



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 60007**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025  
 Fifth Semester  
 Information Technology  
 U23IT511 – AUTOMATA THEORY AND COMPILER DESIGN  
 (Regulation 2023)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

**PART – A**

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	A mobile number validation service requires numbers to be exactly 12 digits. However, it is prefixed by '+'. Write a CFG for the same.	2	K2	CO1
2.	In a chat app, any string of a's and b's is blocked if it contains the sequence "bbb". Write a RE for allowed messages.	2	K2	CO1
3.	What advantages are there to a language-processing system in which the compiler produces assembly language rather than machine language?	2	K2	CO2
4.	What language is generated by the following grammar? $S \rightarrow S ( S ) S \mid \epsilon$ and $S \rightarrow + S S \mid - S S \mid a$	2	K1	CO2
5.	Construct recursive-descent parsers, starting with the following grammar: $S \rightarrow 0 S 1 \mid 0 1$	2	K2	CO3
6.	Write two uses of bootstrapping in compilers.	2	K1	CO3
7.	Define inherited and synthesized attributes.	2	K1	CO4
8.	Differentiate between quadruple and triple representations.	2	K2	CO4
9.	Define an activation record with a suitable diagram.	2	K1	CO5
10.	Differentiate between static and dynamic storage allocation.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	A communication system logs '0' for silence and '1' for signal. A session is valid if the silence-signal pattern (01) occurs exactly twice. Construct a DFA that models this system, show its structural representation (i.e., transition diagram and transition table), and explain how the DFA prevents extra 01 patterns.	13	K2	CO1
	(OR)			
b)	In a mobile app, a password must start with a capital letter, contain at least one small letter and one digit, and end with a special symbol (!, @, #). Draw how an NFA can be designed to validate such passwords. Show the transition diagram and transition table. Why is NFA more suitable in this case than DFA?	13	K2	CO1
12. a)	Consider the context-free grammar: $S \rightarrow S S +   S S *   a$ (i) Give a leftmost derivation for the string. (ii) Give a rightmost derivation for the string. (iii) Give a parse tree for the string. (iv) Is the grammar ambiguous or unambiguous? Justify your answer. (v) Describe the language generated by this grammar.	13	K2	CO2
	(OR)			
b)	Explain the phases of a compiler with a neat diagram.	13	K2	CO2
13. a)	Construct the canonical LR and LALR sets of items for the grammar $S \rightarrow S S +   S S *   a$	13	K3	CO3
	(OR)			
b)	For the following grammar, devise predictive parsers and show the parsing tables. You may left-factor and/or eliminate left-recursion from your grammars first. $bexpr \rightarrow bexpr \text{ or } bterm   bterm$ $bterm \rightarrow bterm \text{ and } bfactor   bfactor$ $bfactor \rightarrow \text{not } bfactor   ( bexpr )   \text{true}   \text{false}$	13	K2	CO3
14. a)	Construct a syntax-directed translation scheme that translates arithmetic expressions from infix notation into prefix notation in which an operator appears before its operands; e.g., -xy is the prefix notation for x - y.	13	K3	CO4
	(OR)			
b)	Generate intermediate code for the following program construct along with the required syntax directed translation. If(a<b) small=a else small=b	13	K3	CO4

15. a) Explain peephole optimization and object code forms in detail with examples. Explain loop optimization techniques and demonstrate how they improve program efficiency with examples. 13 K3 CO5
- (OR)
- b) Construct the DAG and identify the value numbers for the subexpressions of the following expression, assuming + associates from left. 13 K3 CO5
- (i)  $a + b + (a + b)$   
(ii)  $a + b + a + b$   
(iii)  $a + a + (a + a + a + (a + a + a + a))$ .
- Translate the following assignment statements
- (iv)  $a = b[i] + c[j]$  and  
(v)  $a[i] = b * c - b * d$  into a syntax tree, quadruples, triples, and indirect triples.
- Translate the following expression using the goto-avoiding translation scheme.
- (vi)  $\text{if } (a == b \ \&\& \ c == d \ || \ e == f) \ x == 1;$

PART – C

(1 x 15 = 15 Marks)

- | Q.No.  | Questions  | Marks | KL | CO  |
|--------|--|-------|----|-----|
| 16. a) | Consider the recent Men's Asia Cup 2025. Each match is played between two countries and for 20 overs. In each over, there are six balls bowled. Let us assume that each ball can result in 0 or 1 run. It has been observed that if the first three balls result in R1, R1, and R1 runs, then the successive three balls result in R2, R2, and R2 in a typical scenario. Note that $R_i, 1 \leq i \leq 2, \in \{0, 1\}$ . For example, if the first three balls result in 0, 0, and 0, then the three successive balls result in 1, 1, and 1. If we consider this typical finite scenario as a language L, construct an NFA to accept this language. Show the transition diagram and transition table. Convert it to a DFA, if applicable, and show the transition diagram and transition table. | 15    | K4 | CO1 |
| (OR)   |  |       |    |     |
| b)     | Consider the following expression grammar.<br>$E \rightarrow E + T / T$<br>$T \rightarrow T * F / F$<br>$F \rightarrow (E) / id$<br>(a) Compute LR(0) items for the grammar.<br>(b) Construct an SLR Parsing table involving Action and GoTo functions.<br>(c) Describe the moves made by the LR parser on the input string $id * id + id$   | 15    | K3 | CO3 |