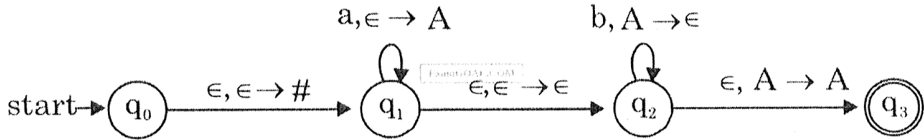


B.E. INFORMATION TECHNOLOGY THIRD YEAR FIRST SEMESTER - 2025
AUTOMATA AND COMPILER(HONS.)

Time: 3 Hrs

Full Mark:100

CO1 [20]	(a) (i) Design a DFA to accept a string of a's and b's ending with abb. (5) (ii) Design a DFA which accepts even number of 0's and odd number of 1's. (5) (b) Give the Regular expressions of the following languages. (5 + 5) a. $L = \{W/W \text{ is a string of odd number of 0's followed by even number of 1's}\}$ b. $L = \{W/W \text{ is in } \{a,b\}^* \text{ and } W \bmod 3 = 0\}$
CO2 [20]	Answer any Two of (a), (b) and (c). (a) Give pushdown automata (PDA) for the following language: $L = \{a^n b^m c^k : n + m = k\}$ Test strings: aabcccccc, aaabbbcc, aabbcccc, aabcc. (10) (b) Convert the following grammar to a PDA. $S \rightarrow AA \mid a, A \rightarrow aAb \mid ab \mid \lambda$ (10) (c) What is accepted by the following PDA Consider the following pushdown automaton over the input alphabet $\Sigma = \{a, b\}$ and stack alphabet $\Gamma = \{\#, A\}$.  <pre> graph LR start((start)) -- "epsilon, epsilon -> #" --> q0((q0)) q0 -- "epsilon, epsilon -> #" --> q1((q1)) q1 -- "a, epsilon -> A" --> q1 q1 -- "epsilon, epsilon -> epsilon" --> q2((q2)) q2 -- "b, A -> epsilon" --> q2 q2 -- "epsilon, A -> A" --> q3(((q3))) </pre>
CO3 [20]	Answer any Two of (a), (b) and (c). (a) Design a Turing Machine to accept the language: $L_{www} = \{www^R \mid w \in (0+1)^*\}$ (10) (b) Design a Turing Machine to replace 0's with 1's in the input string. (10) Answer any Two of (a), (b) and (c). (c) Which of the following grammar is ambiguous? Justify (10) (i) $S \rightarrow S+S \mid S-S \mid a$ (ii) $S \rightarrow iEtS \mid iEtSeS \mid a, E \rightarrow b$ (iii) $S \rightarrow SbS \mid a$
CO4 [20]	(a) Remove useless productions, null productions, unit productions from the following grammar: (10) $S \rightarrow ABC$ $A \rightarrow aBC$ $B \rightarrow C \mid \epsilon$ $C \rightarrow cd \mid DCF$ $D \rightarrow dD \mid \epsilon$ $E \rightarrow eFE$ $F \rightarrow eC$ (b) Prove or Disprove that, the language $L = \{a^n b^n c^n\}$ is context sensitive (10)
CO5,6 [20]	(a) How many tokens will be generated by the scanner for the following statement ? $x = x * (a + b) - 5;$ (4) (b) The grammar $A \rightarrow AA \mid (A) \mid \epsilon$ is not suitable for predictive-parsing - Why ? (4)

(c) Choose the correct Answer

(i) Match all items in Group 1 with the correct options from those given in Group 2. (1)

Group 1	Group 2
P. Regular expression	1. Syntax Analysis
Q. Pushdown automata	2. Code Generation
R. Dataflow analysis	3. Lexical Analysis
S. Register allocation	4. Code Optimization

(ii) In a compiler, keywords of a language are recognized during (1)

(A) parsing the program

(B) the code generation

(C) the lexical analysis of the program

(D) dataflow analysis

(iii) A CFG is not closed under. Explain (2)

a) Dot operation

b) Union Operation

c) Concatenation

d) Iteration

(iv) Which of the following is an example of inherent ambiguous language? Explain (2)

a) $\{a^n | n > 1\}$

b) $\{a^n b^n c^m d^m | n, m > 0\}$

c) $\{0^n 1^n | n > 0\}$

d) None of the mentioned

(v) State true or false: Explain (2)

Statement: $R \rightarrow R | T$

$T \rightarrow \epsilon$

is an ambiguous grammar

a) true

b) false

(vi) Which of the following derivations does a top-down parser use while parsing an input string? The input is assumed to be scanned in left to right order. (1)

- A. Leftmost derivation
- B. Leftmost derivation traced out in reverse
- C. Rightmost derivation
- D. Rightmost derivation traced out in reverse

(vii)

(3)

Consider the following grammar G , with S as the start symbol. The grammar G has three incomplete productions denoted by (1), (2), and (3).

$$S \rightarrow daT \mid (1)$$

$$T \rightarrow aS|bT|(2)$$

$$R \rightarrow (3) \mid \epsilon$$

The set of terminals is $\{a, b, c, d, f\}$. The FIRST and FOLLOW sets of the different non-terminals are as follows.

$$\text{FIRST}(S) = \{c, d, f\}, \text{FIRST}(T) = \{a, b, \epsilon\}, \text{FIRST}(R) = \{c, \epsilon\}$$

$$\text{FOLLOW}(S) = \text{FOLLOW}(T) = \{c, f, \$\}, \text{FOLLOW}(R) = \{f\}$$

Which one of the following options CORRECTLY fills in the incomplete productions?

A (1) $S \rightarrow Rf$ (2) $T \rightarrow \epsilon$ (3) $R \rightarrow cTR$

B (1) $S \rightarrow fR$ (2) $T \rightarrow \epsilon$ (3) $R \rightarrow cTR$

C (1) $S \rightarrow fR$ (2) $T \rightarrow cT$ (3) $R \rightarrow cR$

D (1) $S \rightarrow Rf$ (2) $T \rightarrow cT$ (3) $R \rightarrow cR$

CO1: Explain Finite automata, Regular Languages, their properties and relate them with the problem of lexical analysis. (K3)

CO2: Describe and construct Context Free Languages, Push Down Automata and their properties. (K3)

CO3: Explain and outline Turing Machine, its variants and undecidability. (K4)

CO4: Design CFG for Programming Language constructs and appraise their syntax-analysis using top down and bottom up approaches (K3)

CO5: Construct semantic actions for intermediate code generation for declarative and executable programming language constructs and explain type checking systems. (K3)

CO6: Describe basics of code optimization techniques and run time environment. (K2)