SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE100303

Course / Subject Name: Probability and Statistics

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	BSC

Prerequisite:	Basic Probability and Statistics .
Rationale:	Systematic study of uncertainty (randomness) by probability - statistics and curve fitting by numerical methods.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Define the basic probability terminology and also can describe random variables and their probability functions.	Understand
2	Observe and analyze the behaviour of various discrete and continuous probability distribution functions.	Understand
3	Compute various statistical measures and further, calculate correlation and regression coefficient.	Understand
4	Apply the statistical methods for testing the significance of the large and small sample data by using large sample test, t- test, F- test and Chi-square test.	Apply
5	Apply the least square method for curve fitting.	Apply

COPO Mapping						
CO \ PO	**PO1(Engineering Knowledge)**	**PO2(Problem Analysis)**	**PO3(Design/Development)**	**PO4(Investigation)**	**PO5(Modern Tool Usage)**	**PO6–PO12(Others)**
CO1	3	2	-	2	-	-
CO2	3	3	-	3	-	-
CO3	3	3	-	3	-	-
CO4	3	3	-	3	2	-
CO5	3	3	2	2	2	-

CO PSO Mapping			
CO \ PSO	**PSO1(Domain-Specific Knowledge)**	**PSO2(Software/Statistical Tools)**	**PSO3(Problem Solving in Real-Life Contexts)**
CO1	3	2	1

CO PSO Mapping			
CO \ PSO	**PSO1(Domain-Specific Knowledge)**	**PSO2(Software/Statistical Tools)**	**PSO3(Problem Solving in Real-Life Contexts)**
CO2	3	2	2
CO3	3	2	2
CO4	3	3	3
CO5	3	3	2

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	(E)	(M)	(I)	(V)	
3	2	0	5	60	40	00	00	100

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE100303

Course / Subject Name: Probability and Statistics

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Basic Probability:** Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, probability mass function, continuous random variable, probability density function, cumulative distribution function, properties of cumulative distribution function, Two dimensional random variables and their distribution functions, Marginal probability function, Independent random variables.	8	20
2.	**Some special Probability Distributions:** Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Normal, Exponential and Gamma densities, Evaluation of statistical parameters for these distributions.	10	25
3.	**Basic Statistics**: Measure of central tendency: Moments, Expectation, dispersion, skewness, kurtosis, expected value of two dimensional random variable, Linear Correlation ,correlation coefficient, rank correlation coefficient, Regression, Bounds on probability, Chebyshev‘s Inequality.	10	20
4.	**Applied Statistics:** Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations. Test of significance for Small samples: t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	10	25
5.	**Curve fitting by the numerical method**: Curve fitting by of method of least squares, fitting of straight lines, second degree parabola and more general curves.	4	10
	Total	**42**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
07	**28**	**35**	**0**	**0**	**0**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
5. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

(b) Open source software and website:

1. https://archive.nptel.ac.in/courses/111/105/111105090/#
2. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
3. https://onlinecourses.nptel.ac.in/noc23_ma77/preview
4. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

Suggested Course Practical List

Assign engineering application problems related to the topics mentioned in the content.
It is recommended to perform practicals using VLAB and Excel wherever appropriate and feasible.

Note

- The activities listed above are suggestive, and faculty members have the flexibility to select and modify them as needed.
- The total self-learning hours remain fixed at 45 hours, ensuring comprehensive coverage of topics of Probability and Statistics
- Faculty can adjust the distribution of hours across different activities while maintaining a balanced learning approach.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.

- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective recordkeeping and to ensure transparency in the evaluation and assessment of self-learning activities.

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE100303

Course / Subject Name: Probability and Statistics

List of Laboratory/Learning Resources Required:

R, Python (NumPy, SciPy, matplotlib), Simulation Tools:

Suggested Project List:

1. *Probability Concepts & Random Variables*
2. *Probability Distribution Functions*
3. *Statistical Measures*
4. *Correlation and Regression*
5. *Hypothesis Testing*
6. *Curve Fitting using Least Squares*

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103301

Course / Subject Name: Digital Fundamentals

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	Professional Core Course

Prerequisite:	Basic Electronics and Number Systems
Rationale:	The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors. The students need to know combinational and sequential circuits using digital logic fundamentals. This is the first course by which students get exposure to digital electronics world.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Solve the given problem using fundamentals of Number systems and Boolean algebra and design the simple circuits using various gates for a given problem	Understand
2	Design and implement various Combinational logic circuits and verify its working in a simulator	Apply
3	Design and implement Sequential logic circuits and verify its working in a simulator	Apply
4	To understand memory types, organization, and operations, along with the application of programmable logic devices in modern systems.	Understand

