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ANNEXURE-IX

Syllabi

of

Departmental Core Courses (DC)

of

B. Tech III Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2023-24

(under the flexible curriculum)

DESIGN & ANALYSIS OF ALGORITHMS (3240321/3270321/3270321)

COURSE OBJECTIVES

- To introduce the topic of algorithms as a precise mathematical concept.
- To study the techniques like recursion, divide and conquer, dynamic programming, greedy approach, backtracking and branch and bound.
- To practice their skills on many well-known algorithms and data structures designed to solve real-life problems.

Unit I

Introduction to Computational Model: Algorithms and its Importance, Recurrences and Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithm, Review of Sorting & Searching Algorithms, Basic Tree and Graph Concepts: B-Trees and Traversal Techniques, Topological sort.

Unit II

Divide and Conquer Method: Introduction and its Examples such as Finding the Maximum and Minimum, Binary Search, Merge Sort, Quick Sort and Strassen's Matrix Multiplication and Additional Real World Problems on Divide and Conquer.

Unit III

Greedy Method: Introduction, Characteristics, Examples of Greedy Methods such as Single-Source Shortest Paths, Minimum Cost Spanning Trees: Prim's and Kruskal's Algorithm, Knapsack Problem, Dijkstra's Single Source Shortest Path Algorithm, Optimal Storage on Tapes.

Unit IV

Dynamic Programming: Introduction, The Principle of Optimality, Examples of Dynamic Programming Methods such as – 0/1 Knapsack, Traveling Salesman Problem, Floyd's All Pairs Shortest Path, Longest Common Subsequence and Reliability Design, Matrix Chain Multiplication.

Unit V

Backtracking: Concept and its Examples like 4-Queens Problem, Knapsack problem Hamiltonian Circuit Problem, Graph Coloring Problem etc. Branch & Bound: Introduction and its Examples like - Traveling Salesperson Problem etc. NP-Completeness: Introduction, Class P and NP, Polynomial Reduction, NP-Hard and NP- Complete Problems.

RECOMMENDED BOOKS

1. Fundamentals of Computer Algorithms, Horowitz & Sahani, Universities press.
2. Introduction to Algorithms, Coremen Thomas, Leiserson CE, Rivest RL, PHI.
3. Design & Analysis of Computer Algorithms, Ullmann, Pearson.
4. Algorithm Design, Michael T Goodrich, Robarto Tamassia, Wiley India.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	demonstrate a familiarity with major algorithms and data structures.
CO2	identify important algorithmic design paradigms and methods of analysis.
CO3	analyze the performance of algorithms.
CO4	compare various algorithm design techniques.
CO5	select the design technique to solve any real world problem.
CO6	design efficient algorithm using various design techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	2						1	3	
CO2	3	3	3	3	2	2						1	3	
CO3	3	3	3	3	3	2		2	2	2		3	3	
CO4	3	3	3	3	3	2		2	2	2		3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	2
CO6	3	3	3	3	3	3	3	3	3	2	2	3	3	3

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PYTHON PROGRAMMING (3240322/3270322/3270322)

COURSE OBJECTIVES

- To develop the understanding of algorithms, programming approaches and program documentation techniques in Python.
- To study the concepts of procedural and object oriented programming techniques in Python.
- To design and implement basic programming solutions using Python programming constructs.

Unit I

Introduction to Python: Formal and natural languages, Downloading and installing Python. Problem-solving methods and algorithm development. The first program, Variables, expressions, keywords, Operators, Expressions and statements, Interactive mode and script mode, Order of operations. Data Types: Numeric, string, list tuple, dictionary, set.

Unit II

Function, ways of passing arguments to functions, user defined and inbuilt functions, lambda function. Control Statements: Conditional and unconditional branching, while loop, for loop, loop control statements, range function. Numeric, String, list, tuple, dictionary and set manipulation operations using loops and inbuilt manipulation functions. Packages and modules in python.

Unit III

Exception and File Handling: Errors vs exceptions, Exceptions handling with try block, handling multiple exceptions, writing your own exceptions, file handling modes, reading, writing and appending a file, Handling file exceptions.

