

LNCT UNIVERSITY, BHOPAL

Programme:- MCA (AI/ML)

Semester - II

wef: July 2021

Name of Paper	Paper Code	Theory					
		Credit			Marks		
RDBMS	MAI-201	L	T	J	EST	CAT	Total
		3	1	0	80	20	100
Course Objective	The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.						
Units	Contents (<i>Theory</i>)						Hours /week
I	Introduction: Advantage of DBMS approach, various view of data, data independence, schema and subschema, primary concepts of data models, Database languages, transaction management, Database administrator and users, data dictionary, overall system architecture. ER model: basic concepts, design issues, mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables.						8
II	Domains, Relations and Keys: domains, relations, kind of relations, relational database, various types of keys, candidate, primary, alternate and foreign keys. Relational Algebra & SQL: Features of good relational database design, Codd’s rule, The structure, relational algebra with extended operations, modifications of Database, , basic structure of SQL, set operations, aggregate functions, null values, nested sub queries, derived relations, views, join relations, DDL in SQL. PL/SQL programming: working with stored procedures, triggers, cursor Database Integrity: general idea. Integrity rules, domain rules, attribute rules, relation rules, Database rules, assertions, triggers, integrity and SQL.						8
III	Functional Dependencies and Normalization: basic definitions, trivial and non trivial dependencies, closure set of dependencies and of attributes, irreducible set of dependencies, introduction to normalization, non loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multi-valued dependencies and fourth normal form, Join dependency and fifth normal form.						8
IV	Transaction, concurrency and Recovery: basic concepts, ACID properties, Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, basic idea of concurrency control, basic idea of deadlock, failure classification, storage structure types, stable						8

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	storage implementation, data access, recovery and atomicity- log based recovery, deferred Database modification, immediate Database modification, checkpoints. Distributed Database: basic idea, distributed data storage, data replication, data fragmentation: horizontal, vertical and mixed fragmentation.		
V	Emerging Fields in DBMS: object oriented Databases-basic idea and the model, object structure, object class, inheritance, multiple inheritance, object identity, data warehousing- terminology, definitions, characteristics, data mining and it's overview, Database on www, multimedia Databases-difference with conventional DBMS, issues, similarity based retrieval, continuous media data, multimedia data formats, video servers. Storage structure and file organizations: overview of physical storage media, magnetic disk performance and optimization, basic idea of RAID, file organization, organization of records in files, basic concepts of indexing, ordered indices, basic idea of B-tree and B+-tree organization Network and hierarchical models: basic idea, data structure diagrams, DBTG model, implementations, tree structure diagram, implementation techniques, comparison of the three models.	8	
Text Books/ References Book:-			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
A Silberschatz, H.F Korth, Sudersan	Database System Concepts	VI	MGH Publication
C.J Date	An introduction to Database Systems	VI	Addison-Wesley
Elmasri & Navathe	Fundamentals of Database systems	VII	Pearson
Raghurama Krishnan	Database Systems	III	TMH
COURSE OUTCOMES: Students will be able to			
CO1	Evaluate business information problems and find the requirement of a problem in term of data.		
CO2	Setting to design and implementing data base projects		
CO3	Use different types of physical implementation of data base		

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Name of Paper	Paper Code	Theory					
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Object Oriented Methodology in C++	MAI-202	L	T	J	EST	CAT	Total
		3	1	0	80	20	100
Course Objective	The objective of this course is learning about object oriented methodology using C++.						
Units	Contents (<i>Theory</i>)						Hours /week
I	Evolution of OOP, OOP Paradigm, advantages of OOP, Comparison between Functional Programming and OOP Approach, Characteristics of Object Oriented Language – Objects, Classes, Inheritance, Reusability, User Defined Data Types, Polymorphism, Overloading. Introduction to C++, Identifier and Keywords, Constants, C++ Operators, Type Conversion, Variable Declaration, Statements, Expressions, Features of Iostream.h and Iomanip.h Input and Output, Conditional Expression Loop Statements, Breaking Control Statements.						8
II	Programming Constructs: Input output statements: cin, cout, comments, escape sequence, manipulators, type conversion, operators, and library functions. Control statements, Structures, Enumeration, Functions, passing arguments to functions, reference arguments, overloaded functions, inline functions, default arguments, variables and storage class and returning by reference, Arrays and Strings.						8
III	Classes & Operator Overloading: Objects and Classes, defining class, c++ objects as physical objects, c++ objects and data types, object as function argument, constructors, as function argument, overloaded constructors, copy constructors, returning objects from functions, this pointer, structures and classes, static class data, static functions, friend functions, const and classes, array of objects. Overloading unary and binary operator, Data conversions (built-in & user defined data types).						8
IV	Inheritance & Virtual Functions: Inheritance concept, derived class and base						8

