Registration No : | | | | | | | | | | |

Total Number of Pages : 02

B.Tech/
Integrated Dual Degree (B.Tech and M.Tech)

RCS5C001

5th Semester Reg/Back Examination: 2024-25

Formal Languages and Automata Theory

CST, CSEDS, CSE, CSIT, CSEAIME, ELECTRICAL & C.E, ELECTRONICS & C.E, IT, CSE

Time : 3 Hour

Max Marks : 100

Q. Code : R173

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Construct a CFG over {a,b} generating a language consisting of equal number of a's and b's. Construct a CFG over {a,b} generating a language consisting of equal number of a's and b's.

b) Specify the use of context free grammar.

c) Design a DFA over $\sum$ = f {a, b} such that every string will be accepted must ends with 'aa' or "bb

d) Is the language of Deterministic PDA and Non – deterministic PDA same?

e) Classify different types of Turing Machine

f) Define Arden's theorem

g) Can a context-free grammar generate an infinite language?

h) What do you mean by complement of DFA? Explain with suitable example

i) Name any four closure properties of regular languages

j) State the halting problem of Turing machine.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) What are the applications of Turing Machine?

b) Compare and contrast the Moore machine and Mealy machine models of finite state machines. Provide five distinct points of comparison.

c) Apply the identities of regular expressions to prove the following: (1+00*1)+(1+00*1)(0+10*1)*(0+10*1) = 0*1(0+10*1)*.

d) Convert the following grammar into CNF S→cBA, S→A, A→cB, A→AbbS, B→aaa

e) Construct a minimum state automaton equivalent to given automaton whose transition table is given below:

States/Input	a	b
→q0	q1	q3
q1	q2	q4
q2	q1	q4
q3	q2	q4
*q4	q4	q4

f) Are there any languages which are not recursively enumerable, but accepted by a multi-tape Turing machine? Justify your answer.

g) Construct ϵ - NFA for the regular expression R = (cd | c)*. Construct the equivalent DFA by ϵ-closure method for the given regular expression

h) Consider the grammar G, where the productions are

E→F – E | E – F | F

F → a | b

Prove that the Grammar is ambiguous for the string a – b

i) Convert the following grammar into an equivalent one with no unit productions and no useless symbols S→ABA A→aAA|aBC|bB B→ A|bB|Cb C→CC|Cc

j) Does a Push down Automata have memory? Justify.

k) List the main application of pumping Lemma in CFL's

l) Are NPDA (Nondeterministic PDA) and DPDA (Deterministic PDA) equivalent? Illustrate with an example.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Explain the Chomsky hierarchy of languages, including the four types of languages and their associated grammars. **(16)**

Q4 Let G be the grammar: S→0B |1A, A→0 |0S |1AA, B→1|1S|0BB. For the string 00110101 find: (a) The leftmost derivation (b) The rightmost derivation (c) The derivation tree **(5+5+6)**

Q5 What is the purpose of normalization? Construct the CNF and GNF for the following grammar and explain the steps: S→aAa | bBb |€ A→C|a B→C|b C→CDE | € D→A|B|ab. Constuct a CFG for the regular expression (011+1)(01) **(2+8+6)**

Q6 Discuss variants of Turing Machine. Design a Turing Machine that will accept the language **$L = \{0^n1^n \mid n \geq 1\}$.** **(4+12)**