TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

3-Year Master of Computer Application (MCA) Curriculum and Syllabus

Third Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-PEN-T201	Career advancement and Skill Development	2	0	1	3
TIU-PCA-T201	Career advancement and Skill Development for IMCA2	2	0	1	3
TIU-IMA-T201	Computer Based Operations Research	3	1	0	4
TIU-PCA-T217	Advanced Block Chain Technology ***	3	1	0	3
TIU-PCA-T205	Database Management Systems	3	1	0	4
TIU-PCA-T213	Design and Analysis of Algorithms	3	1	0	4
TIU-PMG-T211	Principles of Management	2	0	0	2
TIU-PCA-T215	OOP using Python	2	1	0	3
Practical					
TIU-PCA-L201	Computer Based Operations Research Lab	0	0	2	2
TIU-PCA-L205	DBMS Lab	0	0	3	2
TIU-PCA-L215	Python Lab	0	0	3	2
TIU-PCA-L213	DAA Lab	0	0	3	2
Sessional					
TIU-PES-S299	Entrepreneurship Skill Development	0	0	3	2
	Total Credits				33

NOTE: YELLOW COLORED IS ONLY FOR IMCA2.
NOTE: GREEN COLORED IS ONLY FOR MCA2.
NOTE: * TO BE STED FROM JULY-19**

Approved by:

External Expert-1 (Prof. Subhadip Basu, J.U.)
External Expert-2 (Prof. Amlan Chakraborty, C.U.)
HOD - (Prof. A.B. Chaudhuri)

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DETAILED SYLLABUS

Career advancement and Skill Development
TIU-PEN-T201

L-T-P: 2-0-1 **Credit: 3**

Course Code	Topics	Credit
#Employability Skill Development	Body Language	1
	Presentation Skill	
	Time Management & Stress Management	
Global Skill	SPANISH/FRENCH	1
Applied Communicative English	Developing fluency in the language	
Total		**2**

Career advancement and Skill Development for IMCA2
TIU-PCA-T201

L-T-P: 2-0-1 **Credit: 3**

Introduction to PL/SQL.
Presentation on Modern Technologies.

DESIGN AND ANALYSIS OF ALGORITHMS
TIU-PCA-T213

L-T-P: 3-1-0 **Credit: 4**

Prerequisites :
Data Structures, Basic mathematics: Induction, probability theory and Basic searching and sorting algorithms.

Course Objectives :
1. To know the basics of computational complexity analysis and various algorithm design paradigms.

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2. Provide students with solid foundations to deal with a wide variety of computational problems.
3. To provide a thorough knowledge of the most common algorithms and data structures.
4. To analyze a problem and identify the computing requirements appropriate for its solutions

Course Outcomes :

1. Apply Knowledge of Mathematics to perform asymptotic analysis of algorithms.
2. Demonstrate a familiarity with major algorithms and data structures.
3. Apply important algorithmic design paradigms and methods of analysis.
4. Synthesize efficient algorithms in common engineering design situations.

UNIT-I: INTRODUCTION
Analysis of Algorithm, Efficiency Analysis framework, asymptotic notations . Analysis of Non-recursive and recursive algorithms. Solving Recurrence Equations.

UNIT-II: DIVIDE AND CONQUER AND GREEDY
Divide & Conquer: General method, Binary search. Analysis of Sorting Techniques. Large integer multiplication, Strassen's Matrix multiplication.

Greedy Method: General method and characteristics, Prim's method for MST , Kruskal method for MST (using nlogn complexity), Dijkstra's Algorithm, Huffman Trees (nlogn complexity), Job Sequencing.

UNIT-III : DYNAMIC PROGRAMMING
General strategy, Principle of optimality, Warshal's and Floyd's Algorithm , Optimal Binary Search Trees, 0/1 knapsack Problem, Travelling Salesman Problem, Matrix Chain Multiplication.

UNIT-IV: BACKTRACKING
General method, Recursive backtracking algorithm, iterative backtracking method. 8-queens problem, Sum of subsets, Graph coloring, Hamiltonian Cycle , 0/1 Knapsack Problem.

UNIT –V: BRANCH AND BOUND
The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound,
LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, traveling sales person problem, 15 Puzzle Problem.

UNIT-VI: COMPUTATIONAL COMPLEXITY AND PARALLEL ALGORITHMS
Non Deterministic algorithms, the classes P, NP, NP Complete, NP hard Proofs for NP Complete Problems: Clique, Vertex Cover Parallel Algorithms: Introduction, models for parallel computing, computing with complete binary tree.

