COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Syllabus of 5th semester:

Course Name : Formal Language & Automata Theory					
Course Code: CSEN3101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module-1: [**9L**]

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, Design of sequence detector (Application of concept of Automata to sequential circuit design), Introduction to finite state model [2L]

Finite state machine: Definitions, capability & state equivalence, kth- equivalence concept[1L]
Deterministic finite automaton and non deterministic finite automaton. Transition diagrams and Language recognizers. [1L]

Finite Automata: NFA with ϵ transitions - Significance, acceptance of languages. [1L]

Conversions and Equivalence: Equivalence between NFA with and without ϵ transitions. NFA to DFA conversion. [1L]
Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L]
Application of finite automata, Finite Automata with output- Moore & Mealy machine. [2L]

Module-2: [10L]

Introduction to Formal Languages and Grammars [1L]
Chomsky Classification of grammar: unrestricted, context sensitive, context free grammar [1L]
Grammar Formalism: Right linear and left linear grammars, Regular grammar, Regular Languages, Regular sets [1L]
Regular expressions, identity rules. [1L]
Arden's theorem statement, proof and applications [1L]
Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L]
Pumping lemma of regular sets.[1L]
Closure properties of regular sets (proofs not required). [2L]
Equivalence between regular grammar and FA. [1L]

Module-3: [10L]

Context free grammar: Introduction to Context free grammars, Derivation trees, Sentential forms, Right most and leftmost derivation of strings, basic applications of the concept of CFG [1L]
Ambiguity in context free grammars. [1L]
Minimization of Context Free Grammars : Removal of useless, null and unit productions [1L]
Chomsky normal form and Greibach normal form. [1L]
Pumping Lemma for Context Free Languages. [1L]
Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L]
Push Down Automata: Push down automata, Definition and design of PDA [1L]
Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L]
Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L]
Introduction to DCFL and DPDA. [1L]

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Module-4: [11L]

Turing Machine : Introduction to Turing Machine, Definition, Model [1L]
Design of TM, TM as language accepter[1L]
TM as transducers [1L]
Computable functions [1L]
Languages accepted by a TM, recursively enumerable and recursive languages [1L]
Church's hypothesis, counter machine [1L]
Types of Turing machines (proofs not required) [1 L]
Universal Turing Machine [1L]
Decidability, Undecidability, Various Undecidable problems like Post's Correspondence Problem (PCP), Turing Machine Halting Problem, Ambiguity of Context Free Grammars etc. [3L]

Learning Outcomes of Formal Language and Automata

Learning outcome of Turing Machine:
Students will be able to design Turing machine as language accepter as well as a transducer.

Learning outcome of Regular Languages and Grammar:
Students will be able to classify a grammar and a language, design a Finite Automata for a regular expression and derive the regular expression for a FA. Students will be able to check equivalence between regular grammar and FA.

Learning outcome of PDA and context free grammar:
Students will be able to minimize context free grammar, derive it's normal forms and recognize a CFG. They will be able to design a PDA for a given CFL. Student will be able to check equivalence of CFL and PDA.

Learning outcome of Finite Automata:
The student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.

TEXT BOOKS:
1."Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.
2."Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.
3."Formal Languages and Automata Theory", C.K.Nagpal, Oxford.
4. "Introduction to the Theory of Computation", Sipser Michael. Cengage Learning.

REFERENCES:
1 "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
2 "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
3 "Introduction to languages and the Theory of Computation", John C Martin, TMH
4 "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Database Management Systems					
Course Code: CSEN3102					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

MODULE-I

Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Role of database administrator and database Users, Three Tier architecture of DBMS.

Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

MODULE-II

Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Relational Database Design [9L]

Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF.

MODULE-III

SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

MODULE-IV

Internals of RDBMS [7L]

Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Course outcomes/Learning objectives:

1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
2. Define the terminology, features, classifications, and characteristics embodied in database systems.
3. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
4. Demonstrate an understanding of the relational data model.
5. Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
6. Formulate, using relational algebra, solutions to a broad range of query problems.
7. Formulate, using SQL, solutions to a broad range of query and data update problems.

8. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
9. Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
10. Use a desktop database package to create, populate, maintain, and query a database.
11. Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.
3. Ramakrishnan: Database Management System , McGraw-Hill.
4. Gray Jim and Reuter Address, "Transaction Processing: Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech.
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.

