

B. Tech. II (ECE), Semester – IV	L	T	P	C
CS 401: OPERATING SYSTEMS	3	0	2	4

INTRODUCTION	(04 Hours)
Operating Systems (OS) Objectives, Formal Definition, Evolution, Types, DMA & Multiprogramming, OS Interfaces,- The Command-less command interpreter systems , Device drivers – Examples.	
PROCESSES, THREADS, SCHEDULING	(06 Hours)
Process Management: The process concept - Programs, Processes & Threads – Process Control Block – PCB as a data structure in contemporary operating systems - Process Hierarchy - System Calls - CPU Scheduling & algorithms metrics – Examples, Uniprocessor-Multiprocessor and Real-Time Scheduling, Case Study: Unix and its related System Calls.	
INTERPROCESS SYNCHRONIZATION & COMMUNICATION	(10 Hours)
Concurrent Processes - The Critical Section & Mutual Exclusion problem - Algorithms - Semaphores, Critical Region, Conditional Critical Region, Monitors, Messages - Examples in Contemporary OS - Classical Process Co-ordination Problems. Deadlocks: Characterization - Prevention - Avoidance - Detection-Recovery-CombinedApproachtoDeadlockhandling&DeadlockHandlingincontemporary OS, Case Study: Unix and its related System Calls.	
MEMORY MANAGEMENT	(04 Hours)
Memory Hierarchy, Static and Dynamic Memory Allocation, Overview of Swapping, Multiple Partitions Contiguous and Non-Contiguous Memory Allocation, Concepts of Paging, Segmentation, Case Study: Unix and its related System Calls.	
VIRTUAL MEMORY	(06 Hours)
Virtual Memory Concepts - Demand paging - Performance - Fragmentation & Compaction. Page replacementandAllocationalgorithms–ResidentSetManagement-CleaningPolicy-MemoryProtection -SystemCalls–Linux/WindowsVirtualMemoryTechniques,CaseStudy:UnixanditsrelatedSystem Calls.	
DEVICE MANAGEMENT	(04 Hours)
Terminals & Capability Databases - Emulators - Virtual Terminals - Disk Devices - Device Independence - Free space management - Performance and Reliability - Storage hierarchy, Case Study: Unix and its related System Calls.	
FILE SYSTEMS AND PROTECTION MECHANISM	(04 Hours)
Levels - File Systems in Disk Partitions - File-naming & File Access - Allocation strategies - Directory systems & their implementations - File Systems to device drivers - File Systems Reliability – Examples of fsck() and fsdb() utilities - File protection - Implementation issues, Case Study: Unix and its related System Calls.	

ADVANCED TOPICS	(04 Hours)
Practicals will be based on the coverage of the above topics separately.	(28 Hours)
(Total Contact Hours: 42 + 28 = 70)	

BOOKS RECOMMENDED
<ol style="list-style-type: none"> 1. Silberschatz, Galvin and Gagne, "Operating System Concepts", 8th Edition, John Wiley & Sons, 2014. 2. W. Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Pearson Pub., 2014. 3. A. Tanenbaum and A. Woodhull, "Operating Systems - Design and Implementation", 3rd Edition, PHI EEE,2006. 4. Crawley, "Operating Systems - An Design Oriented Approach", 1st Edition, McGraw Hill,1998. 5. Kernighan and Pike, "UNIX programming Environment", 2nd Edition, PHI-EEE,2001. 6. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3rd Edition, Addison Wesley Professional,2013.