COPO Mapping					
CO → PO	**PO1(Engineering knowledge)**	**PO2(Problem analysis)**	**PO3(Design/Dev of solutions)**	**PO5(Modern tools usage)**	**PO12(Lifelong learning)**
CO1	✓	✓			✓
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓		✓	✓	✓

COPSO Mapping		
CO → PSO	PSO1(Hardware/Software systems design)	PSO2(Application of tools/technology)
CO1	✓	
CO2	✓	
CO3	✓	✓
CO4	✓	✓
CO5	✓	✓

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103301

Course / Subject Name: Digital Fundamentals

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Module 1:** Fundamentals of Digital Systems and logic families Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.	7	5
2.	conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, QM method of function realization.	8	20
3.	**Module 3:** Sequential circuits and systems A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.	8	2
4.	**Module 4:** A/D and D/A Converters Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.	8	10
5.	**Module 5:** Semiconductor memories and Programmable logic devices. Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).	8	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**15**	**15**	**10**	**10**	**05**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. "Digital logic and Computer design", M. M. Mano, Pearson Education India, 2016.
2. "Fundamentals of Digital Circuits", A. Kumar, Prentice Hall India, 2016.
3. "Digital Principles and Applications" Malvino & Leach, McGraw-Hill Education
4. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, 2009

(b) Open source software and website:

1. LogiSim software
2. Xcircuit and Scilab
3. NPTEL website and IITs virtual laboratory

Suggested Course Practical List:

1. Getting familiar with various digital integrated circuits of different logic families. Study of data sheet of these circuits and see how to test these circuits using Digital IC Tester.
2. Configure diodes and transistor as logic gates and Digital ICs for verification of truth table of logic gates.
3. Configuring NAND and NOR logic gates as universal gates.
4. Implementation of Boolean Logic Functions using logic gates and combinational circuits. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
5. Study and configure of various digital circuits such as adder, subtractor, decoder, encoder, code converters.
6. Study and configurations of multiplexer and de multiplexer circuits.
7. Study and configure of flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
8. Perform an experiment which demonstrates function of 4 bit or 8 bit ALU.
9. Study and configuration of A to D and D to A converter.

List of Laboratory/Learning Resources Required:

1. Digital Storage Oscilloscopes
2. Digital Integrated Circuits Tester.
3. Complete Bread Board Systems, switches and I/O indicators, multi meters, pulse, square wave generators and display facility.
4. Digital Electronics Trainer kit.

Suggested Project List:

1. Number Systems and Boolean Algebra Projects
2. Combinational Logic Circuit Projects
3. Sequential Logic Circuit Projects
4. Memory & Programmable Logic Devices (PLDs)

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103302

Course / Subject Name: Data Structures

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	Professional Core Course

Prerequisite:	Computer Programming & Utilization
Rationale:	Data structure is a subject of primary importance in Information and Communication Technology. Organizing or structuring data is important for implementation of efficient algorithms and program development. Efficient problem solving needs the application of appropriate data structure during program development. Understanding of data structures is essential and this facilitates the understanding of the language. The practice and assimilation of data structure techniques is essential for programming. The knowledge of „C" language and data structures will be reinforced by practical exercises during the course of study. The course will help students to develop the capability of selecting a particular data structure.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Define and classify various data structures, storage structures and common operations on them.	Understanding
2	Use various linear data structures with their representation and perform different operations on them.	Understanding
3	Use various nonlinear data structures with their representation and perform different operations on them.	Understanding
4	Apply various searching and sorting techniques on small and large data set.	Apply
5	Solve the given problem using an appropriate data structure to achieve optimal performance and compare its performance with Other possible data structures.	Understanding

CO-PO Mapping						
CO \ PO	**PO1 (Engineering Knowledge)**	**PO2 (Problem Analysis)**	**PO3 (Design/Development)**	**PO4 (Investigation of Problems)**	**PO5 (Modern Tool Usage)**	**PO6 – PO12 (Generally Not Applicable for this Course)**
CO1	3	2	1	0	1	0
CO2	3	3	2	0	2	0
CO3	3	3	2	0	2	0
CO4	3	3	2	1	3	0
CO5	3	3	3	2	3	0

