

**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
	<ul style="list-style-type: none"> • Basic Computer Organisation <ul style="list-style-type: none"> ➤ 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 <ul style="list-style-type: none"> ➤ Super, Mainframe, Mini, PC. 		4 hours
	<ul style="list-style-type: none"> • Concepts of Software <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Number System <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Boolean Algebra <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Concept of Programming <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Algorithm fundamentals <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Introduction to Problem Solving <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Basic Structure <ul style="list-style-type: none"> ➤ Character set, keywords, identifiers, constants, variables and type declaration, Sample programs, pre-processor. 		2 Hours
	<ul style="list-style-type: none"> • Operators <ul style="list-style-type: none"> ➤ Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associativity; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O. 		3 Hours
	<ul style="list-style-type: none"> • Branching and Looping <ul style="list-style-type: none"> ➤ if, if-else, while, do-while, for. 		3 Hours
	<ul style="list-style-type: none"> • Arrays and Structure <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • User defined functions <ul style="list-style-type: none"> ➤ Need, Call by Reference, call by value, return value and types, nesting of functions, recursion. 		10 Hours
	<ul style="list-style-type: none"> • Pointers <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none">• Definition, types of data structure-linear and non-linear.		1 Hour
	<ul style="list-style-type: none">• Abstract Data types.		1 Hour
	<ul style="list-style-type: none">• Arrays: 1D, 2D and their applications.		7 Hours
	<ul style="list-style-type: none">• Linked List: Single, circular and double link list.		10 Hours
	<ul style="list-style-type: none">• Stack<ul style="list-style-type: none">➤ Stack operations (push and pop), implementation using array and list, application of Stack.		6 Hours
	<ul style="list-style-type: none">• Queue<ul style="list-style-type: none">➤ Queue operation implementation using array and list, circular queue, de-queue, priority queue.		6 Hours
	<ul style="list-style-type: none">• Recursion<ul style="list-style-type: none">➤ Definition.➤ Advantages and limitations of recursion.➤ Understanding what goes behind recursion (internal stack implementation), tail recursion.		4 Hours
	<ul style="list-style-type: none">• Searching and Sorting<ul style="list-style-type: none">➤ Linear Search, Binary Search and their comparison.➤ Bubble Sort and its implementation.		10 Hours
Unit – 2	Computer Networks	10 Marks	Total 20 Hours
	<ul style="list-style-type: none">• Introduction to Networking<ul style="list-style-type: none">➤ 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

	<ul style="list-style-type: none"> • Transmission Media <ul style="list-style-type: none"> ➤ Wired Communication Media (Twisted Pair, Co-axial cable, Fiber Optic). ➤ Wireless Communication Media (Radio wave, Microwave, Infrared, Satellite). 	3 Hours
	<ul style="list-style-type: none"> • Network Connecting Devices <ul style="list-style-type: none"> ➤ Modem, Ethernet Card, RJ45, Repeater, Hub, Switch, Router, Gateway, Wifi card. 	2 Hours
	<ul style="list-style-type: none"> • Network Type and Topologies <ul style="list-style-type: none"> ➤ Types of Network-LAN, MAN, WAN. ➤ Network Topologies- Bus, Star, Ring, Tree. 	3 Hours
	<ul style="list-style-type: none"> • Network Protocols -HTTP, FTP, PPP, SMTP, TCP/IP, POP3, TELNET, HTTPS, VoIP. 	2 Hours
	<ul style="list-style-type: none"> • Referential Model- OSI Model (Basic Concept, use of devices and protocols at different layers). 	1 Hour
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Digital Footprints. 	1 Hour
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Cyber Crime: Definition, hacking, eavesdropping, phishing and fraud emails, ransomware, cyber trolls, cyber bullying. 	3 Hours
	<ul style="list-style-type: none"> • Cyber safety: Safely browsing the web, identity protection, confidentiality. 	2 Hours
	<ul style="list-style-type: none"> • Malware: Viruses, trojans, adware. 	1 Hour
	<ul style="list-style-type: none"> • E-waste management: Proper disposal of used electronic gadgets. 	2 Hours
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Familiarization with the basics of Python programming <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Knowledge of data types <ul style="list-style-type: none"> ➤ Number(integer, floating point, complex), boolean, sequence(string, list, tuple), None, Mapping(dictionary), mutable and immutable data types. 		1 Hour
	<ul style="list-style-type: none"> • Operators <ul style="list-style-type: none"> ➤ Arithmetic operators, relational operators, logical operators, assignment operators, augmented assignment operators, identity operators (is, is not), membership operators (in not in). 		2 Hours
	<ul style="list-style-type: none"> • Expressions, statement, type conversion, and input/output <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Errors: Syntax errors, logical errors, and run-time errors. 		2 Hours
	<ul style="list-style-type: none"> • Flow of Control <ul style="list-style-type: none"> ➤ Introduction, use of indentation, sequential flow, conditional and iterative flow. 		4 Hours
	<ul style="list-style-type: none"> • Conditional statements <ul style="list-style-type: none"> ➤ if, if-else, if-elif-else, flowcharts, simple programs: e.g.: absolute value, sort 3 numbers and divisibility of a number. 		5 Hours
	<ul style="list-style-type: none"> • Iterative Statement <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Strings <ul style="list-style-type: none"> ➤ 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

