# Fourth Semester:

Course Title: **Operating Systems**
Course Code: COM44l
Semester: IV
Credit: **3**
Class Load: 6Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

To introduce the fundamentals of computer operating systems – What the Operating Systems are, what they do, and how they are designed and constructed. Undergoing this course will help a student to use Object Oriented Programming tools in general and JAVA in specific, for the implementation of various application and system related issues.

**Course Contents:**

1. **Operating Systems Structure** **(5 hrs)**
   **Introduction:** Batch Systems, Time-Sharing Systems, Personal-Computer Systems, Parallel Systems, Real-Time Systems, Distributed Systems. Operating-System Structures: System Components, OS Services, System Calls, System Programs and System Structure. Java, System Design and Implementation, System Generation.

1. **Process Management** **(**15 **hrs)**
   **Processes:** Concept and Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication. Threads: Overview, Benefits of threads, User and Kernel Threads, Multithreading Models. Threads in Java.

   **Processor Scheduling:** Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Java Thread Scheduling, Algorithm Evaluation.

   **Process Synchronization**: Background, Critical-Section Problem, Two-Tasks Solutions, Synchronization Hardware, Semaphores, Classical Synchronization, Java Synchronization, OS Synchronization.

   **Deadlocks:** Model of Deadlocks, Deadlock Characterization, Deadlock Handling Methods: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

2. **Memory Management** **(**15 **hrs)**
   **Memory Management**: Concept, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging.

**Virtual Memory:** Concept, Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

**File Systems:** Concept, File Access Methods, Directory Structure, Protection, File-System Structure, Methods of Allocation, Free-Space Management, Directory Implementation, Efficiency and Performance of File Systems, Recovery.

**4. I/O Management (10 hrs)**

**I/O Sub-Systems**: Concept, Application I/O Interface, Kernel I/O Subsystem, I/O Requests Handling, Performance. Mass-Storage Device: Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Stable-Storage Implementation, Tertiary-Storage Structure.

**Laboratory Works:**

Student simulates at least 10 algorithms which cover IPC, process scheduling, Page Replacement, Free Space management, File System, I/O handling, and deadlock.

**Text Book:**

- *Modern Operating Systems:* Andrew S. Tanenbaum, PHI Publication, Third edition, 2008

**References**:


- Silberschatz, A., Galvin, P.B., Gagne, G., *Applied Operating Systems Concepts*, John Wiley & Sons, 2009.
- Silberschatz, A., Galvin, P.B., *Operating Systems Concepts*, John Wiley & Sons.

Course Title: **Database Management System**
Course Code: COM442
Semester: IV
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

1. To provide a theoretical foundation to the fundamentals of database design and database system development.
2. To provide sufficient practical exposure to designing and using database
3. To provide students with experience in the analysis, design and generation of a simple inquiry and update system, using standard RDBMS
4. To give students an understanding of the problem in its context, the need for adequate documentation of the system and management of this data to ensure that the information produced is relevant, accurate and maintainable. Students will use conceptual data analysis methods to produce a logical data model.

**Course Contents:**

1. **Introduction to Database System Architecture (5hrs)**
   Introduction to Database System, Data Independence, Three Levels of Architecture: External, Conceptual and Internal, Mappings. Database Administration, DBMS, Data Communication, Manager, Client-Server Architecture, Distributed Processing, E-R Model. Data Dictionary

2. **Relational Algebra and Relational Calculus (8 hrs)**
   Relational Calculus: Introduction, Operators, Syntax, Semantics, Examples. Additional Operators. Grouping and Ungrouping, Relational Comparisons, Relational Algebra: Introduction, Tuple Calculus, Relational Calculus vs. Relational Algebra, Computational Efficiency, Domain Calculus.

3. **Introduction to Relational Database, SQL and Relational Model Basics (8 hrs)**Relational Database: Introduction. Relational Model and Relations, Optimization. The Catalog, Views. Transactions. SQL: Overview, The Catalog, Views. Transactions. Embedded SQL. Relational Model Basics: Introduction, Domains. Relation Value. Relation Variables. SQL Features.