CO-PSO Mapping Table	**PSO1**	**PSO2**	**PSO3**
CO1: Define and classify various data structures, storage structures, and common operations on them.	✓		
CO2: Use various linear data structures with their representation and perform different operations on them.	✓	✓	
CO3: Use various nonlinear data structures with their representation and perform different operations on them.	✓	✓	
CO4: Apply various searching and sorting techniques on small and large datasets.	✓	✓	✓
CO5: Solve the given problem using an appropriate data structure to achieve optimal performance and compare its performance with other possible structures.	✓	✓	✓

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			**Total Credits L+T+ (PR/2)**	**Assessment Pattern and Marks**				**Total Marks**
				Theory		**Tutorial / Practical**		
L	**T**	**PR**	**C**	(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103302

Course / Subject Name: Data Structures

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction to data structure:** Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures	4	10
2.	**Linear data structure array:** Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	13	30
3.	**Non Linear Data Structure:** **Trees:** Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees **Graphs:** Graph-Matrix Representation Of Graphs, Elementary Graph operations (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	13	30
4.	**Hashing and file structures:** Hashing: The symbol table, Hashing Functions, Collision - Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File ,Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods	6	15
5.	**Sorting & Searching:** Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	6	15

	Total	**45**	**100**

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103302

Course / Subject Name: Data Structures

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**40**	**40**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.
3. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.
4. Fundamentals of Data Structures in C++-By Sartaj Sahani. 5
5. Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher Thomson Learning.

(b) Open source software and website:

1. NPTEL courses
2. Vlabs.iitb.ac.in
3. MOOCs - www.coursera.org
4. www.udacity.com, etc.

Suggested Course Practical List:

1. Introduction to pointers. Call by Value and Call by reference.
2. Introduction to Dynamic Memory Allocation. DMA functions malloc(), calloc(), free() etc.
3. Implement a program for stack that performs following operations using array. (a) PUSH
4. POP (c) PEEP (d) CHANGE (e) DISPLAY
5. Implement a program to convert infix notation to postfix notation using stack.
6. Write a program to implement QUEUE using arrays that performs following operations
   a. INSERT (b) DELETE (c) DISPLAY
7. Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY
8. Write a menu driven program to implement following operations on the singly linked list.

a. Insert a node at the front of the linked list.
b. Insert a node at the end of the linked list.
c. Insert a node such that linked list is in ascending order (according to info. Field)

(d)Delete a first node of the linked list.
(e)Delete a node before specified position.
(f)Delete a node after specified position.

9. Write a program to implement stack using linked list.
10. Write a program to implement queue using linked list.
11. Write a program to implement following operations on the doubly linked list.
    a. Insert a node at the front of the linked list.
    b. Insert a node at the end of the linked list.
    c. Delete a last node of the linked list.
    d. Delete a node before specified position.
12. Write a program to implement following operations on the circular linked list.
    a. Insert a node at the end of the linked list.
    b. Insert a node before specified position.
    c. Delete a first node of the linked list.
    d. Delete a node after specified position.
13. Write a program which create binary search tree.
14. Implement recursive and non-recursive tree traversing methods in order, preorder and post order traversal.
15. Write a program to implement Queue Sort
16. Write a program to implement Merge Sort
17. Write a program to implement Bubble Sort
18. Write a program to implement Binary Search.

List of Laboratory/Learning Resources Required:

1. Data Structure Visualizations
2. IDEs: Code::Blocks, VS Code, Jupyter Notebooks

Suggested Project List:

1. Data Structure Explorer
2. Linear Data Structures Simulator

3. Nonlinear Data Structures Playground
4. Sort & Search Visualizer
5. Optimal Data Structure Selection for Problem Solving

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103303

Course / Subject Name: Database Management Systems

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	Professional Core Course

Prerequisite:	Basic knowledge of Computer Programming
Rationale:	Database is an integral part of real life application system. The course will enable student understand the different issues involved in the design and implementation of a database system. Student will learn the physical and logical database designs, database modeling, relational, hierarchical, and network models. Student will learn to use data manipulation language to query, update, and manage a database. Student will understand essential DBMS concepts such as: database security, integrity, concurrency, storage strategies etc. The students will get the hands on practice of using SQL and PL/SQL concepts.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand DBMS fundamentals, database architecture, relational models, and user roles.	Understand
2	Design databases using E-R diagrams, normalization, and relational schemas.	Apply
3	Apply SQL and PL/SQL for database queries, constraints, procedures, and triggers.	Apply
4	Use transaction management, concurrency control, and recovery techniques.	Understand
5	Demonstrate query optimization, indexing, hashing, and database security.	Understand