Text Books:

1. Horowitz and Sahani, "Fundamentals of computer Algorithms", Galgotia. ISBN 81
2. R.C.T.Lee, S S Tseng, R C Chang, Y T Tsai " Introduction to Design and Analysis of Algorithms, A Strategic approach" Tata McGraw Hill. ISBN
3. Gilles Brassard, Paul Bratle "Fundamentals of Algorithms ", Pearson ISBN 978

Reference Books:

4. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" PHI, ISBN:81
Anany Levitin,"Introduction to the Design & Analysis of Algorithm ",Pearson ISBN 81
5. Steven S Skiena , The Algorithm Design Manual, Springer,2nd edition,
6. George T. Heineman, Gary Pollice, Stanley Selkow "Algorithms in a Nutshell, A Desktop Quick Reference", O'Reilly.

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Computer Based Operations Research
TIU-IMA-T201

L-T-P: 3-1-0 **Credit: 4**

Linear Programming: OR Models, Convex Sets, Graphical Method, Simplex Method, Big M Method, Two Phase Method

Duality and Sensitivity Analysis : Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis

Transportation and Assignment Formulation of Transportation Problem, Initial Feasible Solution Methods, Optimality Test, Degeneracy in TP; Assignment Problem, Hungarian Method, Travelling Salesman Problem

Game Theory and Sequencing : Two Person Zero Sum Game, Pure and Mixed Strategies, Algebraic Solution Procedure, Graphical Solution, Solving by Linear Programming; Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem

Inventory and Queuing Models: Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model, Newsboy Problem. Elements of Queuing Model, Pure Birth Death Model, Single Server and Multi-server Markovian Models with Infinite and Finite Capacity, Machine Repair Model, Networks of Queues.

Recommended Books:
Main Reading:

1. Hamdy A Taha, Operations Research-an introduction, Jain Books, 8th edition.
2. Kanti Swarup, P.K.Gupta & Man Mohan Operations Research , 17th edition, latest reprint 2014,Jain Books.

Supplementary Reading:

1. J. K. Sharma,-Operations Research Theory and Applications-Theory and applications, Jain Books.

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Advanced Block Chain Technology

TIU-PCA-T217

L-T-P: 3-1-0 **Credit: 4**

Introduction to Blockchain

Basic idea, Public Ledgers, Blockchain as public ledgers, Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, The Chain and the Longest Chain, Cryptocurrency to Blockchain 2.0, Permissioned Model of Blockchain.

Basic Crypto Primitives

Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Bitcoin Basics

Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

Distributed Consensus

Importance, Distributed consensus in open environments, Consensus in a Bitcoin network, Consensus in Bitcoin- Bitcoin Consensus, Proof of Work (PoW), Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Permissioned Blockchain

Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Consensus models for permissioned blockchain, Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems, Practical Byzantine Fault Tolerance, Three phase commit, View Change.

Blockchain for Enterprise

Concepts and benefits of blockchain for enterprise, The Hyperledger Project.

Blockchain Components and Concepts

Actors in a Blockchain, Components in Blockchain design, Ledger in Blockchain.

Course Outcomes

Upon completion of this course, students will be able to:

1. Basic knowledge of Distributed Ledger Technologies and how they work.
2. Basic knowledge of Bitcoin, Ethereum and Hyperledger fabric.

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Understandings of current trends of Blockchain, and ability to imagine its use cases and future.

Database Management System
TIU-PCA-T205

L-T-P: 3-1-0 **Credit: 4**

Module 1:
INTRODUCTION:
General introduction to database systems, Concept of file System and Disadvantages, Database-DBMS distinction, Role of DBA, Approaches to building a database, Data models, Database management system, Three-schema architecture of a database, Data Independency, Integrity constraints.

Module 2:
Relational Data Model:
Concept of relations, Schema-instance distinction, Keys, Referential integrity and foreign keys.

1) Relational algebra operators:
Selection, Projection, Union, Intersection, Set difference, Cross product, Rename, Assignment, Various types of joins, Division, Example queries.

2) **Tuple relational calculus**

3) Domain relational calculus

Module 3:
SQL:

Introduction, Data definition in SQL, Table, key and foreign key definitions, Update behaviours, Querying in SQL, Basic select- from- where block and its semantics, Nested queries - correlated and uncorrelated, Notion of aggregation, Aggregation functions group by and having clauses, Embedded SQL

Module 4: Database design concepts-1

Dependencies and Normal forms:
Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory – functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers, Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them, Algorithms for 3NF and BCNF normalization, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF, DKNF.

