



TECHNO INDIA UNIVERSITY
WEST BENGAL

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

4-Years B.Tech. Curriculum and
Syllabus for Computer Science and Engineering (CSE)

Fifth Semester

S. No	Course Code	Course Title	Contact Hrs. / Week			Credit
			L	T	P	
THEORY						
1	TIU-UTR-T301	Career Advancement & Skill Development	2	1	0	3
2	TIU-UCS-T301	Database Management System	3	0	0	3
3	TIU-UCS-T303	Operating System	3	0	0	3
4	TIU-UCS-T305	Computer Graphics and Multimedia System	3	0	0	3
5	TIU-UCS-T307	Object Oriented Programming and Design -II	3	0	0	3
6	TIU-UCS-T309	Compiler Design	3	0	0	3
PRACTICAL						
1	TIU-UCS-L301	Database Management System Lab	0	0	3	2
2	TIU-UCS-L303	Operating System Lab	0	0	3	2
3	TIU-UCS-L305	Computer Graphics and Multimedia System Lab	0	0	3	2
4	TIU-UCS-L309	Object Oriented Programming and Design -II Lab	0	0	3	2
SESSIONAL						
1	TIU-UES-S399	Entrepreneurship Skill Development	0	0	3	2
TOTAL CREDIT						28

Approved By:
External Expert

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Registrar

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Syllabus

Career Advancement & Skill Development

TIU-UTR-T301

L-T-P: 2-1-0

Credit: 3

DATABASE MANAGEMENT SYSTEMS

TIU-UCS-T301

L-T-P: 2-1-0

Credits: 3

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 behaviors, 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

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Conceptual data modelling - motivation, Entities, Entity types, 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, Modeling 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.

Recommended Books:

Main Reading:

1. Ramez Elmasri and Shamkant Navathe, Fundamentals of Database Systems, Publisher - Pearson Education, 5th Edition.
2. Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Tata McGraw - Hill Education.

Supplementary Reading:

1. Peter Rof, Carlos Coronel, Database Systems: Design, Implementation and management, Publisher - Cengage Learning.
2. J.D. Ullaman, Principles of Database Systems, Galgotia Publications.

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OPERATING SYSTEMS

TIU-UCS-T303

L-T-P: 2-1-0

Credits: 3

1. Introduction: Operating Systems, Multi programmed Batched systems, Time sharing systems, Parallel and Distributed Systems, Real Time Systems, Computer System Structures: I/O structure, Storage Structure, Storage Hierarchy, Hardware, Protection, and General System Architecture. Operating System Structures: System components, Operating System Service, System Calls, System programs, System Structure, System Design and Implementation, System Generation, Virtual Machines.

2. Process Management:

Processes: Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Inter-process Communication.

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real Time Scheduling, Algorithm Evaluation.

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling.

3. Storage Management:

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, paging, Segmentation, Segmentation with paging.

Virtual Memory: Demand Paging, Performance of Demand Paging, Page Replacement Algorithms, Thrashing, Demand Segmentation.

File System Interface: Access Methods, Directory Structure, Protection, Consistency Semantics.

File System Implementation: File System Structure, Allocation Methods, Free Space Management, Directory Implementation, Efficiency and Performance, Recovery.

4. I/O Systems:

I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations, Performance.

Secondary-Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability, Stable Storage Implementation.

Tertiary-Storage Structure: Tertiary-Storage Devices, Operating-System Jobs, Performance Issues.

5. Distributed Systems:

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Network Structures: Topology, Network Types, Communication, Design Strategies.

Distributed System Structures: Network Operating Systems, Distributed Operating Systems, Remote Services, Robustness, and Design Issues.

Distributed File Systems: Naming and Transparency, Remote File Access, State-ful versus Stateless Service, File Replication.

Distributed Coordination: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement.

6. Protection & Security:

Protection: Goals of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights.

Security: The Security Problem, Authentication, One-Time Passwords, Program Threats, System Threats, Threat Monitoring, Encryption, Computer-Security Classifications.

7. Case Studies: Windows NT.

Recommended Books:

Main Reading:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India.
3. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, Tata McGraw-Hill.

Supplementary Reading:

1. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley.
3. Maurice Bach, Design of the Unix Operating Systems, Prentice-Hall of India.
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, O'Reilly and Associates.

COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS

TIU-UCS-T305

L-T-P: 3-0-0

Credit: 3

Introduction and Applications: History (From Simple picture to photo realism), What is CG, GUI, Application: Presentation graphics, Painting and drawing, Photo editing, scientific visualization, image processing, digital art, education and training, Entertainment, CAD in architecture, mechanical engineering, aeronautical and automobile industry, Simulation, animation, video games.