	<ul style="list-style-type: none"> • Lists <ul style="list-style-type: none"> ➤ 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	
	<ul style="list-style-type: none"> • Tuples <ul style="list-style-type: none"> ➤ 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	
	<ul style="list-style-type: none"> • Dictionary <ul style="list-style-type: none"> ➤ 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	
	<ul style="list-style-type: none"> • Introduction to Python modules <ul style="list-style-type: none"> ➤ 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	
	<ul style="list-style-type: none"> • Functions <ul style="list-style-type: none"> ➤ 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	
	<ul style="list-style-type: none"> • Exception Handling <ul style="list-style-type: none"> ➤ Introduction, handling exceptions using try-except-finally blocks. 	7 Hours	
Unit – 2	E-Commerce	10 Marks	Total 20 Hours
	<ul style="list-style-type: none"> • An introduction to Electronic Commerce <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Electronic Data Exchange <ul style="list-style-type: none"> ➤ Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model. 		4 Hours

	<ul style="list-style-type: none"> • Electronic Payment System <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Internet Marketing <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Entity Relationship (ER) Modelling <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Relational Model <ul style="list-style-type: none"> ➤ Basic Concepts of Relational Model, Relational Algebra. 		10 Hours
	<ul style="list-style-type: none"> • Integrity Constraints <ul style="list-style-type: none"> ➤ Domain Constraints, Referential Integrity, View. 		2 Hour
	<ul style="list-style-type: none"> • SQL <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Introduction to Artificial Intelligence <ul style="list-style-type: none"> ➤ Definition and scope of AI. ➤ Historical overview and key milestones. ➤ Differentiating AI from human intelligence. 		4 Hours
	<ul style="list-style-type: none"> • AI Subfields and Technologies <ul style="list-style-type: none"> ➤ Machine learning: Supervised, unsupervised, and reinforcement learning. ➤ Deep learning and neural networks. ➤ Natural language processing (NLP) and computer vision. 		10 Hours

	<ul style="list-style-type: none"> • Search as Optimization (only Basic Concepts) <ul style="list-style-type: none"> ➤ Strategies for State Space Search. ➤ Data Driven and Gold Driven Search. ➤ Heuristic Search, Breadth First Search and Depth First Search. ➤ A* Search. 	10 Hours
	<ul style="list-style-type: none"> • Applications of AI <ul style="list-style-type: none"> ➤ 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
	<ul style="list-style-type: none"> • Ethical and Social Implications of AI <ul style="list-style-type: none"> ➤ Bias and fairness in AI systems. ➤ Impact of AI on employment and the workforce. ➤ AI and social inequality. 	3 Hours

CLASS XI

COURSE CODE: COMS (PRACTICAL)

Full Marks: 30

1.	Experiments with basic Linux Commands <ul style="list-style-type: none">Use of Simple commands-ls, cd, cp, cat, mv, mkdir, rmdir, who, use of wildcard etc.	5 Marks
2.	C programming <ul style="list-style-type: none">Flowchart 3 marksProgram coding 10 marksOutput 4 marks	17 Marks
3.	Lab Book	3 Marks
4.	Viva	5 Marks

