Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

BCA (AI &ML)

SEMESTER-II (2026-29)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BCCA205	Major -2	Object oriented Methodology and C++	Max	60	20	20	0	0	3	1	0	4
			Min	24	16							

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To familiarize the students with programming and to encourage them to develop their logic.
2. To make students well versed with C++ language to solve problems efficiently.
3. Using simple and well-drawn illustrations develop their programming skills using modular programming.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1 Develop algorithms for problems.
CO2 To understand the object oriented paradigm.
CO3 Apply the programming concepts to solve the given problems.
CO4 Write the programs using modular programming.
CO5 Understand and write programs using various data structures very efficiently.

TEACHING PEDAGOGY:

T1 Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

ATL1 Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation

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BCCA205	Major -2	Object oriented Methodology and C++	Max	60	20	20	0	0	3	1	0	4
			Min	24	16							

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL6	Assignments
ATL7	Poster
ATL8	Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	**Object Oriented Paradigm:** Need, Features, comparison with other programming paradigm, various programming styles; Basic concepts: C++ basics, C++ character set, C++ Tokens (Identifiers, Keywords, Constants), operators, precedence and associativity, expressions, type conversion and type casting, Structure of a C++ Program (include files, main function), cout, cin, loops and decisions. Use of I/O Operators (<< and >>), Cascading of I/O Operators, Inline Functions, Reference Variables, Call by Reference, Function Overloading.	9	ATL3 ATL6
II	**Concept of a class**, Data Members and Member Functions, visibility modes, scope resolution operator (::); Objects: accessing members through object, object and classes, object arrays, passing objects as function arguments, Friend Function; Constructor and Destructor functions: Default Constructor, Overloaded Constructors, Copy Constructor, Constructor with default arguments, Dynamic Constructors.	9	ATL3 ATL6
III	**Operator overloading**; Inheritance: Concepts of Base Class and Derived Class; Private, Public and Protected derivation of classes, accessibility of base class members by objects of derived class, access mechanism in classes, ambiguity resolution in inheritance, virtual base classes, constructors in derived classes, member/nested classes.	9	ATL3 ATL6
IV	**Pointers:** Declaration and Initialization of Pointers; Dynamic memory	9	ATL3

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	allocation, new, delete operators; Pointers and Arrays: Array of Pointers, Pointer to an Array, Pointer to Objects, Array of Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Early and Late Binding , Runtime Polymorphism, Pure Virtual Functions, Abstract Classes.		ATL6
V	C++ I/O system, Use of defined manipulators, formatted I/O, creating inserters and extractors, file I/O basics, Data File Handling: creating disk files and file manipulations using seekg(), seekp(), tellg() and tellp() functions, ifstream, of stream, file stream classes; Exception Handling: Try, Catch and Throw	9	ATL3 ATL6
	Total Hours	**45**	

SUGGESTED READINGS:

Textbooks

1. Robert Lafore, “Object-Oriented Programming in C++”, 4e, SAMS.
2. Ricahrd C. Lee, Wiiliam M. Tepfenhart“ UML & C++: A Practical Guide To Object Oriented Development”, 2e, Pearson.
3. Herbert Schildt, “C++ the complete reference”, 4e, 2003.

Suggested e- resources (Websites/e- books)

1.E Balagurusamy, “Object Oriented Programming with C++”, 6e, McGraw Hill Education.
2. G.Booch, “Object Oriented Analysis And Design With Applications”, 3e, Pearson.
3. K.R. Venugopal, RajkumarBuyya, “Mastering C++”, 2e, McGraw Hill Education.

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COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	-	-	-	-	-	-	1	-			
CO2	3	3	2	3	-	-	-	-	-	-	1	-			
CO3	3	3	3	2	-	-	-	-	-	-	1	-			
CO4	2	3	2	3	-	-	-	-	-	-	1	-			
CO5	3	3	3	2	-	-	-	-	-	-	1	-			

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SEMESTER-II (2026-29)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BCCA204	Major -3	Data Structures	Max	60	20	20	0	0	3	1	0	4
			Min	24	16							

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To understand the students with the applications of Standard data structure in real world problems.
2. To provide knowledge of creation of new data structures.
3. To familiarize the students with the analysis and design a particular problem.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1 Demonstrate familiarity with major algorithms and data structures.