B. Tech. II (ECE), Semester – IV	L	T	P	C
CS 402: COMPUTER NETWORKS	3	0	2	4

INTRODUCTION	(03 Hours)
Overview of network and data communication, Data Communications, Computer Networking, Protocols and Standards, types of Network, Network Topology, Protocol hierarchies, and design issues of layers, Interfaces and services. Reference Model: The OSI reference model, TCP/IP reference model, network standards and protocols.	
PHYSICAL LAYER	(06 Hours)
Data and transmission techniques, Multiplexing, Transmission media, Asynchronous Communication, Wireless transmission, ISDN, ATM, Cellular Radio, Switching techniques issues.	
DATALINK LAYER	(06 Hours)
Layer design issues, services provided to network layers, Framing, Error control and Flow control, Data link control and protocols – Simplex protocol, Sliding window protocol.	
MEDIUM ACCESS LAYER	(08 Hours)
Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD protocols, Collision free protocols, Limited contention protocols, LAN architectures, IEEE 802 and OSI, Ethernet(CSMA/CD), Bus, Token Ring, DQDB, FDDI, Bridges and recent developments.	
NETWORK LAYER	(08 Hours)

Network Layer design issue, Routing algorithms and protocols, Congestion Control Algorithms, Internetworking, Addressing, N/W Layer Protocols and recent developments.	
TRANSPORT LAYER	(05 Hours)
Transport services, Design issues, transport layer protocols, Congestion Control, QOS and its improvement.	
APPLICATION LAYER	(03 Hours)
Client Server Model , DNS, SMTP, FTP, HTTP, WWW and recent development	
Advanced Topics	(03 Hours)
Practicals will be based on the coverage of the above topics separately.	(28 Hours)
(Total Contact Hours: 42 + 28 = 70)	

BOOKS RECOMMENDED
<ol style="list-style-type: none"> 1. Tanenbaum : “Computer Network”,4th Edition, PHI,1996. 2. William Stalling: “Data and Computer Communication”, 8th Edition, Prentice Hall,2006. 3. Douglas E. Comer:” Internetworking with TCP/IP Volume – I”, 3rd Edition, PHI,1991. 4. W. Richard Stevens: “TCP/IP Illustrated Volume-I”, Addison Wesley,1994. 5. B. Forouzan :” Data Communication And Networking “, 5th Edition,TMH,1997.

B. Tech. II (CSE), Semester – IV	L	T	P	C
CS 403 : DATABASE MANAGEMENT SYSTEM	3	0	2	4

1.INTRODUCTION	(02 Hours)
2.RELATIONAL DATABASE DESIGN	(08 Hours)
Normalization – 1NF, 2NF, 3NF, BCNF, Higher Normal Forms, Denormalization.	
3. QUERY PROCESSING	(08 Hours)
Overview, General Strategies, Query Representation, Query Transformation, Catalog Information, Estimated Size of relations, Measures of Query cost, Selection, Sorting, Join & other operations, Query Evaluation & Choice of Evaluation Plans.	
4. TRANSACTIONS & CONCURRENCY CONTROL	(08 Hours)
ACID Properties, Serializability, Recoverability, The problems in Concurrency control, Semantics of Concurrent Transactions, Locking Scheme, Time - stamp based Protocols, Validation - based protocols, Deadlock handling, Recovery System - Failure Classification, Recovery & Atomicity, Buffer Management, Recovery with Concurrent Transactions, Failure with Loss of Nonvolatile Storage.	
5. OBJECT ORIENTED & OBJECT RELATIONAL DATABASES	(06 Hours)
New Applications, The limitation due to 1NF, The Object-oriented Data Model - Persistent Programming languages. Nested Relational Model - Querying with Complex types. Comparison of Object-oriented & Object-relational Databases.	
6. ADVANCED DATABASES AND APPLICATIONS	(10 Hours)
Distributed Database, Database design for Decision Support, Data Preparation, Data Warehouses and Data Marts, OLAP. Data mining :Introduction, Functionalities, Classification of data mining systems, major issues in data mining, Temporal Database, Logic Based Databases, Multimedia Databases, Spatial & Geographic	

Databases, Information Retrieval Systems, Web Warehousing, Parallel and Distributed DBMS.	
Practicals will be based on the coverage of the above topics separately.	(28 Hours)
Total: 42 Hours + 28 Hours = 70 Hours	

Recommended Books
<ol style="list-style-type: none"> 1. A. Silberschatz, H. F. Korth and S Sudarshan, "Database System Concepts", 6th Edition, TMH, 2010. 2. J. A. Hoffer, M. B. Prescott and F. R. McFadden, "Modern Database Management", 8th Edition, Pearson Prentice Hall, 2007. 3. C. J. Date, "An Introduction to Database Systems", Addison, Wesley, 8th Edition, 2003. 4. Raghu Ramakrishnan and Gehrke: "Database Management System", 3rd Edition, WCB/McGraw-Hill, 2003. 5. Margaret. H. Dunham, "Data Mining. Introductory and Advanced Topics", Pearson Education, 2003.