Unit IV

Object oriented programming: Characteristics and features of OOPS, Classes and objects, constructors and destructors, defining member variables and functions, visibility modes, static members.

Unit V

Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, polymorphism in python. Inheritance: Introduction, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. Association, Aggregation and composition. Array manipulation and visualization using numpy and matplotlib libraries.

RECOMMENDED BOOKS

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming, By Eric Matthes.
2. Learn Python the Hard Way: third Edition T.R. Padmanabhan, Programming with Python, Springer, first Ed., 2016.
3. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning, first Ed., 2012.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	define basics syntax and features of python programming language
CO2	solve computational problems using python language.
CO3	take part in online coding platforms.
CO4	inspect the python program for errors.
CO5	design a program using the features of object oriented concepts.
CO6	construct the python code for real world problem using the libraries.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	1	3	2	1		3		3	3	3	3
CO2	3	3	3	3	3	2	3	3	3		3	3	3	3
CO3	3	3	3	3	3	3		3	3	3	3	3	2	3
CO4	3	3	3	3	3	3			3		3	3	3	3
CO5	3	3	3	1	3	3		3	3		3	3	3	3
CO6	3	3	3	3	3	2	3	3	3	3	3	3	3	3

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ROBOT KINEMATICS (3240323)

COURSE OBJECTIVES

- To introduce the functional elements of Robotics
- To impart knowledge on the kinematics of mechanism
- To introduce the dynamics and control of manipulators

UNIT I

FUNDAMENTALS OF ROBOTICS: Introduction to Robotics: History, Law of Robotics: Terminologies, Classifications Overview: Links & Joints, Coordinate Systems, Work Volume, Precision, Repeatability & Accuracy Position and Orientation of Objects: Roll, Pitch and Yaw Angles, Joint Configuration of Five Types of Serial Manipulators, Wrist Configuration, Overview of end effector.

UNIT II

KINEMATICS AND ROBOT MECHANISM: Degrees of Freedoms: of various mechanisms and its application, Kinematics: Mobility Analysis, Displacement Analysis: constrained mechanisms and robots, Velocity Analysis: constrained mechanisms and robots, singularity,

UNIT III

FORWARD KINEMATIC MODELING AND DENAVIT-HARTENBERG (DH) APPROACH: Translation Matrix - Rotation matrix, Euler Angles, Quaternion Fundamental, Dot and Cross Products, Frames and Joint Coordinates, Homogeneous Transformation, D-H Convention and Procedures: Forward kinematics Solution using D-H Convention: 3R Planar mechanism, 3 DOF RRP, Cartesian, Articulated 3 DOF robots.

UNIT IV

PATH PLANNING AND APPLICATIONS: Definition: Joint space technique, Use of p-degree polynomial, Cubic Polynomial-Cartesian space Technique, Parametric descriptions, Straight line and circular paths, Position and orientation planning. Selection and Application of Serial Manipulators: Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defence, Disaster management. Applications, Micro and Nano robots, Future Applications.

UNIT V

MANIPULATOR DIFFERENTIAL MOTION, DYNAMICS AND CONTROL: Linear and angular velocities, Manipulator Jacobian-Prismatic and rotary joints, Lagrange Euler formulation, Dynamic model: Manipulator control problem, Linear control schemes, PID controller.

RECOMMENDED BOOKS

1. R.K. Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. John J. Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M. P. Groover, M. Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.
4. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
5. K. K.Appu Kuttan, Robotics, I K International, 2007.
6. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
7. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
8. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
9. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.
10. S. B. Nikku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, John Wiley & Sons Ltd., 2020.
11. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education 2014.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1: illustrate the significance, social impact and future prospects of robotics and automation in various engineering applications.

CO2: describe the components and anatomy of robotic systems and basics of robotics.

CO3: explain different motions of a robotic system through kinematic modeling.

CO4: employ a suitable path planning of end-effectors for a given robotics application.

CO5: develop the dynamic model for a robot manipulator.