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	class, derived class constructors, overloading member functions, class hierarchies, public, private & protected inheritance, levels of inheritance, multiple inheritance, Virtual Inheritance, new and delete operator. Early & late binding, Virtual functions.			
V	Files I/O & Generic Programming: Using istream/ostream member functions, Understanding implementation of Files, Writing and Reading Objects. Exception Handling: types of exceptions, try, throw, catch block. Templates: types and concepts of generic programming.	8		
Text Books/ References Book:-				
Name of Authors		Titles of the Book	Edition	Name of the Publisher
Bjarne Stroustrup		The C++ Programming Language	IIIrd	Addision Wesley
Herbert Schildt,		“C++ The Complete Reference”, McGraw Hill		McGraw Hill
D. Ravichandran,		Programming with C++		Tata Mcgraw Hill
E. Balagursamy		Object Oriented Programming using C++		Tata McGraw Hill.
COURSE OUTCOMES: Students will be able to				
CO1	Describe the object-oriented programming approach in connection with C++			
CO2	Apply the concepts of object-oriented programming			
CO3	Illustrate the process of data file manipulations using C++			
CO4	Apply virtual and pure virtual function & complex programming situations			

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Name of Paper	Paper Code	Theory					
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Probabilistic Modelling and Reasoning with Python	MAI-203	L	T	J	EST	CAT	Total
		3	1	0	80	20	100
Course Objective	The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems						
Units	Contents (<i>Theory</i>)						Hours /week
I	Introduction to Statistics: Role of statistics in scientific methods, current applications of statistics. Scientific data gathering: Sampling techniques, scientific studies, observational studies, data management. Data description: Displaying data on a single variable (graphical methods, measure of central tendency, measure of spread), displaying relationship between two or more variables, measure of association between two or more variables.						8
II	Probability Theory: Sample space and events, probability, axioms of probability, independent events, conditional probability, Bayes’ theorem. Random Variables: Discrete and continuous random variables. Probability distribution of discrete random variables, binomial distribution, poisson distribution. Probability distribution of continuous random variables, The uniform distribution, normal (gaussian) distribution, exponential distribution, gamma distribution, beta distribution, t-distribution, distribution. Expectations, variance and covariance. Probability Inequalities. Bivariate distributions						8
III	Point Estimations: Methods of finding estimators, method of moments, maximum likelihood estimators, bayes estimators. Methods of evaluating estimators, mean squared error, best unbiased estimator, sufficiency and unbiasedness Interval Estimatoins: Confidence interval of means and proportions, Distribution free confidence interval of percentiles						8

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IV	Test of Statistical Hypothesis and p-values: Tests about one mean, tests of equality of two means, test about proportions, p-values, likelihood ratio test, Bayesian tests Bayesian Statistics: Bayesian inference of discrete random variable, Bayesian inference of binomial proportion, comparing Bayesian and frequentist inferences of proportion, comparing Bayesian and frequentist inferences of mean	8	
V	Univariate Statistics using Python: Mean, Mode. Median, Variance, Standard Deviation, Normal Distribution, t-distribution, interval estimation, Hypothesis Testing, Pearson correlation test, ANOVA	8	
Text Books/ References Book:-			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Achim Klenke	Probability Theory A Comprehensive Course	Second Edition	Springer
Christian Heumann, Michael Schomaker Shalabh	Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R		Springer International Publishing
Douglas C. Montgomery	Applied Statistics and Probability for Engineers		Wiley India
COURSE OUTCOMES: Students will be able to			
CO1	Basics of Statistics and Probability distributions .		
CO2	Sampling theory and Theory of Estimation		
CO3	Various tests of Hypothesis and Significance		
CO4	Correlation and Regression and fitting of different types of curves		

