Minor Computer Science and Engineering

Department of Computer Science and Engineering

Fifth Semester					
Minor CSE					
	22CPT104	Data Structures		3	PC
	22CPT303	Operating System		3	PC
				6	

Sixth Semester					
Minor CSE					
	22CPT211	Computer Networks		3	PC
	22CPT213	Database Information Systems		3	PC
				6	

Seventh Semester					
Minor CSE					
	22CPT304	Software Engineering		3	PC
				3	

Eighth Semester					
Minor CSE					
	22CPT309	Artificial Intelligence		3	PC
				3	

Data Structures					
Prerequisite: :Nil		L	T	P	C
Total hours: 42		3	0	0	3
Course Content					Hrs
Unit 1	Fundamentals of Data Structures, Memory Allocation, Abstract DataTypes, Arrays, Lists Stack Implementation, Stack applications. Queue Implementation, Sequential, Circular, and Dequeue representation, Dynamic Queue implementation, Queue applications.				8
Unit 2	Searching and Sorting: Linear and Binary search, Bubble Sort, Selection Sort, Insertion Sort, Merge sort, Quick sort, Counting sort, Bucket sort, Radix sort, Heap sort, comparisons of sorting algorithms.				8
Unit 3	Hashing and Hash Tables: Hash functions, Open and closed hashing, Dynamic and extendible hashing, Hash collision, chaining, Hash Tables and Probing Techniques				8
Unit 4	Trees: Binary Tree and its representations, Tree traversal, Binary Search Tree, Threaded binary trees, Representing list as binary trees, Dynamic implementation of Binary tree and AVL tree, Tree applications, Interval tree, M-way search Tree, B-Tree and its variants , B+ Tree , Heaps and itsapplications				10
Unit 5	Graphs: Fundamentals of Graph, Adjacency Matrix and List; GraphTraversal using DFS and BFS. Dijkstra and Prims algorithms.				8

References

1.	T. Cormen, C. Lieserson, R. Rivest, and C. Stein, "Introductions to Algorithms", Prentice-Hall/India,3rd edition, 2009
2.	Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, Data Structures Using C
3.	Introduction to Algorithms ,Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and CliffordStein,PHI,2nd Edition.
4.	Aho A.V., J.E. Hop croft, J.D. Ullman, Data Structures and algorithms, Addison Wesley
5.	Introduction to design & Analysis of Algorithms,Anany Levitin,2ndEdition,Pearson.

Operating System					
		L	T	P	C
Total Hours: **42**		3	0	0	3
Prerequisite: Computer Organization and Architecture, Data structures and algorithms, Problem solving using C					
Course Content					Hrs
Unit 1	***Introduction:*** What is an operating system, Types of operating systems and differences among them, OS as a virtual machine; User and Operating-System Interface, System Calls, System Services, Linkers and Loaders, Booting, OS as a resource manager, Interrupts and traps, System calls, Limited direct execution, user versus kernel mode. ***CPU Scheduling:*** Process, Process v/s program, context switch, Process state diagram, CPU scheduling – FCFS, SJF, SRTF, Priority, Pre-emptive priority, Round Robin, MLFQ, Lottery, CFS, Multi-Processor Scheduling, Real-Time CPU Scheduling, Thread v/s process, Process and Thread APIs				10
Unit 2	***Synchronization:*** Inter-process communication and Processes: IPC in Shared-Memory Systems and Message-Passing Systems, Race condition, mutual exclusion, The Critical-Section Problem (CSP), Algorithmic solutions to CSP – Dekker's, Peterson's, Lamport Bakery Solution; Hardware Support for Synchronization – Test and Set, Compare and Swap; OS support for synchronization - Mutex Locks, Semaphores, Monitors; Condition Variables; Classic Problems of Synchronization – Producer Consumer, Sleeping Barber; Dining Philosopher's Problem, Deadlock – Prevention, avoidance, detection and recovery, Safe state, Banker's algorithm. Livelock.				10
Unit 3	***Memory Management:*** working set model, hardware support; Contiguous allocation-partitioned memory allocation – fixed and variable partitioning, memory management with bit maps – swapping – relocation- protection and sharing. Non contiguous allocation – Paging – principles , page allocation, segmentation. Virtual memory concepts, address translation, management of virtual memory, page replacement policies, protection and sharing, Thrashing; Caching principles and quantitative estimation of cache behavior				8
Unit 4	***I/O Management:*** Overview of Mass-Storage Structure, HDD Scheduling, NVM Scheduling, Error Detection and Correction, Storage Device Management, Swap-Space Management, SSD (Solid State Disks); I/O Systems -Overview; I/O Hardware; Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations ***File management:*** File Concept, Access Methods, Directory Structure, Protection, File-System Interface, Shared files. File-System Implementation: Structure and Operations; Directory Implementation; Allocation Methods; Free-Space Management; Case study: EXT, NTFS, HFS				8
Unit 5	***Security and Protection:*** Program Threats – stack overflow, return to libc, RoP, heap spraying, integer overflow, format string attacks; System and Network Threats; User Authentication; Principles of Protection - Protection Rings, Domains; Access Matrix, Implementation of the Access Matrix – Access Control Lists, capabilities; Revocation of Access Rights, Role-Based Access Control, Mandatory Access Control, Capability-Based Systems				6
References					