CO6: apply robotic control to solve real-world industrial problems.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1		1	3	2	2	1		1	1	3	2
CO2	3	1	1		1									
CO3	2	3	2	3	3	1			1			1	3	1
CO4	2	3	3	2	3	2								
CO5	3	3	3	3	3	1	1	1	2	2	1	3	3	2
CO6	3	3	3	2	3	2	1	2	2	2	3	3	3	3

OPERATING SYSTEMS (3240324)

COURSE OBJECTIVES

- To provide basic knowledge of computer operating system structures and functioning.
- To compare several different approaches to memory management, file management and process management.
- To understand various problems related to concurrent operations and their solutions.

Unit I

Basics of Operating System: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.

Unit II

Process Management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit III

Process Synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Unit IV

Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit V

Storage Management: Mass-Storage Structure, Overview, Disk Structure, Disk Attachment, Disk Scheduling.

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Structure, Allocation Methods, Free-Space Management.

RECOMMENDED BOOKS

1. Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.
2. Operating Systems, internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.
3. Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	illustrate the basic concepts of operating systems.
CO2	explain the working procedure of operating systems.
CO3	analyze various operating system problems and issues.
CO4	develop the solutions for various operating system problems and issues.
CO5	evaluate the performance of various scheduling and allocation techniques.
CO6	test the working of various scheduling and allocation techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	2						1	3	
CO2	3	3	3	3	2	2						1	3	
CO3	3	3	3	3	3	2		2	2	2		3	3	
CO4	3	3	3	2	3	2		2	2	2		3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	2
CO6	3	3	3	3	3	3	3	3	3	2	2	3	3	3

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DATABASE MANAGEMENT SYSTEM (3270323/3280323)

COURSE OBJECTIVES

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modelling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

Unit I

DBMS: Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

Unit II

Relational Model: Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select, Project, Division, Intersection, Union, Division, Rename, Join etc.

Unit III

SQL: Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers.

Unit IV

Relational Database Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

Unit V

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

RECOMMENDED BOOKS

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8th Edition.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 demonstrate the concepts of different types of database systems.
CO2 apply relational algebra concepts to design database systems.
CO3 make use of queries to design and access database systems.
CO4 analyze the evaluation of transaction processing and concurrency control.
CO5 determine the normal form of the relation.
CO6 design a ER diagram/database system for a real world application.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			2		2	1		3	2	
CO2	3	3	3	3	1	2		2					3	1
CO3	3	3	3	3			1				1			2
CO4	3	3	3	3		1		1	3		2	2		
CO5	3	3	3	3	2	2			2					
CO6	3	3	3	3			2	2		2	2	3	2	2

COMPUTER NETWORKS (3270324/3280324)

COURSE OBJECTIVES

- Familiarize the student with the basic taxonomy and terminology of the computer networking.
- Provide detailed knowledge about various layers, protocols and devices that facilitate networking.
- Enable Students to deal with various networking problems such as flow control, error control and congestion control.

Unit I

Introduction: Computer Network, Types- LAN, MAN & WAN, Data Transmission Modes- Serial & Parallel, Simplex, Half Duplex & Full Duplex, Synchronous & Asynchronous Transmission, Transmission Medium- Guided & Unguided, Cables- Twisted Pair, Coaxial Cable & Optical Fiber, Networking Devices-Repeaters, Hub, Switch, Bridge, Router, Gateway and Modem, Performance Criteria- Bandwidth, Throughput, Propagation Time & Transmission Time, Network Standardization- OSI Reference Model & TCP/IP Reference Model.

Unit II

Physical Layer: Network Topologies- Bus, Ring, Star & Mesh, Switching- Circuit Switching, Message Switching & Packet Switching, Multiplexing: FDM – Frequency Division Multiplexing, WDM – Wavelength Division Multiplexing & TDM – Time Division Multiplexing.

Unit III

Data Link Layer: Introduction, Design Issues, Services, Framing, Error Control, Flow Control, ARQ Strategies, Error Detection and Correction, Parity Bits, Cyclic Redundancy Code (CRC), Hamming Codes, MAC Sub Layer- The Channel Allocation Problem, Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE 802.3, IEEE 802.4 and IEEE 802.5.