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Name of Paper		Paper Code	Theory					
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Software Engineering Methodologies and UML		MAI-204	L	T	J	EST	CAT	Total
			3	1	0	80	20	100
Course Objective		To understand the software engineering methodologies involved in the phases of project development and study of the problem identify project scope, objectives and infrastructure.						
Units	Contents (<i>Theory</i>)							Hours /week
I	Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model– Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document — SRS Document – Requirements Change Management - Project Management.							8
II	Software Design Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Development of Detailed Design & Creation of Software Design Document - Dataflow Oriented design – Designing for reuse – Programming standards.							8
III	Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Reliability – Software Quality Assurance – Standards. Need of Software Estimation – Function Point – Risk Management.							8
IV	Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Functional Testing – Structural Testing – Regression Testing - Testing Tools – Test Case Management – Challenges of Software Maintenance – Types of Maintenance. Software Maintenance Organization – Maintenance Report.							8
V	Introduction to UML : Use Case Approach,; Identification of Classes and Relationships, Identifying State and Behavior, Use Case Diagram Class Diagram – State Diagram - Sequence ‘Diagram – Activity Diagram – Deployment Diagrams Case Study – LMS.							8

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Text Books/ References Book:-			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
R. S. Pressman	Software Engineering – A practitioner’s approach	VI	McGraw Hill
Pankaj Jalote	Software Engg	IV	Narosa Publications
Ian Sommerville	Software Engineering 6/e	VI	Addison-Wesley
COURSE OUTCOMES: Students will be able to			
CO1	Reflect critically on the development process and its component to evaluate the results.		
CO2	Produce project artifacts that show the development of the software.		
CO3	Develop the understanding to the use of modeling language in the field of software development.		

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Name of Paper		Paper Code	Theory					
			Credit			Marks		
R Programming for Data Science and Data Analysis		MAI-205	L	T	J	EST	CAT	Total
			3	1	0	80	20	100
Course Objective		The objective of this course is to teach students R Programming Language, basic functions in R programming language and critical techniques						
Units	Contents (<i>Theory</i>)							Hours /week
I	Getting Started with R and R Workspace: Introducing R, R as a programming Language, the need of R, Installing R, RStudio, RStudio’s user interface, console, editor, environment pane, history pane, file pane, plots pane, package pane, help and viewer pane R Workspace, R’s working directory, R Project in R Studio, absolute and relative path, Inspecting an Environment, Inspect existing Symbols, View the structure of object, Removing symbols, Modifying Global Options, Modifying warning level, Library of Packages, Getting to know a package, Installing a Package from CRAN, Updating Package from CRAN, Installing package from online repository, Package Function, Masking and name conflicts							8
II	Basic Objects and Basic Expressions: Vectors, Numeric Vectors, Logical Vectors, Character Vectors, subset vectors, Named Vectors, extracting element, converting vector, Arithmetic operators, create Matrix, Naming row and columns, subsetting matrix, matrix operators, creating and subsetting an Array, Creating a List, extracting element from list, subsetting a list, setting value, creating a value of data frame, subsetting a data frame, setting values, factors, useful functions of a data frame, loading and writing data on disk, creating a function, calling a function, dynamic typing, generalizing a function. Assignment Operators, Conditional Expression, using if as expression and statement, using if with vectors, vectorized if: ifelse, using switch, using for							8