References:

1. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
2. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition.
3. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : OPERATING SYSTEMS					
Course Code: CSEN3103					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I:
Introduction [4L]
Introduction to Operating System. Operating system functions, OS Architecture (Monolithic, Microkernel, Layered, Hybrid) , evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.
System Structure [3L]
Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, System calls.
Module II:
Process Management [17L]
Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.
Threads [2L]: overview, benefits of threads, user and kernel threads.
CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.
Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Module III:
Storage Management [19L]
Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
File Systems [4L]: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.
I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.
Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.
Module IV:
Protection & Security [4L]
Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.
Learning outcomes/Course Outcomes of Operating System :
This course provides a comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems. In particular, the course will consider inherent functionality and processing of program execution. The emphasis of the course will be placed on understanding how the various elements that underlie operating system interact and provides services for execution of application software.
Master functions, structures and history of operating systems.
Master understanding of design issues associated with operating systems.
Master various process management concepts including scheduling, synchronization, deadlocks.
Be familiar with multithreading.

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Master concepts of memory management including virtual memory.
Master system resources sharing among the users.
Master issues related to file system interface and implementation, disk management.
Be familiar with protection and security mechanisms.
Be familiar with various types of operating systems including Linux.

References :

1. Milenkovie M., "Operating System : Concept & Design", McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
4. Dhamdhere: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Computer Architecture					
Paper Code: CSEN 3104					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module 1:
(9L)

CPU Architecture: Instruction Execution Mechanism details;
Classification of Computer Architecture – Von Neumann and Harvard;
Basics of Pipelining;
Instruction Set Architecture details; Comparison between various types: Stack / Accumulator / Memory to Memory/ Load Store architecture;
CISC vs. RISC Architecture; MIPS Architecture & ISA as case study.
(4L)

Pipelined Architecture: Brief Introduction, Performance Measures - speed up,
Efficiency ,performance - cost ratio etc.
Static pipelines - reservation tables, scheduling of static pipelines, definitions - minimum average latency, minimum achievable latency, greedy strategy etc.,
Theoretical results on latency bounds without proof.
Dynamic pipelines - reservation tables, outline only.
(5L)

Module 2:
(9L)

Vector Processing: Vector registers; Vector Functional Units; Vector Load / Store;
Vectorization; Vector operations: gather / scatter; Masking; Vector chaining;
(2L)

SIMD Architectures: brief introduction, various concepts illustrated by studying detailed
SIMD algorithms, viz., Matrix multiplication, Sorting on Linear array, Mesh;
Intel MMX operations; (4L)

Interconnection Networks: Detailed study of Interconnection Network - Boolean cube,
Mesh, Shuffle-exchange, Banyan, Omega, Butterfly, Generalized Hypercube,
Delta etc (3L)

Module 3:
(8L)

Superscalar Architecture: Microarchitecture of a typical super scalar processor :
Instruction fetching, decoding and parallel execution; branch prediction;
Handling memory operations; (2L)

Branch Prediction: Handling Control Dependency; Delayed Branching; Branch Prediction techniques; (2L)

MIMD Architectures: Sorting and Matrix Multiplication algorithms (flavours only); (4L)

Module 4:
(8L)

Data Flow Architecture: Data Flow Graphs; ISA; Nodes; Programs; Control flow vs. Data flow; Example Dataflow Processor; Advantages & Disadvantages; (2L)
VLIW Architecture;
(2L)
Memory Consistency; (2L)
Cache Coherence;
(2L)

Text Books:
1. Patterson & Hennessy: Computer Organization and Design: The Hardware/Software Interface (3rd Ed – 5th Ed)
2. Hennessey & Patterson : Computer Architecture – A Quantitative Approach

3. Hwang & Briggs: Advanced Computer Architecture and Parallel processing, MH.
4. Quinn: Designing Efficient Algorithms for Parallel Computers, MH.
5. Yale N. Patt, Sanjay J. Patel: Introduction to Computing Systems: From Bits & Gates to C & Beyond.