Module 5:
ER Model: Database design concepts-2
Conceptual data modelling - motivation, Entities, Entity types,

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Various types of attributes, Relationships, Relationship types, E/R diagram notation,
High-level conceptual modelling, ER Modelling concepts, ER Diagrams, Cardinality constraints

Enhanced ER Model:

Higher-order relationships, Enhanced ER Model (EER), Weak-entity types,
Subclasses and inheritance, Specialization and Generalization,
Modelling of UNION types using categories.

Module 6:

Data Storage and Indexes:

File organizations, Primary, Secondary index structures, Various index structures - hash-based, Dynamic hashing techniques, Multi-level indexes, B+ trees.

Module 7:

Transaction Processing and Concurrency Control:

Transaction Fundamentals : OLTP environments, Concurrency issues, need for transactions, Necessary properties of transactions (ACID properties), Transaction states, serializability, Serial schedules, Conflict serializability, View serializability, Recoverable and non-recoverable schedules, Cascading rollbacks, Cascadeless schedules.

Concurrency control : Serialized and non-serialized schedules, Testing for serializability, Locking, Lock compatibility matrix, Locking and serializability, Deadlocks and starvation, Two- phase locking (2PL) protocol, Conservative, strict and rigorous 2PL, 2PL with lock conversions, Timestamp-ordering based protocol, Multi-versioning protocol, Multi-granularity locking, Deadlock prevention protocols, Wait-die and wound-wait schemes, Time-out based schemes, Deadlock recovery, Nested transactions

Module 8:

Database recovery techniques:

Recovery concepts, Deferred updates technique, Immediate update technique, Shadow paging.

Module 9:

Query Processing and Optimization:

Translating SQL into relational algebra, Basic query operations, Heuristics in query optimization, Selectivity and cost estimates in query optimization, Semantic query optimization.

Module 10:

Speciality Databases: Parallel databases, Object-based Databases, XML.

Recommended Books:

Main Reading:

1. Elmasri, Navathe. Fundamentals of Database Systems (Third Edition), Pearson Education, 2004.

2. Database System Concepts, Fifth Edition, AviSilberschatz, Henry F. Korth, S. Sudarshan

Supplementary Reading:

1. Introduction to Database Systems by CJ Date

2. Data base Systems design, Implementation, and Management by Rob & Coronel, Thomson, 5th Edition

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3. P. Bhattacharyya and A.K. Majumder, Data base management system, TMH

OOP using Python
TIU-PCA-T209

L-T-P: 2-1-0 **Credit: 3**

Detailed Syllabus:

Introduction to Python , The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, Functions, Scoping and Abstraction Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters, Structured Types, Mutability and Higher-Order Functions Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects, Testing, Debugging, Exceptions and Assertions, Types of testing – Black-box and Glass-box, Debugging, Handling Exceptions, Assertions, Classes and Object-Oriented Programming Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Simple Algorithms and Data structures Search Algorithms, Sorting Algorithms, Hash Tables, Regular Expressions – REs and Python, Plotting using PyLab, Networking and Multithreaded Programming – Sockets, Threads and Processes, Chat Application , Security – Encryption and Decryption , Classical Cyphers• Graphics and GUI Programming – Drawing using Turtle, Tkinter• and Python, Other GUIs.

Books for Main Reading:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

2. R. Nageswara Rao, “Core Python Programming”, dreamtech

3. Wesley J. Chun. “Core Python Programming - Second Edition”, Prentice Hall

4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Pyhon”, Wiley.

Books for Supplementary Reading:

1. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication

2. Luke Sneeringer, “Professional Python”, Wrox

3. “Hacking Secret Ciphers with Python”, Al Sweigart, URLhttps://inventwithpython.com/hacking/chapters

Principles of Management
TIU-PMG-T201

L-T-P: 2-0-0 **Credit: 2**

Course Objectives

The purpose of this course is to provide students with a broad and integrative introduction to the theories and practice of management. In particular, this course focuses on the major areas of the management process: planning,

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organizing, leadership and control from an organizational viewpoint. The course also attempts to enable students to understand the role, challenges, and opportunities of management in contributing to the successful operations and performance of organizations.