Unit IV

Network Layer & Transport Layer: Introduction, Design Issues, Services, Routing- Distance Vector Routing, Hierarchical Routing & Link State Routing, Shortest Path Algorithm- Dijkstra's Algorithm & Floyd–Warshall's Algorithm, Flooding, Congestion Control- Open Loop & Closed Loop Congestion Control, Leaky Bucket & Token Bucket Algorithm. Connection Oriented & Connectionless Service, IP Addressing.

Unit V

Presentation, Session & Application Layer: Introduction, Design Issues, Presentation Layer- Translation, Encryption- Substitutions and Transposition Ciphers, Compression- Lossy and Lossless. Session Layer – Dialog Control, Synchronization. Application Layer- Remote Login, File Transfer & Electronic Mail

RECOMMENDED BOOKS

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, Pearson Education India.
3. Computer Networks and Internets, Douglas E. Comer, Pearson India.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	explain the fundamental concepts of computer networks.
CO2	illustrate the basic taxonomy & terminologies of computer networks.
CO3	identify various parameters for affecting the performance of computer networks.
CO4	analyze the concepts of communication using various layers of the OSI model.
CO5	evaluate the performance of computer networks in congestion and the Internet.
CO6	design the network environment and applications for implementation of computer networking concepts.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	1	1			1	1		1	3	
CO2	3	3	3	2	2	1			1	1		1	3	
CO3	3	3	3	3	2	1			2	1		2	3	
CO4	3	3	3	3	1	2			2	1		2	3	2
CO5	3	3	3	3	3	3	2	1	3	1	2	2	3	2
CO6	3	3	3	3	3	3	3	2	3	2	3	2	3	3

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ANNEXURE-X

Experiment list/ Lab manual/ Skill Based Mini-Project List of Laboratory Courses offered for B. Tech III Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2023-24

(under the flexible curriculum)

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PYTHON PROGRAMMING (3240322/3270322/3270322)

LIST OF PROGRAMS

1. Write a program in python to calculate the area of various geometric shapes.
2. Write a program in python to demonstrate the working of different operators used in python and also deduce the precedence of each operator.
3. Write a program in python that takes numbers from users and places them in three lists representing even, odd and prime numbers.
4. Write a program in python that generates Fibonacci series and store it in a list and dictionary simultaneously.
5. Write a program in python that checks whether an input string contains special characters or not.
6. Write a python program that generates fibonacci series using recursion.
7. Write a program in python which takes names of two students and displays a number of unique characters in each name, also displaying the word formed by unique characters.
8. Write a program in python which reverses the digits of an integer.
9. Write a python program which checks whether a number entered by a user is an Armstrong number or not.
10. Write a python program which performs following operations using functions on a list of numbers:
    a. Displays sum of numbers
    b. Displays Maximum number
    c. Displays Minimum number
    d. Displays Average of numbers
11. Write a program to demonstrate the working and applications of lambda function in python.
12. Write a program to demonstrate how exception handling is implemented in python.
13. Write a program in python to overload +, -, *, >=, <= operators for a class representing rational numbers in the form of p/q.
14. Write a program in python to implement different types of inheritances using an employee, human and admin class. Each class must contain appropriate data members and member functions.
15. Write a program in python where a customer class has an association with a Bill class. Use appropriate attributes and member functions for each class.

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PYTHON PROGRAMMING (3240322/3270322/3270322)

LIST OF SKILL BASED MINI-PROJECTS

List of Micro Projects:

1. Write a python program that validates an email ID entered by the user, where the validation rules include that at least one character should be in lowercase and one in uppercase and contains at least one numeric character and one special symbol.
2. Implement countdown clock and timer in python.
3. Suppose a text file contains information about students in the form of Name, Enrolment, Semester, CGPA. Write a python script to display semester-wise student details in descending order of CGPA.