B. Tech. II (CSE), Semester – IV	L	T	P	C
CS 404 : OBJECT ORIENTED TECHNOLOGY	3	0	2	4

INTRODUCTION	(02 Hours)
Introduction to system analysis and design, Structured system analysis and design, Object oriented analysis and design, Object oriented methodologies, Iterative development and Unified Process	
STRUCTURAL MODELING	(06 Hours)
Object Oriented Fundamentals, Basic structural Modeling, UML Model, Class Diagrams, Object Diagrams, Packages and Interfaces, Case Studies.	
BEHAVIORAL AND ARCHITECTURAL MODELING	(12 Hours)
Use Case Diagrams, Interaction Diagrams, State Chart Diagrams, Collaborations, Design Patterns, Component Diagrams, Deployment Diagrams, Case Studies	
OBJECT ORIENTED TESTING METHODOLOGIES	(10 Hours)
Implications of Inheritance on Testing, State Based Testing, Adequacy and Coverage, Scenario Based Testing, Testing Workflow, Case Studies , Object Oriented Metrics	
COMPONENTS	(11 Hours)
Abuses of inheritance, danger of polymorphism, mix-in classes, rings of operations, class cohesion and support of states and behavior, components and objects, design of a component, lightweight and heavyweight components, advantages and disadvantages of using components.	
Practicals will be based on the coverage of the above topics separately.	(28 Hours)
(Total Contact Hours: 42 + 28 = 70)	

BOOKS RECOMMENDED

1. M. Page-Jones, "Fundamentals of Object Oriented Design in UML", Pearson Education, 2002
2. G. Booch, J. Rumbaugh and I. Jacobsons, "The Unified Modeling Language User Guide", Addison Wesley, 2002.
3. A. Bahrami, "Object Oriented System Development", McGraw Hill, 2003.
4. J. Baugh, I. Jacobson and G. Booch, "The Unified Modeling Language Reference Manual", Addison Wesley, 1999.
5. C. Man C, "Applying UML & Patterns: An Introduction to Object-Oriented Analysis & Design", Addison Wesley, 2002.
6. G. Booch, M. Engle and B. Young, "Object-Oriented Analysis and Design with Applications", 3rd Edition, 2007.

B. Tech. II (CSE), Semester – IV	L	T	P	C
CS 405: SYSTEM SOFTWARE	3	0	2	4

INTRODUCTION	(02 Hours)
Introduction System software, Utility Software, systems programming .	
ASSEMBLER	(04 Hours)
Introduction, Cross Assembler, Micro Assembler, Meta Assembler, Single pass Assembler, Two Pass Assembler, Design of Operation code table, Symbol table, Literal table.	
MACRO PROCESSOR	(04 Hours)
Introduction of Macros, Macro processor design, Forward reference, Backward reference, positional parameters, keyword parameters, conditional assembly, Macro calls within Macros, Implementation of macros within Assembler. Designing Macro name table, Macro Definition table, Kew word parameter table, Actual parameter table, Expansion time variable storage.	
COMPILER STRUCTURE	(02 Hours)
Analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.	
LEXICAL AND SYNTAX ANALYSIS	(14 Hours)
Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, error reporting, and implementation. Regular definition, Transition diagrams. Context free grammars, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, Bottom up parsing, operator precedence parsing, LR parsers.	
INTERMEDIATE CODE GENERATION	(06 Hours)
Intermediate representations, Code generation & instruction selection issues, basic blocks & flow graphs, register allocation, optimization of basic blocks, loops, global dataflow analysis.	
RUN TIME ENVIRONMENT	(06 Hours)
Absolute loader, Relocation - Relocating loader, Dynamic loader, Bootstrap loader, Linking-loader, Program relocatability, Design of Absolute Loader, Design of direct-linking editor, other Loader scheme e.g. (Binders, Linking Loaders, Overlays, Dynamic Binders.	
Advanced Topics	(04 Hours)
Practicals will be based on the coverage of the above topics separately.	(28 Hours)
(Total Contact Hours: 42 + 28 = 70)	

