(), pop(), reverse(), sort(), sorted(), min(), max(), sum(); nested lists, suggested programs: finding the maximum, minimum, mean of numeric values stored in a list; linear search on list of numbers and counting the frequency of elements in a list.	**10 Hours**
	• **Tuples** ➢ Introduction, indexing, tuple operations (concatenation, repetition, membership and slicing); built-in functions/methods – len(), tuple(), count(), index(), sorted(), min(), max(), sum(); tuple assignment, nested tuple.	**5 Hours**
	• **Dictionary** ➢ Introduction, accessing items in a dictionary using keys, mutability of a dictionary (adding a new term, modifying an existing item), traversing a dictionary, built-in functions/methods – len(), dict(), keys(), values(), items(), get(), update(), del(), del, clear(), fromkeys(), copy(), pop(), popitem(), setdefault(), max(), min(), sorted().	**5 Hours**
	• **Introduction to Python modules** ➢ Importing module using 'import <module>' and using from statement, importing math module (pi, e, sqrt(), ceil(), floor(), pow(), fabs(), sin(), cos(), tan()); random module (random(), randint(), randrange()), statistics module (mean(), median(), mode()).	**10 Hours**
	• **Functions** ➢ Types of function (built-in functions, functions defined in module, user defined functions), creating user defined function, arguments and parameters, default parameters, positional parameters, function returning value(s), flow of execution, scope of a variable (global scope, local scope).	**7 Hours**
	• **Exception Handling** ➢ Introduction, handling exceptions using try-except-finally blocks.	**7 Hours**
Unit – 2	**E-Commerce** **10 Marks**	**Total 20 Hours**
	• **An introduction to Electronic Commerce** ➢ What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business (C2C, C2G,G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C). ➢ Internet, Intranet & Extranet, Role of Internet in B2B Application, Web promotion, Banner, Exchange, Shopping Bots.	**8 Hours**
	• **Electronic Data Exchange** ➢ Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model.	**4 Hours**

	• **Electronic Payment System** ➢ Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash.	**4 Hours**
	• **Internet Marketing** ➢ The PROS and CONS of online shopping, The cons of online shopping, Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	**4 Hours**

SEMESTER – IV

Course Code: COMS (Theory)

Full Marks: 35 **Contact Hours: 80**

Unit – 1	**Database Management System** **20 Marks**	**Total 50 Hours**
	• **Introduction** ➢ Drawbacks of Legacy System, Advantages of DBMS, Layered Architecture of Database, Data Independence, Data Models, Schemas and Instances, Database Languages, Database Users, DBA, Data Dictionary.	**3 Hours**
	• **Entity Relationship (ER) Modelling** ➢ Entity, Attributes and Relationship, Structural Constraints, Keys (Super Key, Key, Candidate Key, Alternate Key, Primary Key), ER Diagram of Some Example Database, Weak and strong Entity Set, Specialization and Generalization, Constraints of Specialization and Generalization, Aggregation.	**10 Hours**
	• **Relational Model** ➢ Basic Concepts of Relational Model, Relational Algebra.	**10 Hours**
	• **Integrity Constraints** ➢ Domain Constraints, Referential Integrity, View.	**2 Hour**
	• **SQL** ➢ Introduction, Data Definition Language and Data Manipulation Language, Data type (char(n), varchar(n), int, float, date), constraints (not null, unique, primary key), create database, use database, show databases, drop database, show tables, create table, describe table, alter table (add and remove an attribute, add and remove primary key), drop table, insert, delete, select, operators (mathematical, relational and logical), aliasing, distinct clause, where clause, in, between, order by, meaning of null, is null, is not null, like, update command, delete command, aggregate functions (max, min, avg, sum, count), group by, having clause, joins: cartesian product on two tables, equi-join and natural join .	**25 Hours**
Unit – 2	**Foundation of Artificial Intelligence (AI)** **15 Marks**	**Total 30 Hours**
	• **Introduction to Artificial Intelligence** ➢ Definition and scope of AI. ➢ Historical overview and key milestones. ➢ Differentiating AI from human intelligence.	**4 Hours**
	• **AI Subfields and Technologies** ➢ Machine learning: Supervised, unsupervised, and reinforcement learning. ➢ Deep learning and neural networks. ➢ Natural language processing (NLP) and computer vision.	**10 Hours**

	• **Search as Optimization (only Basic Concepts)** ➢ Strategies for State Space Search. ➢ Data Driven and Gold Driven Search. ➢ Heuristic Search, Breadth First Search and Depth First Search. ➢ A* Search.	**10 Hours**
	• **Applications of AI** ➢ AI in finance: Fraud detection, algorithmic trading, and risk assessment. ➢ AI in customer service and chatbots. ➢ AI in education: Personalized learning and intelligent tutoring systems.	**3 Hours**
	• **Ethical and Social Implications of AI** ➢ Bias and fairness in AI systems. ➢ Impact of AI on employment and the workforce. ➢ AI and social inequality.	**3 Hours**