Graphic Devices: Display Devices, Random-scan and raster scan monitors, Color CRT, Plasma panel displays, LCD Panels, Plotters, Film recorders, Graphics workstations, Display processors, Graphics software, Input/output Devices, Touch panels, light pens, graphics tables.

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2D Drawing Geometry: Mathematics for computer graphics, A brief concept of Trigonometry, Polar coordinated Parametric Functions, Vectors (Scalar product, cross product), Matrices (scalar multiplication, Matrix addition and multiplication, matrix inverse).

2D transformation Use of homogeneous coordinate systems, Translation, scaling, rotation, Mirror reflection, Rotation about an arbitrary point, Zooming and panning, Rubber band methods, dragging, Parametric representation of a line segment.

Lines, Curves and Conic Section: Line drawing algorithms, Bresenham's circle drawing algorithm, Generation of ellipses through transformation on circles, Curve drawing, Parametric representation, need for cubic curves, Drawing cubic Bezier and B-spline curves (No derivations needed), Condition for smoothly joining curve segments.

Graphic Operations: Window port and viewport Elimination of totally visible and totally invisible lines with respect to a rectangular window using line end point codes, Explicit line clipping algorithm, Sutherland Cohen algorithm, Midpoint sub-division algorithm. Filling Stack based and queue based seed fill algorithms, Scan Line seed fill algorithm, Generation of bar charts, pie charts, Character generation.

3D Graphics:

1- Transformation Right handed coordinate system with vertical y-axis, Transformation matrices for translation, scaling, and rotation around axes.

2- Parallel Projection Multi views - front, top and side views, Oblique view - Projection on xy plane with rays along a given direction.

3- Perspective Projection Transformation matrix to yield one vanishing point perspective view with viewpoint lying on Z axis, Effect of translating the object, Computing the vanishing point, Numerical examples.

4- Hidden surface removal Back face removal, Floating horizon technique.

Animation:

Basics of Animation, Tweaking and Morphing.

Multimedia:

1. Concepts of hypertext/hypermedia

2. Multimedia applications Education, video conferencing, training, Entertainment, and electronic encyclopedias.

3. Music and Sound Audio Basic Concepts, Analog Vs Digital, Digital Audio Basic Concepts.

4. MIDI Hardware, MIDI Messages, MIDI File.

5. Video Basic Concepts, Analogue Video and Digital Video.



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6. Images and Graphics Basic Concepts, Image Formats, Graphics Format, File Format, Image Quality and Graphic Systems, Compression, Image Compression, Compression Requirements, Standards (JPEG, MPEG and H.261).
7. Multimedia Hardware CD ROM, Audio speaker, Sound Card, Video Cameras, Scanners, Multimedia Platforms.
8. Currently available multimedia software

Recommended Books:

Main Reading:

1. D Heam and P M Baker, Computer Graphics, Prentice Hall of India (Second Edition), 1995.
2. Woo, Neider, Davis, Shreiner, OpenGL Programming Guide, Third Edition, 2000, Pearson Education Asia.
3. T. Vaughan, Multimedia, making it working, Fifth edition, 2001, McGraw Hill.
4. D. P. Mukherjee, Computer Graphics and Multimedia, PHI

Supplementary Reading:

1. J D Foley & A Van Dam, Fundamentals of interactive Computer Graphics, Addison Wesley (Second Edition).
2. S Harrington, Computer Graphics - A Programming, McGraw Hill Approach International Ed.
3. Rajneesh Agrawal and Bharat BhushanTiwari, Multimedia Systems, Excel Publications.
4. ShaliniGovil-Pai, Principles of Computer Graphics-Theory and Practice Using OpenGL and Maya, Springer International Edition.

OBJECT ORIENTED PROGRAMMING AND DESIGN - II

TIU-UCS-T307

L-T-P: 3-0-0

Credit: 3

Unit I

Introduction to Java Programming Language, Data Types and Operations, Structured Programming, Selection Statements, Loops, Methods, Method Abstraction and Stepwise Refinement, Arrays, Object-Oriented Programming: Classes and Objects, Constructors, Implementing & Designing Classes, Use of Keywords: static, final, this, Class Abstraction and Encapsulation, Strings and Text I/O, Inheritance and Polymorphism, use of super keyword, Overriding vs. Overloading, Object: The Cosmic Super class, Abstract Classes and Interfaces, Packages, Object-Oriented Design and Patterns.

Unit II

GUI Programming: GUI Basics, Graphics, Event-Driven Programming, Creating User Interfaces, Applets and Multimedia, Exception Handling, Binary I/O, Files & Streams, Recursion, Dynamic

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Binding, Generics & Generic Programming, Java Collections Framework, Algorithm Efficiency, Searching & Sorting.