4. **Data Integrity and Views (7 hrs)**
   Data Integrity: Introduction. Type constraints, Attribute Constraints,Relvar Constraints, Database Constraints, State vs. Transition Constraints, Views: Introduction, Retrieval and Updates of Views, Snapshots.

5. **Database Design (7 hrs)**
   Functional Dependencies: Introduction, Trivial and Non-trivial Dependencies, Closure of a Set of Dependencies, Closure of a Set of Attributes, Data Normalization: Introduction.

Non-Loss Decomposition and Functional Dependencies. MVD, JD,INF. 2NF and 3NF. BCNF. 4NF, 5NF and PJNF.

**6. Recovery and Concurrency (6 hrs)**

Transaction Recovery: Introduction, Transaction, Transaction Recovery,System Recovery, Media Recovery, Two-Phase Commit Protocol, Transaction Concurrency: Introduction, Locking Deadlock. Serializability, Isolation Levels, Intent Locking

**7. Security (3 hrs)**

Introduction, Discretionary Access Control, Mandatory Discretionary Access Control, Statistical Database, Data Encryption.

**Assignments/Project Works**

The course will be supplemented by assignments/project work. The assignments can involve the design of a schema for a realistic application, and the implementation and coding of the entire application using SQL (and other development tools such as graphical user interfaces or forms packages) on a relational database system.

**Text Book:**

- A. Silberschatz, H.F. Korth, and S. Sudarshan, *Database System Concepts*, 4th Edition, McGraw Hill (ISBN: 0-07-120413)

**References:**

- Date, C.J., *AnIntroduction to Database*, 7th Edition, Addison Wesley, 2000.
- Elmasri, R. and Navathe, Shamkant B., Fundamentals of Database Systems, Third Edition 2000 Addison Wesley, 2000.

**Course Title: Technical Writing**
Course Code: ENG443
Semester: IV
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: 3 **Hrs**)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**
The main objectives of this course are:

1. To develop the ability to deliver technical knowledge orally in English.
2. To be able to comprehend and take notes after listening.
3. To fasten reading skills in technical and non-technical reading materials.
4. To develop summarizing skills in writings.
5. To write reports, letters, description on technical talks, seminar papers, memoranda, application and tender notices.

**Course Contents:**

**1. Review of Written English (5 hrs)**
Sentence structure (identification of sentence or its types and transformation of sentences).

**2. Oral Communication and Note Taking (12 hrs)**
Types of English (Variety levels of English), Technical talk (Environmental Pollution, Construction, Water resources, Impact of computer in modern society, Impact of satellite communication, urban development).

**3. Technical Writing Skills (13hrs)**
Preparation of short memoranda (Importance-formats), Business letters (Importance-purposes), Preparation of application (Job application-biodata), Description writing (Process, Mechanism, Place etc.), Seminar papers (Conduction of seminar, Preparation of circular, Presenting seminar paper), Preparation of proposals (Importance-types-formats), Preparation of reports (Importance-types-formats)

**4. Reading Skills (15 hrs)**
Comprehension questions and exercises (fro prescribed passages-Freedom, Kinship and the family, Marconi and the invention of Radio, R foundation, The turbo-prop engine, The use and misuse of Science and grief), Outlining or note making from any passages, Precise writing from any passages. Knowledge and Wisdom, Beauty and Custom

**Laboratory Works:**

1. To familiarize the students with the audio-visual equipment. (Overhead projector, slide projector, Dictaphone).
2. To watch the visual cassettes and to get familiarized with the language (follow me – I).
3. To watch the visual cassettes and to get familiarized with the language (follow me – II)
4. Some general rules of pronunciation.
5. Word accent in English.
6. Attributes of good English.
7. To present a seminar paper.
8. To participate in a group discussion.
9. To conduct a meeting.
10. To prepare and practice to face an interview.

**Text Book:**

- Andrea J. Rutherford. *Basic Communication Skills for Technology*. 2nd Edition. Addision Wesley. Pearson Education Asia (LPE) ISBN: 8178082810.
- Anne Eisenberg, *Effective Technical Communication*, Mc-Graw Hill 1982.