CO2 Analyse performance of algorithms.

CO3 Choose the appropriate data structure and algorithm design method for a specified application..

CO4 Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs.

CO5 Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

TEACHING PEDAGOGY:

T1 Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching

T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

ATL1 Quiz

ATL2 Activity Based Learning

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BCCA204	Major -3	Data Structures	Max	60	20	20	0	0	3	1	0	4
			Min	24	16							

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL3	Midterm Exams
ATL4	Flip Class
ATL5	Seminar Presentation
ATL6	Assignments
ATL7	Poster
ATL8	Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	The Concept of Data Structure, Abstract Data Type, Concept of List and Array, Introduction to Stack, Stack as an Abstract Data Type, Primitive Operations on Stack, Stack's Applications - polish notations Infix, Postfix, Prefix and Recursion. Introduction to Queues, Primitive operations on Queues, Queue as an Abstract Data Type, Circular Queue, Dequeue, Priority Queue, Applications of Queue.	12	ATL3 ATL6
II	Linked List - Introduction to Linked List, Memory Representations of Linked List, comparison; Operations on Linked List, Linked Representation of Stack and Queue, Header Nodes. Types of Linked List : Doubly Linked List, Circular Linked List, Application of Linked List, Self Referential Structures.	12	ATL3 ATL6
III	Trees: Definition, Basic Terminology of Trees, Tree Representations as Array and Linked. Binary Trees, Binary Tree Operations. Traversal of Binary Trees – In order, Preorder & Post order, Complete Binary Tree, almost complete binary tree; Application of Binary Tree.	12	ATL3 ATL6
IV	Complexity: concept and notations. Searching: Sequential, Binary and their comparison. Sorting - External and Internal Sorting, Insertion Sort, Selection	12	ATL3

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	Sort, Quick Sort, Bubble Sort, Heap Sort, Comparison of Sorting Methods. Hashing;		ATL6
V	Graphs - Introduction to Graphs, Basic Terminology, Directed, Undirected and Weighted graph, Representation of Graphs, Graph Traversals - Depth First and Breadth First Search. Applications of Graphs.	12	ATL3 ATL6
	Total Hours	**30**	

SUGGESTED READINGS:

Textbooks

1. Kruse R.L. Data Structures and Program Design in C; PHI
2. Aho, “Data Structure & Algorithms”.
3. TremblyandSORRENSON,“Introduction to Data Structure with Applications”.
4. TennenBaum A.M. &others,“Data Structures using C & C++”; PHI
5. Horowitz &Sawhaney,“Fundamentals of Data Structures”, Galgotia Publishers.

Suggested e- resources (Websites/e- books)

1. YashwantKanetkar, “Understanding Pointers in C”, BPB.
2. Lpschuists, “Data Structure”, (Schaum 's Outline Series, McGraw Hill publication)
3. Ellis Horowitz and SartajSawhney, “Fundamentals of Computer Algorithm”

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BCCA204	Major -3	Data Structures	Max	60	20	20	0	0	3	1	0	4
			Min	24	16							

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1							1				
CO2	3	2	3	2							1				
CO3	3	2	3	2			1				1	-			
CO4	3	2	2	1							1	-			
CO5	3	2	3	2							1	-			

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BCCA203N	Minor -2	Data Fundamentals	Max	60	20	20	0	0	3	0	2	4
			Min	24	16							

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COURSE OBJECTIVES:

The student will have ability to:

1. To introduce the concepts of Cloud Computing.
2. To understand the concepts Data Behavior on Cloud.
3. To familiar various tool to Handling Data on Azure.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1 Understand Core data concepts on Azure
CO2 Familiar with the use of relational data in Azure
CO3 Understand the use of non-relational data in Azure

TEACHING PEDAGOGY:

T1 Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

ATL1 Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation
ATL6 Assignments

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ATL7 Poster

ATL8 Oral Viva-voce examination

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Data concepts Features of unstructured, structured and semi-structured data, common formats for data files, types of databases, features of transactional workload and analytical workloads, Identify roles and responsibilities for data workloads, responsibilities of database administrators, data engineers and data analysts.	12	ATL3 ATL6
II	Relational data on Azure Identify features of relational data, need for normalization, common structured query language (SQL) statements, common database objects, Azure SQL family of products including Azure SQL Database, Azure SQL Managed Instance, and SQL Server on Azure Virtual Machines, Azure database services for open-source database systems.	12	ATL3 ATL6
III	working with non-relational data on Azure Capabilities of Azure storage, Azure Blob storage, Azure File storage, Azure Table storage, use cases for Azure Cosmos DB, Azure Cosmos DB APIs.	12	ATL3 ATL6
IV	Analytics workload on Azure common elements of large-scale analytics, considerations for data ingestion and processing, options for analytical data stores, Azure services for data warehousing, Azure Synapse Analytics, Azure Databricks, Azure HDInsight, and Azure Data Factory.	12	ATL3 ATL6
V	Microsoft Power BI Data visualization in Microsoft Power BI, capabilities of Power BI, features of data models in Power BI, appropriate visualizations for data	12	ATL3 ATL6

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	Total Hours	**60**	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

https://www.redhat.com/en/services/training/rh124-red-hat-system-administration-i

B. Remedial classes for slow learners:

As per the AUMP SOP for slow and fast learners.

SUGGESTED READINGS:

Suggested e- resources (Websites/e- books)

1.https://docs.microsoft.com/en-us/learn/modules/explore-core-data-concepts/

2.https://docs.microsoft.com/en-us/learn/modules/explore-roles-responsibilities-world-of-data/

3.https://docs.microsoft.com/en-us/learn/modules/explore-relational-data-offerings/

4.https://docs.microsoft.com/en-us/learn/modules/explore-provision-deploy-relational-databaseofferings-azure/

5.https://docs.microsoft.com/en-us/learn/modules/explore-provision-deploy-non-relational-dataservices-azure/

6.https://docs.microsoft.com/en-us/learn/modules/explore-non-relational-data-stores-azure/

7.https://docs.microsoft.com/en-us/learn/modules/examine-components-of-modern-datawarehouse/

8.https://docs.microsoft.com/en-us/learn/modules/explore-fundamentals-stream-processing/

9. https://docs.microsoft.com/en-us/learn/modules/explore-fundamentals-data-visualization/

	Title
1.	Provision Azure relational database services-Azure SQL Database
2.	Explore Azure Storage
3.	Explore Azure Cosmos DB
4.	Explore Azure Synapse Analytics
5.	Analyse streaming data

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6.	Process streaming data using Spark
7.	Explore Azure Synapse Data Explorer
8.	Visualize data with Power BI
9.	Basic SQL command on SQL Server 18 CREATE , INSERT , UPDATE , DELETE

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	3	1					2	1			
CO2	3	3	2	2	3	1					2	1			
CO3	3	3	2	2	3	1					2	1			

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Choice Based Credit System (CBCS) in the light of NEP-2020

BCA (AI & ML)

SEMESTER-II (2026-29)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									CREDITS
			Marks	THEORY			PRACTICAL		L	T	P	
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BCCA206	Practical (Major-2)	Programming Lab in C++	Max	0	0	0	30	20	0	0	4	2
			Min				13.5	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To familiarize the students with programming and to encourage them to develop their logic.
2. To make students well versed with C++ language to solve problems efficiently.
3. Using simple and well-drawn illustrations develop their programming skills using modular programming.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1 Develop algorithms for problems.
CO2 To understand the object oriented paradigm.
CO3 Apply the programming concepts to solve the given problems.
CO4 Write the programs using modular programming.
CO5 Understand and write programs using various data structures very efficiently.

