

U.G. 5th Semester Examination - 2021

COMPUTER SCIENCE

[HONOURS]

Course Code : COM.SC-H-CC-L-511

(Theory of Computation)

Full Marks : 60 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP-A

1. Answer any **ten** questions: $2 \times 10 = 20$
- a) What is Unit Production?
 - b) Define grammar.
 - c) When do you say a grammar to be ambiguous?
 - d) Define Transition Graphs.
 - e) Construct the regular expression for a language that consists of all strings ending with 10. Assume $\Sigma = \{0, 1\}$.
 - f) State the applications of Turing Machine.
 - g) Define relation with example.
 - h) Differentiate between L^+ and L^* .

- i) Describe the instantaneous description of a PDA.
- j) State the use of DFA.
- k) Explain dead state with proper example.
- l) Draw a finite automata for accepting the strings over $\{0,1\}$ with odd number of 0's.
- m) What language will be generated by $\{S \rightarrow aSa; S \rightarrow bS\}$? Justify.

GROUP-B

2. Answer any **four** questions: $5 \times 4 = 20$
- a) Prove that the following language is not regular.
$$L = \{ 1^p \mid p \text{ is a prime number} \}.$$
 - b) How does a Turing machine (TM) differ from PDA and FSA? State the transition function of a TM. $4+1=5$
 - c) Prove that “A language L is accepted by some ϵ -NFA E if and only if L is accepted by some DFA”.
 - d) Construct a Context Free Grammar for $L = \{0^i 1^j \mid 1 \leq i \leq j\}$. Show the steps for deriving the string 0011 by your designed grammar rules. $3+2=5$

- e) What is Halting problem? Explain why Halting problem is unsolvable (informal explanation is sufficient). $2+3=5$
- f) Explain Chomsky hierarchy and corresponding type0, type1, type2 and type 3 grammars.

- d) Define Non-deterministic Turing machine. Design a Turing Machine which recognizes the set of all even length palindromes over $\{0,1\}$. $3+7=10$

GROUP-C

3. Answer any **two** questions: $10 \times 2 = 20$
- a) When is a CFG said to be in Chomsky Normal Form? Convert the following CFG into Chomsky Normal Form:
- $$S \rightarrow ASB$$
- $$A \rightarrow aAS|a|\varepsilon$$
- $$B \rightarrow SbS|A|bb \quad 2+8=10$$
- b) Construct a non-deterministic finite automaton accepting the set of strings over $\{a, b\}$ ending with aba . Use your designed automaton to construct a DFA accepting the same set of strings. $4+6=10$
- c) State and prove pumping lemma for Context Free Languages. $3+7=10$