**References:**


- Houp and T.E. Pearsall, *Reporting Technical Information*, Allyn and Bacon, Boston.
- V.R. Narayanaswami, *Strengthen your writing*, Orient Longman, Madras.
- ChampaTickoo& Jaya Sasikumar, *Writing with a Purpose*, Oxford University Press, Bombay.
- A handbook of pronunciation of English words (with 90-minute audio cassettes) Communication Skills in English.

**Course Title:** **Computer Graphics**
Course Code: COM4**4**4
Semester: IV
Credit: **3**
Class Load: 6Hrs per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60)+ Internal (20+20)

**Course Objectives:**
To be familiar with the basic techniques used in computer graphics systems.

**Course Contents:**

**1 Introduction (3 hrs)**
History of computer graphics, Applications of computer graphics.

**2 Hardware Concepts (8 hrs)**
Keyboard, mouse, Light pen, Touch screen and tablet input hardware, Raster and vector display architecture, Architecture of simple non-graphical display terminals, Architecture of graphical display terminals including frame buffer and color manipulation techniques, Advanced raster graphic architecture.

**3 Two-Dimensional Algorithms (12 hrs)**
Direct and incremental line drawing algorithms, Bresenham algorithms, Two-dimensional object to screen viewing transforms, Two-dimensional rotation, Scaling and translation transforms, Recent transform concepts and advantages, Data structure concepts and CAP packages.

**4 Graphical Languages (6 hrs)**
Need for machine independent graphical languages, Discussion of available languages and file formats, Detailed discussion of graphical languages to be used in projects.

**5 Three-Dimensional Graphics (12 hrs)**
Three- dimensional object to screen perspective viewing transforms, Extension of two-dimensional transforms to three dimensions, Methods of generating non-planar surfaces, Hidden line and hidden surface removal techniques, Need for shading in data visualization, Algorithms to simulate ambient, diffuse and specular reflections, Constant, Gouraud and Phong shading models, Specialized and future three dimensional display architectures.

**6 Project Development (4 hrs)**
Project planning and description, Project development, Project report and presentation.

**LaboratoryWorks:**
Develop a graphical project. The topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

**Text Book:**


- Hearn and Baker, *Computer Graphics*, Prentice- Hall of India Private Limited.

- Foley, J. D., A. V. Dam, S. K. Feiner, J. F. Hughes, *Computer Graphics Principle and Practices*, Addison Wesley Longman, Singapore Pvt. Ltd., 1999.

Course Title: **Theory of Computation**
Course Code: COM445
Semester: IV
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Tutorial: 3 Hr**)
Evaluation: External (60)+ Internal (20+20)

**Course Objectives:**

To provide the knowledge of automate, context free language, and complexity theory.

**Course Contents:**

**1 Finite Automata and Regular Expression (5 hrs)**
Finite state system, Non-deterministic finite automata, Regular expressions.

**2 Properties of Regular Sets (4 hrs)**
The pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for regular sets.

**3 Context-free Grammars (8 hrs)**
Derivative trees, Simplification of context- fee grammars, Normal forms.

**4 Push down Automata (4 hrs)**
Pushdown automata and context-free grammars.

**5 Properties of Context-free Languages (CFL) (6 hrs)**
The pumping lemma for CFL's Closure properties of CFL's, Decision algorithms for CFL's.

**6 Turing Machines (5 hrs)**
Computable languages and functions, Chruch's hypothesis.

**7 Undecidability (5 hrs)**
Properties of recursive and recursively languages, Universal Turing machines and undecidable problem, Recursive function theory

**8 Computational Complexity Theory (4 hrs)**
Computational problems, Complexity classes, Big O notation

**9 Intractable Problems (4 hrs)**
Computable languages and functions, NP-complete problems.

**Laboratory Works:**

All algorithms covered in the text to be implemented in PHIGS/OpenGL in C/C++.

**Text Book:**

- John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation,* 3rdEdition, Pearson - Addison-Wesley.

**References:**

- Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, Prentice Hall.
- EfimKinber, Carl Smith, Theory of Computing: A Gentle introduction, Prentice- Hall.