List of Suggestive C Programs

- WRITE A PROGRAM to print the sum and product of digits of an integer.
- WRITE A PROGRAM to reverse a number.
- WRITE A PROGRAM to compute the sum of the first n terms of the following series,
 $S=1+1/2+1/3+1/4+.....$
- WRITE A PROGRAM to compute the sum of the first n terms of the following series, $S =1-2+3-4+5.....$
- Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
- Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
- WRITE A PROGRAM to compute the factors of a given number.
- Write a macro that swaps two numbers. WRITE A PROGRAM to use it.
- WRITE A PROGRAM to print a triangle of stars as follows (take number of lines from user):
*

- WRITE A PROGRAM to perform following actions on an array entered by the user :
 - Print the even-valued elements
 - Print the odd-valued elements
 - Calculate and print the sum and average of the elements of array
 - Print the maximum and minimum element of array
 - Remove the duplicates from the array
 - Print the array in reverse orderThe program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.
- WRITE A PROGRAM that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
- Write a program that swaps two numbers using pointers.
- Write a program in which a function is passed address of two variables and then alter its contents.
- Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays

the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

- a) Show address of each character in string
- b) Concatenate two strings without using strcat function.
- c) Concatenate two strings using strcat function.
- d) Compare two strings
- e) Calculate length of the string (use pointers)
- f) Convert all lowercase characters to uppercase
- g) Convert all uppercase characters to lowercase
- h) Calculate number of vowels
- i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. WRITE A PROGRAM to display Fibonacci series (i) using recursion, (ii) using iteration.

19. WRITE A PROGRAM to calculate Factorial of a number (i) using recursion, (ii) using iteration.

20. WRITE A PROGRAM to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose

22. Copy the contents of one text file to another file, after removing all whitespaces.

23. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

24. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

25. Write a Program to implement stack operations using array.

26. Write a Program to implement queue operations using array.

27. Write a Program to search an element from a collection using Linear Search.

28. Write a Program to sort a collection of elements using Bubble Sort.

CLASS XII

COURSE CODE : COMS (PRACTICAL)

Full Marks : 30

1.	MYSQL <ul style="list-style-type: none">• Table creation 3 Marks• Data insertion in table 2 Marks• 2 Queries 5 Marks	10 Marks
2.	Python Program <ul style="list-style-type: none">• Coding 9 Marks• Output 3 Marks	12 Marks
3.	Lab Book	3 Marks
4.	Viva	5 Marks

Suggested Practical List

List of Suggestive Python Programs

- Input a welcome message and display it.
- Input two numbers and display the larger / smaller number.
- Input three numbers and display the largest / smallest number.
- Generate the following patterns using nested loops:
Pattern-1 Pattern-2 Pattern-3
* 12345 A
** 1234 AB
*** 123 ABC
**** 12 ABCD
***** 1 ABCDE
- Write a program to input the value of x and n and print the sum of the following series:
 - $1 + x + x^2 + x^3 + x^4 + \dots x^n$
 - $1 - x + x^2 - x^3 + x^4 - \dots x^n$
 - $x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \dots \frac{x^n}{n}$
 - $x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots \frac{x^n}{n!}$
- Determine whether a number is a perfect number, an Armstrong number or a palindrome.
- Input a number and check if the number is a prime or composite number.
- Display the terms of a Fibonacci series.
- Compute the greatest common divisor and least common multiple of two integers.
- Count and display the number of vowels, consonants, uppercase, lowercase characters in string.
- Input a string and determine whether it is a palindrome or not; convert the case of characters in a string.
- Find the largest/smallest number in a list/tuple

- Input a list of numbers and swap elements at the even location with the elements at the odd location.
- Input a list/tuple of elements, search for a given element in the list/tuple.
- Create a dictionary with the roll number, name and marks of n students in a class and display the names of students who have marks above 75.
- Write a random number generator that generates random numbers between 1 and 6 (simulates a dice).

Database Management System

- Create a student table and insert data. Implement the following SQL commands on the student table:
 - o ALTER table to add new attributes / modify data type / drop attribute
 - o UPDATE table to modify data
 - o ORDER By to display data in ascending / descending order
 - o DELETE to remove tuple(s)

 - o GROUP BY and find the min, max, sum, count and average.

 - o LIKE, DISTINCT, NOT IN, IN, JOIN, CARTISIAN PRODUCT SET DIFFERENCE, UNION, INTERSECTION etc.