Detailed Syllabus:

Introduction to Management:

Definition; Characteristics of management; Principles of management; Process and functions of management; Managerial hierarchy and levels; Managerial Skills and roles; Emerging issues and challenges for management.

Management Theories:

The classical, behavioural, management science, systems, contingency, and contemporary perspectives on management.

The Environmental Context of Management:

Concept; Organization-environment interface; Types and components of organizational environment; Emerging business environment in Nepal.

Organizational Goal Setting and Planning:

Organizational goals – purpose and functions; The planning function – planning system, methods, types, and steps in the planning process; Concept of strategic planning – situational analysis; Tools to aid strategic planning.

Managerial Decision Making:

Concept; The decision making process; Types and conditions of decision making; Group decision making; Techniques to aid decision making.

Organizational Structure and Design:

Principles, process, and approaches to organizing; Organizational design – major types; Departmentation; Authority, power and responsibility; Delegation and decentralization of authority; Informal organization; Emerging concepts in organizing and design.

Staffing:

Concept, objectives, importance and components of staffing; Human resource management system.

Leadership:

Concept and functions; Leadership versus management; Qualities of good leadership; Leadership traits and styles; Approaches to leadership.

Managing Work Teams:

Concept, importance, types, and formation of work groups; Team management – concept, types and strategy for effective team management; Organizational conflicts – concept, types, and sources; Conflict management strategies and techniques.

Employee Motivation:

Concept and types; Theories of Maslow and Herzberg; Techniques of employee motivation.

Interpersonal and Organizational Communications:

Concept and purpose; Communication network and process; Communication flows; Types of communication; Barriers to effective communication; Enhancing organizational communication.

Control System:

Concept, types and process; Features of effective control; Managing information for effective control; Techniques of control.

Quality Management:

Concept and principles; Quality control – concept and methods; Total Quality Management – concept and techniques; Factors affecting control; Deming management; Emerging quality management issues and challenges.

Organizational Change:

Concept; Forces for change – internal and external; Need for planned change; Process of planned change; Resistance to change; Causes of resistance; Overcoming resistance to change; Implementing and monitoring the change process.

Organizational Development:

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Concept, objectives, key benefits, OD activities and process.

Basic Texts

1. Robbins, S. P., & DeCenzo, A. D. Fundamentals of Management. New Delhi: Pearson Education.
2. Pant, P. R. Principles of Management. Kathmandu: Buddha Academic Enterprises.

References

1. Griffin, R. W. Management. New Delhi: AITBS Publishers and Distributors.
2. Bateman, T.S. & Snell, S.A. Management: Competing in the New Era. New Delhi: Tata McGraw Hill.
3. Weihrich, H., Cannice, M. V. & Koontz, H. Management: A *Global Perspective.* New Delhi: Tata McGraw Hill.

Computer Based Operations Research Lab
TIU-PCA-L201

L-T-P: 0-0-2 **Credit: 2**

Implementation of Simplex method, Travelling Salesman problem, Sequencing problem, EOQ elimination and simulation of queuing model.

DBMS Lab
TIU-PCA-L205

L-T-P: 0-0-3 **Credit: 2**

Study of commercial DBMS package (Oracle-latest version).

Developing database application with Oracle, creation of a database, writing SQL queries and retrieving data.

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Python Lab
TIU-PCA-L209

L-T-P: 0-0-3 **Credit: 2**

DAA Lab
TIU-PCA-L213

L-T-P: 0-0-3 **Credit:2**

Lab :1 : Divide and Conquer : > Implement Binary Search using Divide and Conquer approach.

Lab :2 : Divide and Conquer : > Implement Sorting techniques using Divide and Conquer approach > Find Maximum and Minimum element from a array of integer using Divide and Conquer approach.

Lab :3 : Greedy method(implement any one of the following problem) : >Job sequencing with deadlines.

Lab :4 : Greedy method (implement any one of the following problem) : >Minimum Cost Spanning Tree by Prim's Algorithm >Minimum Cost Spanning Tree by Kruskal's Algorithm.

Lab :5 : Dynamic Programming : > Find the minimum number of scalar multiplication needed for chain of matrix.

Lab :6 : Dynamic Programming : >Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) >Implement Traveling Salesman Problem.

Lab :7 : Dynamic Programming : >Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm).

Lab :8 : Backtracking (implement any one of the following problem): >Graph Coloring Problem >Hamiltonian Problem.

Lab :9 : Backtracking: > 8-queens problem.

Lab :10: Brunch and Bound : > Implement 15 Puzzle Problem.

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