	Title	CO Mapping
1.	Define a friend function. Explain the relation of friend function with respect to Public, Private and Protected data members of the class.	CO4
2.	Write a C++ program that uses a function to check whether a given number is divisible by another number or not. Give proper comments whether the denominator number is a prime number or not.	CO4

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3.	Write a program in C++ a. To generate the number pyramid	CO4
4.	Create two function max and min to find the largest and smallest numbers respectively	CO4
5.	Write a function in C++ that take one string argument and return a reversed string.	CO4
6.	Write a C++ program using structure to store information of 10 employee (id_no, empname, empadd, sal) and display information of an employee depending upon the employee no given.	CO4
7.	Create a class contains name & telephone number as two of it's fields. Write a C++ Program	CO4
8.	Using an object to do the following. (a) to add a record (b) to search of telephone number for a given name. (c) to determine the name of telephone number is known .(d) Updating the data file, whenever there is a change in telephone number.	CO4
9.	Member function: (1)to assign initial values (2) to increment only people total in case ticket is not sold out. (3) to increment people total as well as amount total in case ticket is not sold out (4) to display the two totals (5) to display the number of tickets sold out.	CO5
10.	Create a class Bank account of 20 customers with the following data members depositor no, (a) initialize the data member (b) deposit money (c) Display the customer information (d) withdraw money after checking the balance (min bal for saving account is 500 and for current 1000) (e) search the depositor details according to name or number or both.	CO5
11.	Write a program to interchange the private values of two classes by using a friend function swap().	CO5
12.	Write C++ code to create a class date. Using this class, calculate the age of a person as on the current date.	CO5
13.	Define a class string use overloaded = = operator to compare two string.	CO5

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			Marks	THEORY			PRACTICAL					
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14.	Find the largest value of two objects using > operator.	CO5
15.	Write a C++ program to print the number between 1 to 100 and 100 to 1 using operator overloading.	CO5

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	-	-	-	-	-	-	1	-			
CO2	3	3	2	3	-	-	-	-	-	-	1	-			
CO3	3	3	3	2	-	-	-	-	-	-	1	-			
CO4	2	3	2	3	-	-	-	-	-	-	1	-			
CO5	3	3	3	2	-	-	-	-	-	-	1	-			

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BCCA207	Practical (Major-3)	Data Structure lab in C/ C++	Max	0	0	0	30	20	0	0	4	2
			Min				13.5	9				

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COURSE OBJECTIVES:

The student will have ability to:

1. To understand the students with the applications of Standard data structure in real world problems.
2. To provide knowledge of creation of new data structures.
3. To familiarize the students with the analysis and design a particular problem.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1 Demonstrate familiarity with major algorithms and data structures.
CO2 Analyse performance of algorithms.
CO3 Choose the appropriate data structure and algorithm design method for a specified
CO4 application..
Demonstrate understanding of the abstract properties of various data structures such as
CO5 stacks, queues, lists, trees and graphs.
Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

LIST OF PRACTICAL

	Title	CO

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		Mapping
1.	Write a program to create a two dimensional array and perform add, subtract and multiplication operations.	CO4
2.	Write a program to create a two dimensional array using dynamic memory allocation	CO4
3.	Write a program to implement stack.	CO4
4.	Write a program to convert infix expression into postfix expression.	CO4
5.	Write a program to check balanced parentheses for a given infix expression.	CO4
6.	Write a program to evaluate postfix expression.	CO4
7.	Write a program to implement queue.	CO4
8.	Write a program to implement circular queue.	CO4
9.	Write a program to implement link list with insert, delete, search, view, and delete function.	CO5
10.	Write a program to implement ordered link list.	CO5
11.	Write a program to add two polynomials.	CO5
12.	Write a program to create doubly link list.	CO5
13.	Write a program to implement tree with insert, delete and search function.	CO5
14.	Write a program for in order, post order and preorder traversal of tree.	CO5
15.	. Write a program for binary search and sequential search using recursion.	CO5
16.	Write a program for bubble sort and sequential search.	
17.	Write a program for insertion sort and quick sort.	

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CO1	3	2	2	1							1				
CO2	3	2	3	2							1				
CO3	3	2	3	2			1				1	-			
CO4	3	2	2	1							1	-			
CO5	3	2	3	2							1	-			

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