1.	Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, *Operating Systems:Three Easy Pieces* [online http://pages.cs.wisc.edu/~remzi/OSTEP/]
2.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, *Operating System Concepts*. 9th edition. Wiley.
3.	Andrew Tanenbaum & Albert Woodhull, *Operating Systems: Design and Implementation*. Prentice-Hall.
4.	Maurice J Bach, *Design of Unix Operating System*. AT&T Bell Labs.
5.	Andrew Tanenbaum, *Modern Operating Systems*, Prentice Hall.
6.	William Stallings, *Operating Systems: Internals and Design Principles*, 9th Edition, Pearson.
7.	Crowley: *Operating System A Design Approach*, TMH.

Computer Networks					
Prerequisite: Data communication.		L	T	P	C
Total hours: 42		3	0	0	3
Course Content					Hrs
Unit - I	**Introduction:** Internet – nuts and bolts, network service, network protocols, network edge, network core, performance metrics- delay, throughput, etc. protocols and service models.				4
Unit - II	**End-to-End protocols and Applications-I:** Application layer: principles of application layers, Domain Name System (DNS), HTTP, FTP, E-mail, www and etc. Pear to pear systems, video streaming, Socket programming. Flow control – window/credit schemes, rate control schemes, Congestion control Transport layer and TCP/IP. Introduction to ATM networks and Network Management And Interoperability.				8
Unit - III	**End-to-End protocols and Applications-II :** Introduction to transport layer, multiplexing and de-multiplexing, connection oriented and connection less end to end protocols, principles reliable data transfer, and congestion control.				11
Unit - IV	**Data Plane :** Introduction to network layer, layer 3 devices and inside, addressing – IPv4, IPv6, etc. NAT, **Control Plane :** Retransmission algorithms. Stability of queuing systems.. High speed switches scheduling, BroaPCast routing and spanning trees. Shortest path routing. Distributed routing algorithms, optimal routing, and traffic engineering. ICMP, SNMP,etc				11
Unit - V	**Future/Advanced Internet:** Internet of Things (IoT) and applications, Software Defined Networks (SDN) : Control plane, data-plane, and issues, Information centric networks (ICN), Content distribution networks (CDN) and Future Internet.(5 Classes)				6

References

1.	Data Networks: Bertsekas and Gallagher, PHI
2.	Computer Networks: L. Peterson and Davie, Elsevier
3.	Computer Networking A top down Approach: J.F.Kurose, Pearson
4.	Computer Networks : Andrew S. Tanenbaum, Pearson

Database Information Systems					
Prerequisite: :NiL		L	T	P	C
Total hours: 40		3	0	0	3
Course Content					Hrs
Unit 1	Introduction to Database System Database approach and Information systems , Database System Architecture, current advances in database technology, Database Systems Development Life Cycle- Prototyping methodology three-schema architecture, three- tiered architecture Hierarchical model, Network model, Relational model, Object oriented model, Multidimensional model				6
Unit 2	Database Models: ER-model notation, entity & entity type, relationship & relationship type, Degree, Cardinality & modality, Supertype/Subtype relationship Relational model concepts, Converting ER to Relational model				6
Unit 3	Introduction to SQL-DDL,DML and PCL, Advanced topics of SQL, PL/SQL language: Functions, Procedures & triggers, Views, Cursors etc. Formal query languages Relational Algebra and Relational Calculus Overview, Query processing and optimization				10
Unit 4	Relational schema, Functional dependencies, Inference axioms, Keys, closures, redundant FD's , Decompositions, Join Dependencies Normalization, normal forms:1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Best Database Design criterion Transactions, concurrency control, Crash Recovery, Physical DB design, file organizations, Indexing Structures, File indexing, hashing				14
Unit 5	Client/Server database architecture Application Development, Database Security, Overview of Distributed database, Data Warehousing and Data mining, Data Analytics				4

References

1.	**Database System Concepts** ,Silberschatz A, Korth H F, and Sudarshan S, , McGraw Hill,,6th Ed.
2.	**Modern Database Management systems**, Hoffer J A, Prescott M B, and Topi H. Pearson Education Inc.,13th Edition
3.	**Fundamentals of Database Systems**, Elmasri R, Navathe S B, Pearson Education, 7th Edition..
4.	**Database Management System**, Raghurama krishnan & Johannes Gehrke, McGraw-Hill 3rd edition
5	**Commercial Application development using ORACLE Developer 2000 Forms 5.0**, Ivan Bayross, BPB Publications.