List of Macro Projects:

1. Suppose a text file contains information about students in the form of Name, 10th-class exam roll number, marks in physics, marks in chemistry and marks in mathematics. Write a python script to generate a text file containing subject-wise merit list.
2. Design and implementation of a real-time, User friendly Currency Converter.
3. Write a python program to create a Tic-Tac-Toe Game.

List of Mini projects:

1. Create a login module with below mentioned features:
    a. Verify username and password correctly
    b. Register new user and set its password
    c. Change password of any registered user
    Note: Store the usernames and passwords in a Dictionary.
2. Suppose a text file contains employee details in the form of comma separated values as: employee name, ID, gross salary, Annual Provident Fund deposited, Advance tax deposited. Write a python script to calculate annual tax detection for each employee and store details in:
    a. Dictionary, where key represents employee ID, value represents the net tax to be deposited by the employee.
    b. In a text file as: Name: <Employee Name>; ID: <Employee ID>; Tax: <Tax to be deposited>
    Tax to be calculated according to below mentioned rules:
        i. St. deduction: 5 Lac.
        ii. 0 to 5 Lac: 5% tax deduction
        iii. 5 to 7.5 Lac: 10% tax deduction
        iv. 7.5 to 10 Lac: 15% tax deduction
        v. Above 10 Lac: 20 % tax deduction
3. Write a program in python to represent a student using OOPS where each student is represented by name, ID, Semester and CGPA. The student class to be implemented should contain all the necessary functions appropriate according to a student. The class should contain 3 dictionary variables as static members which should contain a semester-wise topper list. The key in each dictionary should represent the student Merit position, and value should represent details of a particular student.

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ROBOT KINEMATICS (3240323)

LIST OF EXPERIMENTS

1. Study of kinematic links, pairs and chains
2. To find the degree of freedom of a given mechanism.
3. To Study Straight Line Mechanism.
4. Study of Open and Closed kinematic chain mechanism:
    a. Oldham Coupling Mechanism,
    b. A quick return mechanism and
    c. CAM follower mechanism.
5. Introduction of RoboAnalyzer software.
6. Validation of the forward kinematics of manipulators through RoboAnalyzer.
    a. Demonstration of 2D, 3D Transformation, Scaling
    b. Demonstration Rotation,
    c. Demonstration Translation,
    d. Demonstration Multiple transformation, and Homogeneous Transformations
7. Kinematics analysis of 2R Manipulators by RoboAnalyser.
8. Demonstration of D-H convention for kinematic analysis.
9. Kinematics of PUMA 560: Robot teaching
10. Study of PID controllers.

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DATABASE MANAGEMENT SYSTEM (3270323/3280323)

LIST OF PROGRAMS

While creating tables, databases the name should have a prefix of your roll number.

Ex. If your roll number is 55 then every table name must start with 55 TABLE_NAME. 1. Write program name 2. Write description of command used for executing the query. 3. Write commands in bold letters. 4. Take the screenshot of the output.

1. Implementation of DDL commands of SQL with suitable examples.
   a. Create table
   b. Alter table
   c. Drop Table
2. Implementation of DML commands of SQL with examples.
   a. Insert
   b. Update
   c. Delete
3. Implementation of different type of function with suitable example
   a. Number function
   b. Aggregate function
   c. Character function
   d. Conversion function
   e. Data function
4. Implementation of different types of operators in SQL.
   a. Arithmetic operators
   b. Logical operators
   c. Set operator
   f. Comparison Operator
   g. Special operator
5. Implementation of type of joins.
   a. Inner Join
   b. Outer Join
   c. Natural Join etc.
6. Study and implementation of
   a. Group by & having clause
   b. order By clause
   c. Indexing
7. Study of Implementation of
   a. Sub queries
   b. Views
8. Study & implementation of different type of constraints.
9. Study & implementation of database backup & recovery command. Study & implementation of Rollback, commit, savepoint.
10. Creating Database /Table Space
    a. Managing Users: Create User, Delete User
    b. Managing roles: Grant, Revoke.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. construct a database schema for a given problem domain.