Unit III

Multithreading, Networking, JDBC, Internationalization, Advanced GUI Programming: MVC, JavaBeans and Bean Events, Containers, Layout Managers, and Borders, Menus, Toolbars, Dialogs and Swing Models, JTable and JTree, **Java Fx**

UNIT IV

Advanced Topics: Distributed Objects: Fundamentals of distributed systems, Middleware, Common Object Request Broker, Architecture (CORBA), Enterprise Java Beans (EJB) Architecture, .NET Common Language Runtime.

Recommended Books:

Main Reading:

1. Y. Daniel Liang, "Introduction to Java Programming: Comprehensive Version", 7th Edition, 2009, Pearson Education Inc., New Delhi.
2. Herbert Schildt, "Java The Complete Reference", 8th Edition, 2011, McGraw Hill Education (India) Private Limited.
3. Kathy Sierra, Bert Bates, Head First Java, SPD Publications.

Supplementary Reading:

1. Richard A. Johnson, "An Introduction to Java Programming and Object Oriented Application Development", First Edition, 2007, CENGAGE Learning India Pvt. Ltd., New Delhi.
2. E. Balagurusamy, "Programming with Java: A Primer" 3. Cay S. Horstmann, "Big Java", 3rd Edition, Wiley India Pvt. Ltd., New Delhi.

COMPILER DESIGN

TIU-UCS-T309

L-T-P: 3-0-0

Credit: 3

Compiler structure: Analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.

Lexical analysis: Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, error reporting, and implementation. Regular definition, Transition diagrams, LEX.

Syntax analysis: Context free grammars, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, Bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.

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Syntax directed definitions: Inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

Type checking: Type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: Storage organization, activation tree, activation record, parameter passing Symbol table, dynamic storage allocation.

Intermediate code generation: Intermediate representations, translation of declarations, assignments Intermediate Code generation for control flow, Boolean expressions and procedure calls, implementation issues.

Code generation and instruction selection: Issues, basic blocks and flow graphs, register allocation, code generation DAG representation of programs, code generation from DAGs, peep hole optimization, code generator generators, specifications of machine.

Code optimization: Source of optimizations, and optimization of basic blocks, loops, global dataflow analysis, and solution to iterative dataflow equations. Code improving transformations, dealing with aliases, data flow analysis of structured flow graphs.

Recommended Books

Main Reading:

1. Aho, Ullman, Sethi and Lam, Principles of Compiler Design, Pearson Education
2. Holub, Compiler Design in C, PHI

Supplementary Reading:

1. Andrew L. Appel, Modern Compiler Implementation in C, Foundation Books, Delhi
2. Dick Gruneet. Al., Modern Compiler Design, Wiley Dreamtech
3. S. Chattopadhyay, Compiler Design, PHI
4. S. Pal: Systems Programming, Oxford University Press

DATABASE MANAGEMENT SYSTEMS LAB

TIU-UCS-L301

L-T-P: 0-0-3

Credits: 2

1. Study of commercial DBMS package (Oracle-latest version).
2. Developing database applications with Oracle, creation of a database, writing SQL queries and retrieving data.

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OPERATING SYSTEMS LAB
TIU-UCS-L303

L-T-P: 0-0-3

Credit: 2

Shell Programming: Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).

Process: Starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

Signal: Signal handling, sending signals, signal interface, signal sets.

Semaphore: Programming with semaphores (use functions semctl, semget, semop, set semvalue, del_semvalue, semaphore_p, semaphore_v).

POSIX Threads: Programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

Inter-process communication: Pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Recommended Books:

Main Reading:

1. Sumitabha Das, Unix and Shell Programming, TMH
2. B.M. Harwani, Unix and Shell Programming, Oxford Higher Education

Supplementary Reading:

1. Y. Kanetkar, UNIX Shell Programming, BPB Publications
2. A. Rama Sathish, Unix Programming, Scitech Publications



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COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS LAB

TIU-UCS-L305

L-T-P: 0-0-3

Credit: 2

Assignments given by the concerned faculty are to be solved.

OBJECT ORIENTED PROGRAMMING AND DESIGN – II LAB

TIU-UCS-L309

L-T-P: 0-0-3

Credit: 2

1. Assignments on class, constructor, overloading, inheritance, overriding.
2. Assignments on wrapper class, vectors, arrays.
3. Assignments on developing interfaces- multiple inheritances, extending interfaces.
4. Assignments on creating and accessing packages.
5. Assignments on multithreaded programming, handling errors and exceptions, applet programming and graphics programming.
6. Use of CASE tools.

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