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	loop, nested for loop, while loop	
III	Working with Basic Objects and Strings: Working with object function, getting data dimensions, reshaping data structures, iterating over one dimension, logical operators, logical functions, dealing with missing values, logical coercion, math function, number rounding functions, trigonometric functions, hyperbolic functions, extreme functions, finding roots, derivatives and integration, Statistical function, sampling from a vector,	8
IV	Working with random distributions, computing summary statistics, covariance and correlation matrix, printing string, concatenating string, transforming text, Formatting text, formatting date and time, formatting date and time to string, finding string pattern, using group to extract data, reading data	8
V	Working with Data – Visualize and Analyze Data: Reading and Writing Data, importing data using built-in-function, READR package, export a data frame to file, reading and writing Excel worksheets, reading and writing native data files, loading built-in data sets, create scatter plot, bar chart, pie chart, histogram and density plots, box plot, fitting linear model and regression tree	8

Text Books/ References Book:-

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Garrett Grolemond	Hands-On Programming with R		
Hadley Wickham & Garrett Grolemond	R for Data Science		

COURSE OUTCOMES: Students will be able to

CO1	Know Open Source
CO2	Know Platform Independency
CO3	Understand Machine Learning Operations, Exemplary support for data wrangling
CO4	Do Quality plotting and graphing

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
Data Structure & Algorithm Design	MAI-206	L	T	J	EST	CAT	Total
		3	1	0	80	20	100
Course Objective	The goal of this course is to provide a solid background in the design and analysis of the major classes of algorithms.						
Units	Contents (<i>Theory</i>)						Hours /week
I	Overview of Data Structure: Need for Data Structure, Execution Time, Algorithm Analysis, Algorithm Complexity, Space Complexity, Time Complexity, Asymptotic Analysis, Asymptotic Notations Sorting and Searching Techniques: Bubble, Selection, Insertion, Shell sorts and Sequential, Binary, Indexed Sequential Searches, Interpolation, Binary Search Tree Sort, Heap sort, Radix sort						8
II	Stack and Queue: Contiguous implementations of stack, various operations on stack, various polish notations -infix, prefix, postfix, conversion from one to another -using stack, evaluation of post and prefix expressions. Contiguous implementation of queue: Linear queue, its drawback, circular queue, Dequeue Operation, linked implementation of stack and queue, isfull(), isempty()						8
III	General List: list and it's contiguous implementation, it's drawback, singly linked list - operations on it, doubly linked list -operations, circular linked list; linked list using arrays.						8
IV	Trees: definitions -height, depth, order, degree, parent and child relationship etc; Binary Trees: various theorems, complete binary tree, almost complete binary tree; Tree traversals -preorder, in order and post order traversals, their recursive and non -recursive implementations; expression tree - evaluation; linked representation of binary tree -operations. Threaded binary trees; forests, conversion of forest into tree. Heap-definition.						8
V	ALGORITHM ANALYSIS : Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack						8

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	Problem – Dynamic Programming – Optimal Binary Search Tree - Warshall’s Algorithm for Finding Transitive Closure.			
Text Books/ References Book:-				
Name of Authors		Titles of the Book	Edition	Name of the Publisher
Kruse R.L		Data Structures and Program Design in C	II	PHI
Trembly		Introduction to Data Structure with Applications	IV	
Tennenbaum A.M & others		Data Structures using C & C++	III	PHI
Mark Allen Addison Wesley		Data structure and Algorithm Analysis in C Weiss		
COURSE OUTCOMES: Students will be able to				
CO1	Describe, explain and use abstract data types including stacks, queues and lists			
CO2	Design and Implement Tree data structures and Sets			
CO3	implement non linear data structures			
CO4	Understand algorithm design and implementation			

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Name of Paper	Paper Code	Practical				
		Credit		Marks		
Programming Lab in C++	MAI-207	P	J	ESP	CAP	Total
		4	4	120	80	200

Content:

- Simple C++ programs to implement various control structures.
 - if statement
 - switch case statement and do while loop
 - for loop
 - while loop
 - Array
- Write a program Illustrating Class Declarations, Definition, and Accessing Class Members
- Write a C++ Program to illustrate default constructor, parameterized constructor and copy constructors
- WAP to find the largest of three numbers using inline function.
- Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
- Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
- Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
- WAP to Illustrate Multilevel Inheritance.
- WAP to Demonstrate Multiple Inheritances.
- Write a Program to demonstrate friend function and friend class.
- Write a C++ to illustrate the concepts of console I/O operations.
- Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
- Write a Program to illustrate New and Delete Keywords for dynamic memory allocation
- Write a C++ program to allocate memory using new operator.
- WAP to demonstrate template class
- WAP to demonstrate template function.