CO-PO Mapping Table						
CO / PO	**PO1(Engineering Knowledge)**	**PO2(Problem Analysis)**	**PO3(Design/Development)**	**PO4(Investigations)**	**PO5(Modern Tools)**	**PO6 - PO12(Others)***
CO1	3	2	-	-	-	-
CO2	3	3	3	-	2	-
CO3	3	3	2	2	3	-
CO4	3	3	-	3	3	-

CO-PO Mapping Table						
CO / PO	**PO1(Engineering Knowledge)**	**PO2(Problem Analysis)**	**PO3(Design/Development)**	**PO4(Investigations)**	**PO5(Modern Tools)**	**PO6 - PO12(Others)***
CO5	3	2	2	2	3	-

COPSO Mapping Table			
Course Outcomes (COs)	**PSO1(Apply fundamental concepts in computer science and engineering)**	**PSO2(Design, develop, and maintain software systems)**	**PSO3(Solve real-world problems using modern tools & practices)**
CO1: Understand DBMS fundamentals, database architecture, relational models, and user roles.	3	2	1
CO2: Design databases using E-R diagrams, normalization, and relational schemas.	2	3	2
CO3: Apply SQL and PL/SQL for database queries, constraints, procedures, and triggers.	2	3	2
CO4: Use transaction management, concurrency control, and recovery techniques.	3	2	2
CO5: Demonstrate query optimization, indexing, hashing, and database security.	3	2	3

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			**Total Credits L+T+ (PR/2)**	**Assessment Pattern and Marks**				**Total Marks**
				Theory		**Tutorial / Practical**		
L	**T**	**PR**	**C**	(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Course / Subject Code: BE103303

Course / Subject Name: Database Management Systems

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).	3	10
2.	**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	6	10
3.	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.	4	15
4.	**Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.	5	10
5.	**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	6	15
6.	**Storage strategies:** Indices, B-trees, hashing.	4	10
7.	**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	6	10
8	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	4	05
9	**SQL Concepts:** Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, join, Exist, Any, All , view and its types., transaction control commands.	10	10
10	**PL/SQL Concepts:** Cursors, Stored Procedures, Stored Function, Database Triggers.	4	05
	TOTAL	52	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**40**	**40**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh, S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal, McGraw Hill Publication, New Delhi

(b) Open source software and website:

1. NPTEL Course: **Introduction to Database Systems** by Prof. Sreenivasa Kumar- IIT Madras
2. NPTEL Course: **Data Base Management System** by y Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay- IIT Kharagpur.

Suggested Course Practical List:

1. To study DDL-create and DML-insert commands
2. Create table and insert sample data in tables.
3. Perform queries involving predicates LIKE, BETWEEN, IN etc.
4. To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.
5. To study Single-row functions.
6. Displaying data from Multiple Tables (join)
7. To apply the concept of Aggregating Data using Group functions.
8. To solve queries using the concept of sub query.
9. To apply the concept of security and privileges
10. To study Transaction control commands
11. Write Cursor
12. Write Trigger

List of Laboratory/Learning Resources Required:

Database Management System
Oracle DBMS (Express Edition for labs)
MySQL or Maria DB
PostgreSQL
SQLite (for lightweight scenarios
SQL IDEs / Client Tools
Oracle SQL Develop
MySQL Workbench
Pg Admin (for PostgreSQL)
DBeaver (multi-platform support)
DB Browser for SQLite
ER Diagram and Schema Design Tools
Lucidchart / Draw.io (online)
Microsoft Visio
MySQL Workbench (has EER diagram support)
ERD Plus (free web-based tool)
Text Editors
Visual Studio Code / Sublime Text / Notepad++
Virtualization Software (Optional)
Virtual Box / VMware (if using virtual machines for DBMS setup)

Suggested Project List:

Student Management System
Library Management System
Hospital Management System
Online Retail Store Database
Banking System Simulation
Hotel Booking System
Secure Employee Database System

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