BOOKS RECOMMENDED	
1.	A. V. Aho, R. Sethi and J D.Ullman, "Compilers-Principles, Techniques and Tools", 2nd Edition, Pearson,2006.
2.	Leland L. Beck, "System Software -An Introduction to System Programming", 3rd Edition, Addison Wesley, reprint2003.
3.	Kenneth C. Loudon," Compiler Construction-Principles and Practice", 1st Edition, Thomson,1997.
4.	D. M. Dhamdhare, "System Programming and Operating System", 2nd Edition, TMH,1993.
5.	Houlb, "Compiler Design in C", PHI, EEE,1995.

B. Tech. II (CSE), Semester – IV	L	T	P	C
CS 406 : DESIGN AND ANALYSIS OF ALGORITHMS	3	1	0	4

INTRODUCTION	(04 Hours)
Introduction to algorithms, analysis and design techniques. Analysis Techniques: Mathematical, Empirical and Asymptotic analysis. Review of the notations in asymptotic analysis. Recurrence Relations and Solving Recurrences - Proof Techniques –Illustrations	
DIVIDE AND CONQUER APPROACH	(08 Hours)
Sorting & order statistics: Divide and Conquer technique – Various Comparison based Sorts – Analysis of the Worst-case and the Best-cases – Randomized Sorting Algorithms – Lower Bound on Sorting - Non-comparison based sorts – Applications – Medians and Order Statistics	
GREEDY DESIGN TECHNIQUES	(08 Hours)
Basic Greedy Control Abstraction – Motivation – The Thirsty Baby Problem – Formalization – Activity Selection and its variants – Huffman Coding – Horn Formulas - The Tape Storage Problem - The Container Loading Problem – The Knapsack Problem – Graph Algorithms – Minimum Spanning Trees – Single Source Shortest Paths – Maximum Bipartite Cover Problem – Applications	
DYNAMIC PROGRAMMING	(08 Hours)
Motivation – The Coin Changing problem – The Longest Common Subsequence – The 0/1 Knapsack problem – Memoization – All-pairs Shortest Path Problems - The Dynamic Programming Control Abstraction	
BACKTRACKING	(04 Hours)
Backtracking - Branch & Bound - N-Queens problem - 15-puzzle problem.	

NUMBER THEORETIC ALGORITHMS	(06 Hours)
Number Theoretic notions – the GCD – Modular Arithmetic – The Chinese Remainder Theorem – Generators – Cyclic Groups – Galois Fields – Applications in Cryptography - The Primality Testing.	
NP-COMPLETE PROBLEMS	(06 Hours)
Polynomial time – verification – NP-completeness – Search Problems – The reductions – Dealing with NP-completeness – Approximation Algorithms – Local Search Heuristics.	
Tutorials will be based on the coverage of the above topics separately.	(14 Hours)
(Total Contact Hours: 42 + 14 = 56)	

BOOKS RECOMMENDED
<ol style="list-style-type: none"> 1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 3rd Edition, MIT Press,2009. 2. Donald E. Knuth, "The Art of Computer Programming, Vol I &III", 3rd Edition, Pearson Education, 1997. 3. Sara Baase, Allen van Gelder, "Computer Algorithms: Introduction To Design & Analysis", 3rd Edition, Pearson Education,2000. 4. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", 2nd Edition, Universities Press/Orient Longman,2005. 5. J. Kleinberg, E. Tardos, "Algorithm Design", 1st Edition, Pearson Education, Reprint2006.