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Name of Paper	Paper Code	Practical				
		Credit		Marks		
RDBMS Lab	MAI-208	P	J	ESP	CAP	Total
		2	0	30	20	50

Contents:

Create the following Databases.

Salesmen

SNUM SNAME CITY COMMISSION

1001	Piyush	London	12 %
1002	Sejal	Surat	13 %
1004	Miti	London	11 %
1007	Rajesh	Baroda	15 %
1003	Anand	New Delhi	10 %

SNUM : A unique number assigned to each salesman.

SNAME : The name of salesman.

CITY : The location of salesmen.

COMMISSION: The Salemen's commission on orders.

Customers

CNUM CNAME CITY RATING SNUM

2001	Harsh	London	100	1001
2002	Gita	Rome	200	1003
2003	Lalit	Surat	200	1002
2004	Guni	Bombay	300	1002
2006	Chirag	London	100	1001
2008	Chinmay	Surat	300	1007
2007	Pratik	Rome	100	1004

CNUM : A unique number assigned to each customer.

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CNAME : The name of the customer.

CITY : The location of the customer.

RATING : A level of preference indicator given to this customer.

SNUM : The number of salesman assigned to this customer.

Orders

ONUM AMOUNT ODATE CNUM SNUM

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3001  18.69  10/03/97      2008   1007
3003  767.19      10/03/97      2001  1001
3002  1900.10 10/03/97      2007   1004
3005  5160.45 10/03/97      2003   1002
3006  1098.16 10/03/97      2008   1007
3009  1713.23 10/04/97      2002   1003
3007   75.75  10/04/97      2004   1002
3008  4723.00 10/05/97      2006   1001
3010  1309.95 10/06/97      2004   1002
3011  9891.88 10/06/97      2006   1001
```

ONUM : A unique number assigned to each order.

AMOUNT : The amount of an order.

ODATE : The date of an order.

CNUM : The number of customer making the order.

SNUM : The number of salesman credited with the sale.

Write queries :-

1. Produce the order no, amount and date of all orders.
2. Give all the information about all the customers with salesman number 1001.
3. Display the following information in the order of city, sname, snum and commission.
4. List of rating followed by the name of each customer in Surat.
5. List of snum of all salesmen with orders in order table without any duplicates.
6. List of all orders for more than Rs. 1000.
7. List of names and cities of all salesmen in London with commission above 10%.
8. List all customers whose names begins with a letter 'C'.
9. List all customers whose names begin with letter 'A' to 'G'.
10. List all orders with zero or NULL amount.
11. Find out the largest orders of salesman 1002 and 1007.
12. Count all orders of October 3, 1997.

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13. Calculate the total amount ordered.
14. Calculate the average amount ordered.
15. Count the no. of salesmen currently having orders.
16. List all salesmen with their % of commission.
17. Assume each salesperson has a 12% commission. Write a query on the order table that will produce the order number, salesman no and the amount of commission for that order.
18. Find the highest rating in each city in the form : For the city (city), the highest rating is : (rating)
19. List all in descending order of rating.
20. Calculate the total of orders for each day and place the result in descending order.
21. Show the name of all customers with their salesman's name.
22. List all customers and salesmen who shared a same city.

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Name of Paper	Paper Code	Practical				
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Mini Project in C++	MAI-209	P	J	ESP	CAP	Total
		2	0	30	20	50

Design a project using files to insert, retrieve, and update the records. It should also allow the user to update a particular attribute of a record.