CO2. apply integrity constraints on a database schema using a state-of-the-art RDBMS.

CO3. apply SQL queries using DDL and DML to design and access database systems.

CO4. make use of operators and functions used in query.

CO5. distinguish Tables and Views for database systems.

CO6. develop a small project for a real world scenario.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			2		2	1		3	2	
CO2	3	3	3	3	1	2		2					3	1
CO3	3	3	3	3			1				1			2
CO4	3	3	3	3		1		1	3		2	2		
CO5	3	3	3	3	2	2			2					
CO6	3	3	3	3			2	2		2	2	3	2	2

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DATABASE MANAGEMENT SYSTEM (3270323/3280323)

LIST OF SKILL BASED MINI PROJECT

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Design ER-Diagram, Create Schema and insert at least 5 records for each table. Add appropriate database constraints

Mini Skill Project 1

Consider the following schema for a Library Database:
BOOK (Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS (Book_id, Author_Name)
PUBLISHER (Name, Address, Phone)
BOOK_COPIES (Book_id, Programme_id, No-of_Copies)
BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date)
LIBRARY_PROGRAMME (Programme_id, Programme_Name, Address)

Write SQL queries to:

1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library.

Mini Skill Project 2

Consider the following schema for Order Database:
SALESMAN (Salesman_id, Name, City, Commission)
CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Write SQL queries to:
1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesman who had more than one customer.
3. List all the salesman and indicate those who have and do not have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

Mini Skill Project 3

Consider the schema for Movie Database:
ACTOR (Act_id, Act_Name, Act_Gender)
DIRECTOR (Dir_id, Dir_Name, Dir_Phone)

MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST (Act_id, Mov_id, Role)
RATING (Mov_id, Rev_Stars)

Write SQL queries to:

1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

Mini Skill Project 4

Consider the schema for College Database:
STUDENT (USN, SName, Address, Phone, Gender)
SEMSEC (SSID, Sem, Sec)
CLASS (USN, SSID)
COURSE (Subcode, Title, Sem, Credits)
IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to:

1. List all the student details studying in the fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
If FinalIA = 17 to 20 then CAT = 'Outstanding'
If FinalIA = 12 to 16 then CAT = 'Average'
If FinalIA< 12 then CAT = 'Weak'
Give these details only for 8th semester A, B, and C section students.

Mini Skill Project 5

Consider the schema for Company Database:
EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
DLOCATION (DNo,DLoc)
PROJECT (PNo, PName, PLocation, DNo)
WORKS_ON (SSN, PNo, Hours)

Write SQL queries to:

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.

3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

Mini Skill Project 6

A university registrar's office maintains data about the following entities:
(a)courses, including number, title, credits, syllabus, and prerequisites;
(b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
(c) students, including student-id, name, and program; and
(d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.
Construct an E-R diagram forthe registrar's office. Document all assumptions that you make about the mapping constraints.

Mini Skill Project 7

Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

Mini Skill Project 8

Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.

Mini Skill Project 9

Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes.

Mini Skill Project 10

Consider a database used to record the marks that students get in different exams of different course offerings.
a. Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the above database.
b. Construct an alternative E-R diagram that uses only a binary relationship between students and course-offerings. Make sure that only one relationship exists between a particular student and course-offering pair, yet you can represent the marks that a student gets in different exams of a course offering.

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ROBOT MODELING AND SIMULATION LAB (3240325)

COURSE OBJECTIVES

- To impart a comprehensive understanding of the essential components and structures of robotic systems
- To enable students to derive and implement the kinematic and dynamic models of robotic manipulators and mobile robots.
- To develop proficiency in using simulation tools for modeling and analyzing robotic systems.
- To understand and implement the integration and fusion of sensor data to enhance robotic perception and decision-making.

Program List

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system.
3. Estimation of accuracy, repeatability, and resolution.
4. Robot programming and simulation for pick and place.
5. Robot programming and simulation for Color identification.
6. Robot programming and simulation for Shape identification.
7. Robot programming and simulation for writing practice.
8. Robot programming and simulation for any industrial process (Packaging, Assembly)
9. Robot programming and simulation for multi-process.
10. Interfacing of robotic arm with various sensors such as: temperature, IR, ultrasonic, PIR etc.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1. understanding of the key components and structure of robotic systems.