Software Engineering					
Prerequisite: :Nil		L	T	P	C
Total hours: 42		3	0	0	3
Course Content					Hrs
Unit 1	**Introduction to Software Engineering**: The evolving Role of Software Engineering, The Changing Nature of Software, Legacy software, Software Evolution and Software Myths. Industrial Engineering Tools for Software Engineering.				8
Unit 2	**Process Models**: Software Process Models: The Waterfall Model, The Incremental Model, the RAD model, Evolution Process Model: Prototyping, The Spiral model, Concurrent Development Model. Agile Process Models: Extreme Programming (XP)				6
Unit 3	**Software Project Management:** Management Activities, Project Planning, Project scheduling, Risk management. Requirements Engineering. Feasibility study, requirement analysis, cost benefit analysis, planning systems, analysis tools and techniques.				6
Unit 4	**System Design:** design fundamentals, modular design, data and procedural design, object oriented design and UML. **System Development**: Code documentation, program design paradigms.				6
Unit 5	**Software Testing**: Test Strategies for Conventional Software, Test Strategies for Object – Oriented Software, Verification and Validation Testing, System Testing, Debugging. Black-Box and White-Box Testing, Basis Path Testing, Control Structure Testing, Regression Testing, Mutation Testing, Dataflow Testing.				8
Unit 6	**Software Maintenance**: Maintenance Characteristics, Maintainability, Maintenance Tasks and side effects				8
References					
1.	Pressman Roger S, Software Engineering A Practitioner's Approach, TATA McGraw-Hill Publications, 6th Edition, 2005, ISBN No. 007-301933X				
2.	Ian Sommerville, Software Engineering, Pearson Education, 7th Edition, 2008, ISBN: 978-81-7758-530-8.				
3.	Ghezzi C. Jazayeri M and Mandrioli: Fundamentals of Software Engg. , PHI.				
4.	Rajib Mall, Fundamentals of software engineering. PHI Learning Pvt. Ltd..				
5.	Unified Modeling Language Reference manual", Grady Booch, James Rambaugh, Ivar Jacobson, Pearson India, ISBN – 9788177581614 R5.				

Artificial Intelligence					
Prerequisite: Nil		L	T	P	C
Total hours: 42		3	0	0	3
Course Content					Hrs
Unit 1	Overview of AI, Problems, Shift in focus of AI towards providing smarter solutions, Change in application domains of AI, State-of-the-art technologies in AI. Problem space and searching techniques, Types of production system, Control strategies, Heuristic search Techniques. Defining AI problems as a State Space Search: example, Production Systems, Types of production systems, Search and Control Strategies, Problem Characteristics.				6
Unit 2	Heuristic search techniques- Generate-and-test, Hill Climbing, Best First Search, A* , Problem Reduction, AO*, Constraint Satisfaction with inferencing, backtracking and local search, Mean-Ends Analysis. Knowledge representation, Representation, mappings, approaches and issues.				8
Unit 3	Propositional Logic and theorem proving, First order Predicate logic: syntax and semantics, Propositional v/s First Order Predicate Logic, Satisfiabilit problems, model finding, Inference algorithms: Backward and forward chaining, Resolution (proof by contradiction). Representing Simple facts in Logic, Representing Instances and Isa relationships, Computable Functions and Predicates, Using First Order Logic, Inferencing process and resolution, Unification algorithm. Knowledge Representation : Ontologies, objects, events, PEAS, Forward v/s backward reasoning, Matching and control knowledge, Levels of knowledge representation, entailment, implication, contradiction, contingency, model checking, Modus ponens inference rule, CNF clauses, Horn clauses. SAT Solvers: DPLL Weak Structures: Semantic Nets, Frames, Strong Structures: Conceptual Dependencies, Scripts. Expert Systems and applications : Representing and using domain knowledge, Expert system shells, Knowledge Acquisition.				10
Unit 4	Game Playing : Minimax Search Procedures, Adding alpha-beta cutoffs , State-of-the-Art Game Programs and modern examples, Watson and how it solved Jeopardy. Information Retrieval - Google's page rank algorithm, Introduction to natural language processing.				8
Unit 5	Uncertain knowledge and reasoning Quantifying uncertainity, Probabilistic reasoning,, Graphical Models, Bayesian networks, Bayesian inference, forward and backward inference, inference by enumeration, and variable elimination algorithm, Probabilistic reasoning overtime, Inference in temporal models. Sampling: prior sampling, rejection sampling, likelihood weighting. Hidden markov models, the forward algorithm, the HMM Viterbi algorithm. Concepts in Machine learning: Introduction , Foundations of AI v/s ML, When to use ML and when not to use, Framework for AI/ML application to a problem, Taxonomy of Computational Intelligence, Classification under Machine Learning.				10
References					
1.	Artificial Intelligence: A Modern Approach by Russel and Norvig, Third Edition, Pearson, 2015.				
2.	Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.				
3.	Introduction to AI & Expert System: Dan W. Patterson, PHI.				