**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]

**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]

**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.