SECTION A

Answer ALL the questions: (10×2=20)

1. Construct deterministic finite automata to check whether given number is divisible by two.
2. Define non-deterministic finite automata.
3. Define a context free grammar.
4. Construct a grammar to generate the language $L(G) = \{a^m cb^m : m \geq 0\}$.
5. Show that the grammar G = ({S}, {a}, S   SS, S   a, S) is ambiguous.
6. Define a derivation tree.
7. Eliminate -production from the set of all production rules
   (S   aSa, S   bSb, S   a, S   b, S   )
8. Define a unit production.
9. State uvwxy theorem.
10. Define Cauchy normal form.

SECTION B

Answer any FIVE questions: (5× 8=40)

11. Construct finite automata which can list whether a given positive integer is divisible by 3(three).
12. Construct an NFA to accept set of all strings over {0, 1} ends with 111 or 000.
13. Prove that $L = \{a^p / p \text{ is a prime}\}$ is not regular.
14. Write a grammar to generate $L = \{a^n b^n / n \geq 1\}$.
15. Remove $\vee$ production from the CFG given below $S \rightarrow AB, A \rightarrow aAA / \vee, B \rightarrow bBB / \vee$.
16. For the string aabbaaa find left and right most derivation using the production rule given below, $S \rightarrow AaS / a / SS, A \rightarrow SbA / ba$.
17. Write about Chomsky hierarchy.
18. Define ambiguous grammar and Show that the grammar $S \rightarrow SS, S \rightarrow a, S \rightarrow b$ is ambiguous.

SECTION C

Answer any TWO questions: (2×20=40)

19. a) Construct an NFA accepting all strings over $\{0,1\}$ which end in 1 but does not contain the substring 00.
    b) Construct finite automata to accept $L = \{ab, ba\}$.

20. a) Show that the grammar $E \rightarrow E + E / E * E / E / id$ is ambiguous. Construct an equivalent grammar making id+id*id unambiguous .
    b) Find a CNF grammar equivalent to a grammar whose production rules are
    $S \rightarrow bA / aB, A \rightarrow bAA / aS / a, B \rightarrow aBB / bS / b.$

21. Construct an equivalent DFA for a given NFA

	a	b
q_0	$\{q_0, q_1\}$	W
q_1	W	$\{q_1, q_2\}$
q_2	W	W

22. State and prove Pumping lemma and also show that $L = \{a^n b^n / n \geq 1\}$ is not regular.