CO2. acquire hands-on experience in simulating robotic systems using industry-standard tools.

CO3. design and implement control algorithms for robotic systems.

CO4. develop models for robot behavior based on human inputs.

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ROBOT MODELING AND SIMULATION LAB (3240325)

Skill based Mini Projects

Micro Project:

- Robotic Arm with Vision-Based Sorting
- Pick and Place Robotic Arm
- Implement communication protocols between the arms.
- Develop a user interface for remote operation.

Macro Projects:

- Teleoperated Robotic Arm
- Use simulation tools to test coordination and task execution.
- Implement advanced sensors for force feedback and tactile sensing

Mini Project:

- Robotic Arm with Machine Learning for Adaptive Tasks
- Robotic Arm for Medical Applications
- Collaborative Dual-Arm Robot
- Use sensors to gather data about objects and arm movements.

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COMPETITIVE PROGRAMMING LAB (3270325/3280325)

Program List

1. Optimize data structures for specific problem scenarios, such as using heaps, trees, hash tables, etc., to achieve better time or space complexity.
2. Explore problems that can be solved by breaking them down into smaller subproblems, solving each independently, and combining their solutions.
3. Practice solving problems using dynamic programming techniques, breaking down the problem into smaller overlapping subproblems.
4. Dive deeper into graph algorithms such as shortest path algorithms (Dijkstra's algorithm, Bellman-Ford algorithm), minimum spanning trees (Prim's algorithm, Kruskal's algorithm), etc.
5. Experiment with algorithms for string matching, substring search, longest common subsequence, etc.
6. Experiment with algorithms that use randomness to solve problems, such as randomized algorithms for sorting, graph algorithms, etc.
7. Solve the parallel matrix multiplication problem using techniques like Strassen's algorithm.
8. Solve the single-source shortest paths problem using Bellman-Ford algorithm.
9. Implement the traveling salesman problem (TSP) using a branch and bound to find the shortest possible route that visits each city exactly once and returns to the origin city.
10. Solve the N-Queens problem to place N queens on an N×N chessboard without any two queens attacking each other.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1. solve a wide range of computational problems encountered in competitive programming contests, including optimization problems, graph problems, string problems, and more.

CO2. gain a deep understanding of various algorithmic techniques.

CO3. analyze the time and space complexity of algorithms.

CO4. apply effective techniques to improve the efficiency of algorithms and reduce computational complexity.

CO5. analyze empirical evaluation in algorithm design, and interpret experimental results to draw meaningful conclusions.

CO6. develop critical thinking skills and problem-solving strategies required to tackle novel and challenging computational problems efficiently.

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COMPETITIVE PROGRAMMING LAB (3270325/3280325)

Skill Based Project List

Micro Project:

- Develop a web-based tool that analyzes the time and space complexity of code snippets. Users can input their code, and the tool calculates and displays the Big O notation complexity of the algorithm.

Macro Project:

- Develop a console application that solves classic dynamic programming problems like the Fibonacci sequence, coin change problem, and longest common subsequence. Users can input problem parameters, and the program outputs the solution.

Mini Project:

1. Build a tool that analyzes the time and space complexity of algorithms. Users can input their code or algorithm, and the tool should provide insights into its complexity using visualizations and detailed analysis.
2. Develop a personalized dashboard for competitive programmers that displays their progress, recent submissions, upcoming contests, and recommended problems. Include visualization tools for performance analysis and goal tracking.
3. Implement a Python script that solves divide and conquer problems like finding the maximum subarray sum or computing the nth Fibonacci number efficiently using the divide and conquer approach.
4. Develop a web-based tool that visualizes popular algorithms like sorting algorithms (merge sort, quicksort), graph algorithms (Dijkstra's algorithm, Prim's algorithm), etc. Users should be able to step through the algorithm's execution to understand its workings.