Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN										Course Code	2	1	C	S	5	1

Fifth Semester B.E. Degree Examinations, April/May 2024

AUTOMATA THEORY AND COMPILER DESIGN

Duration: 3 hrs **Max. Marks: 100**

Note: 1. Answer any* FIVE *full questions choosing ONE full Question from each Module.
2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*

Module-1

1. **a.** Mention four applications of automata theory. **04** (1 :1 : 1.2.1)

b. Design DFA accepting the following languages: **09** (4 :1 : 1.6.1)
(i) Set of all strings of a's and b's which end with abb
(ii)L = {w € {0, 1 }* : string w contain substring 011 }
(iii)L = {w € {a, b}* : string w begins with ab and is of even length }

c. Convert the following NFA to its equivalent DFA. Also draw transition diagram of equivalent DFA. **07** (3:1 : 2.5.1)

Ò	0	1
→p	{p}	{p, q}
q	{ r }	{ r}
⋆ r	ϕ	ϕ

(OR)

2. **a.** Define compiler. What is language processing system? List out any four system softwares of LPS. **05** (1 :1 : 1.2.1)

b. Explain various modules of compiler with a neat diagram. **08** (2 :1 : 1.6.1)

c. Translate the following assignment statement: **07** (3 :1 : 2.5.1)
a = b + c ∗ 45
Clearly indicate the input and output of each software module.

Module-2

3. **a.** Design regular expression for the following languages: **06** (4 :2 :2.5.1)
(i) set of all strings of a's and b's which contain substring abb
(ii) L = $\{a^n b^m : n>=4, m<=3\}$
(iii) L = $\{a^{2n} b^{2m+1} : m>=0, n>=0\}$

b. Prove that every language defined by a regular expression is also defined by finite automata (epsilon NFA). **05** (3 :2 : 2.5.1)

c. State and prove pumping theorem for regular languages. Show that $L=\{a^n b^n \mid n >= 0\}$ is not regular language. **09** (3 :2 : 2.5.1)

(OR)

4. **a.** Explain two buffer scheme with diagram. What are its drawbacks? Explain the use of sentinel character. **06** (2 :2 : 1.6.1)

b. Write an algorithm for advancing forward pointer. **06** (4 :2 : 2.5.1)

c. Write regular definition and transition diagram for following tokens: **08** (3 :2 : 2.5.1)
(i)Identifier (ii) Number

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

Module-3

5.	**a.**	Construct (i)Leftmost Derivation(LMD) (ii)Rightmost Derivation(RMD) (iii)Parse tree for the string 000101 using the grammar: S→A1B A→0A | € B →0B |1B| €	**07**	(3 :3 : 1.7.1)
	b.	Show that the following grammar is ambiguous for the statement: ' if expr then if expr then stmt else stmt' stmt → if expr then stmt | if expr then stmt else stmt' |other Write un-ambiguous grammar	**07**	(3 :3 : 1.7.1)
	c.	What is top-down parsing? Construct top-down parse tree for the input string id + id ⋆ id using the grammar: $E \rightarrow TE^I$ $E^I \rightarrow + TE^I \mid €$ $T \rightarrow FT^I$ $T^I \rightarrow \star FT^I \mid €$ $F \rightarrow (E) \mid €$	**06**	(3 :3 : 1.2.1)

(OR)

6.	**a.**	Compute FIRST ( ) set for the grammar of Q.No. **5.c**	**05**	(3 :3 : 1.2.1)
	b.	Explain the structure and working of predictive LL(1) parser with diagram.	**05**	(2 :3 : 1.6.1)
	c.	Construct predictive LL(1) parsing table for the following grammar: A → BaBb | CbCa B → € C → €	**10**	(4 :3 : 1.7.1)

Module-4

7.	**a.**	Define Push Down Automata. Design PDA for the following language: $L=\{a^n b^n \mid n >= 1 \}$. Draw the Transition Diagram. Write Sequence of ID's of PDA for the input string aaabbb	**10**	(4 :4 :2.5.1)
	b.	Design non determistic PDA(NPDA) for the following language: $L=\{w\ w^R \mid w \in (0,1\}^* \}$. Draw the transition diagram.	**10**	(4 :4 : 2.5.1)

(OR)

8.	**a.**	Perform shift reduce parsing of input string id ⋆ id using the grammar: E → E +T | T T → T ⋆ F | F F → (E) | id	**06**	(3 :4 : 1.6.1)
	b.	Explain the structure and working of SLR parser with a neat diagram.	**06**	(2 :4 : 1.2.1)
	c.	Compute canonical set of LR(0) items for the following grammar: A → (A) | a	**08**	(3 :4 : 2.5.1)

Module-5

9.	**a.**	Explain with a diagram the working of basic Turing machine.	**06**	(2 :5 : 1.2.1)
	b.	Define Turing machine. Design TM for the following Language: $L = \{a^n b^n : n >= 0 \}$. Write sequence of ID's of TM for the input string aabb	**14**	(4 :5 : 2.5.1)

(OR)

10	**a.**	Consider the grammar given below: S →E n E→ E + T | T T → T ⋆ F | F F →(E) | digit (i) Obtain SDD for the above grammar (ii) Write Annotated parse tree for the input string 7 ∗ 8 + 9	**08**	(3 :5 : 2.5.1)
	b.	Construct (i) three address code (ii) Quadruple (iii)Triple for the following expression: a + a ⋆ (b – c) + (b – c) ⋆ d	**06**	(3 :5 : 1.7.1)
	c.	Explain various issues in the design of code generator.	**06**	(2 :5 : 1.2.1)

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Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)