Reference Books & Materials:
1. NPTEL Materials on Computer Organization and Architecture;
2. Onur Mutlu's lecture materials on Computer Architecture from CMU web site: https://users.ece.cmu.edu/~omutlu/

Paper:

1. James E. Smith, and Gurindar S. Sohi, The Microarchitecture of Superscalar Processors, in Proceedings of the IEEE, vol. 83, no. 12, December 1995.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Microprocessors & Microcontrollers					
Course Code: AEIE3105					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I - [8L]

Introduction to microcomputer system, History and evolution of microprocessor and microcontrollers and their advantages and disadvantages;
Introduction to 8 bit microprocessor: 8085 microprocessor internal architecture, buses, 8085 pin description; Software instruction set, timing diagram of the instructions, addressing modes and assembly language programming; Interrupts of 8085 processor: classification of interrupts, Programming using interrupts.

Module II - [10L]

Introduction to 8086/8088 Architecture: Architecture, memory segmentation, signal descriptions, clock generator, resetting the microprocessor, wait state inserting, bus buffering, interrupts, instruction set, addressing modes and assembly language programming of 8086/8088.

Module III - [10L]

Introduction to microcontrollers: Intel MCS-51 family features, 8051 architecture, pin configuration, I/O ports and memory organization; Instruction set and basic assembly language programming, interrupts and returns; Interrupts, timer/counter and serial communication;MCS-51 applications: Square wave generation, LED, A/D converter and D/A converter interfacing with 8051;
Brief introduction to PIC microcontroller (16F877): Architecture, pin details, memory layout etc.

Module IV - [12L]

Memory and ADC / DAC interfacing with 8085/ 8086;
Support IC chips: 8255, 8237, 8259 and 8251- Block diagram, pin details, modes of operation, control word(s) format and interfacing with 8085/8086/8051.

References:

1. Ramesh S. Gaonkar, *Microprocessor architecture, programming and applications with 8085/8085A*; Wiley eastern Ltd.
2. B. Ram, *Fundamental of Microprocessor and Microcontrollers*; Dhanpat Rai Publications.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, *Microprocessors and Microcontrollers*; Oxford Publications.
4. A. Nagoor Kani, *8085 Microprocessor and its Applications*; Third Edition, TMH Education Pvt. Ltd.
5. Douglas V. Hall, *Microprocessors & Interfacing*, Tata McGraw-Hill.
6. Ray & Bhurchandi, *Advanced Microprocessors & Peripherals*, Tata McGraw-Hill.
7. Barry B. Brey, *The Intel Microprocessors*, PHI/Pearson Ed. Asia.
8. Muhammed Ali Mazidi and Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Education Inc.
9. Ajay V Deshmukh, *Microcontrollers Theory and Applications*, Tata McGraw-Hill.

10. Raj Kamal, *Embedded systems- Architecture, Programming and Design*, McGraw Hill Education (India) Pvt. Ltd.

Course outcome:

After the completion of the course the students will be able to:

1. Learn the architecture and function of each pin of 8 bit microprocessor 8085, 16 bit microprocessor 8086/8088, 8051 and PIC microcontroller.
2. Develop the skill in program writing for 8085 microprocessor, 8086 microprocessor, 8051 and PIC microcontroller.
3. Perform memory and I/O interfacing with 8085 microprocessor, 8086 microprocessor.
4. Describe the architecture of different types of programmable peripheral devices and their interfacing with microprocessor, 8086 microprocessor and 8051 microcontroller.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Economics for Engineers					
Course Code: HMTS3101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module I:

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.

The basic concept of economics – needs, wants, utility.

National Income-GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity.

Inflation: meaning, reasons, etc. **(6L)**

Module II:

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.

Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India.

International Business or Trade Environment. **(4L)**

Module III:

Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.

Financial Statement Analysis (Ratio and Cash Flow analysis). **(8L)**

Module IV:

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.

Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.

Marginal Cost based decisions. **(6L)**

Module V:

Time Value of Money: Present and Future Value, Annuity, Perpetuity.

Equity and Debt, Cost of Capital. **(4L)**

Module VI:

Capital Budgeting: Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return.

Depreciation and its types, Replacement Analysis, Sensitivity Analysis. **(8L)**

References:

1. R**.** Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall of India Private Limited. New Delhi

2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of India Private Limited, New Delhi

3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.

4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *Engineering Economic Analysis.* New York: Oxford University Press. 2012.