

**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT**

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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Fifth Semester B.E. Degree Examinations, September/October 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

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
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**Module-1**

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|-------------|--|-----------|----------------|
| 1.          | <p><b>a.</b> Describe the following terms with examples:<br/>(i) Alphabet (ii)String (iii)Language (iv)Power of Alphabet<br/>(v)<math>\Sigma^*</math> (sigma closure)</p>  | <b>10</b> | (2 :1 : 1.7.1) |
|             | <p><b>b.</b> Design DFA for the following languages:<br/>(i)<math>L = \{w \in \{a,b\}^* \mid \text{string } w \text{ end with substring } abb\}</math><br/>(ii)<math>L = \{w \in \{0,1\}^* \mid \text{string } w \text{ begins with } 01 \}</math><br/>(iii)<math>L = \{w \in \{0,1\}^* \mid \text{string } w \text{ contains substring } 01 \}</math></p> | <b>10</b> | (3 :1 : 1.7.1) |
| <b>(OR)</b> |  |           |                |

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|----|---|-----------|----------------|
| 2. | <p><b>a.</b> Describe any four applications of automata theory. Define deterministic Finite Automata.</p> | <b>10</b> | (2 :1 : 1.7.1) |
|    | <p><b>b.</b> Convert the following <math>\epsilon</math>-NDFSM into equivalent DFSM.</p>                  | <b>10</b> | (3 :1 : 1.7.1) |

Q	$\epsilon$	a	b	c
p	{q, r}	$\phi$	{q}	{r}
q	$\phi$	{p}	{r}	{p, q}
* r	$\phi$	$\phi$	$\phi$	{p}

**Module-2**

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|-------------|---|-----------|----------------|
| 3.          | <p><b>a.</b> Prove that every language defined by regular expression is also defined by Finite Automata.</p>  | <b>10</b> | (2 :2 : 1.7.1) |
|             | <p><b>b.</b> Design regular expression for the following languages<br/>(i) <math>L = \{a^m b^n : m+n \text{ is even}\}</math> (ii) <math>L = \{a^m b^n : m \geq 4, n \leq 3\}</math><br/>(iii) set of all strings of a's and b's which contain sub string abb</p> | <b>10</b> | (3 :2 : 1.7.1) |
| <b>(OR)</b> |   |           |                |

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|----|--|-----------|----------------|
| 4. | <p><b>a.</b> Define tokens, patterns and lexemes with examples. Describe the two buffer scheme that handles large lookaheads safely.</p>                                 | <b>10</b> | (2 :2 : 1.7.1) |
|    | <p><b>b.</b> Convert the following regular expressions to equivalent DFSM:<br/>(i)<math>(a+b)^*ab</math> (ii)<math>(01+1)^*0</math> (iii) <math>(aa)^*+(bb)^*</math></p> | <b>10</b> | (3 :2 : 1.7.1) |

**Module-3**

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|-------------|---|-----------|----------------|
| 5.          | <p><b>a.</b> Write regular definition and transition diagram for the following tokens:<br/>(i) Identifier (ii) Number (iii) Relational operator</p>                                     | <b>10</b> | (3 :3 : 1.7.1) |
|             | <p><b>b.</b> What is Ambiguity? Show that the following Grammar is Ambiguous.<br/><math>E \rightarrow E+E \mid E^*E \mid ( E ) \mid id</math> for the string <math>id+id^*id</math></p> | <b>10</b> | (3:3 : 1.7.1)  |
| <b>(OR)</b> |   |           |                |

6. a. Design CFG for the following languages: **10** (3 :3 : 1.7.1)  
 (i)  $L = \{a^{2n} b^m \mid n \geq 0, m \geq 0, 1\}$  (ii) Set of all strings with equal number of a's and b's.
- b. Consider the Grammar  $E \rightarrow E+E \mid E * E \mid (E) \mid id$ . Find Left most and rightmost derivation of and Parse tree for the string  $id + id * id$ . Show that the grammar is Ambiguous. **10** (3 :3: 1.7.1)

**Module-4**

7. a. Design Push Down Automata. Design PDA for the following languages: **10** (3 :4 : 1.7.1)  
 "Set of all strings which consists of equal number of a's and b's". Draw transition diagram.
- b. Design NPDA for the following language: **10** (3 :4 : 1.7.1)  
 $L = \{w w^R \mid w \in \{0,1\}^*\}$

**(OR)**

8. a. Construct SLR parsing table for the following grammar: **10** (3 :5 : 1.7.1)  
 $A \rightarrow (A) \mid a$
- b. Perform shift reduce parsing of input string  $id * id$  using following grammar: **10** (3:5 : 1.7.1)  
 $E \rightarrow E+T \mid T \quad T \rightarrow T * F \mid F \quad F \rightarrow (E) \mid id$   
 Explain conflicts which occur during shift reduce parsing.

**Module-5**

9. a. Design a TM for  $L = \{0^n 1^n 2^n \mid n \geq 0\}$ . Show the moves for 001122. **10** (3 :5: 1.7.1)
- b. Define Turing machine. Explain with a diagram the basic working of Turing machine. Briefly explain Instantaneous Description (ID). **10** (3 :5: 1.7.1)
- (OR)**
- 10 a. Write the Syntax directed definition of a simple desk calculator and give annotated parse trees for the following expression:  $4 * 6 + 8$ . **10** (1 :1 : 1.7.1)
- b. Construct the syntax tree and DAG for the following expression:  $a + a * (b - c) + (b - c) * d$  **10** (1 :1 : 1.7.1)

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