EPCET LIBRARY BANGALORE-49

CBCS SCHEME

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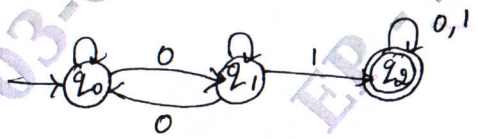
BCS503

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026
Theory of Computation

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Define DFA. Design the DFA to accept each of the following languages. i) Draw a DFA to accept decimal strings divisible by 3. ii) L = { W∈ {a, b}* , W has even number of a's and odd number of b's}.	**10**	**L2**	**CO1**
	b.	Convert the following NFA to DFA → p: {p, q}, {p} q: {r}, {r} r: {s}, ϕ * s: {s}, {s}	**10**	**L3**	**CO1**
		OR			
Q.2	**a.**	Define the following terms with an example : i) Alphabet ii) Power of an alphabet iii) String iv) Concatenation v) Languages.	**10**	**L2**	**CO1**
	b.	Consider the 6 – NFA. Compute ∈ – CLOSURE of each state and convert the automaton to DFA. → p: ϕ, {p}, {q}, {r} q: {p}, {q}, {r}, ϕ * r: {q}, {r}, ϕ, {p}	**10**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Define Regular expression. Obtain the RE for the following languages. i) $L = \{a^n b^m / m + n \text{ is even}\}$ ii) L = {w : | w | mod 3 = 0 , where w ∈{a, b}*}.	**6**	**L2**	**CO2**
	b.	Obtain the ∈ - NFA for the Regular expression : i) (a + b)* abb (a + bb) i) ab (a + b)* aab.	**6**	**L2**	**CO2**
	c.	State and prove Pumping Lemma theorem for Regular Languages and prove the Language $L = \{a^n b^n / n \geq 1\}$ is not Regular language.	**8**	**L3**	**CO2**
		OR			

Q.4	**a.**	Minimize the following DFA using Table filling algorithm : | | a | b | |---|---|---| | →A | B | F | | B | G | C | | * C | A | C | | D | C | G | | E | H | F | | F | C | G | | G | G | E | | H | G | C |	**8**	**L3**	**CO2**
	b.	Prove that Regular Languages are closed under i) Intersection ii) Complementation.	**6**	**L2**	**CO2**
	c.	Obtain a RE for the following (Fig. Q4(c)). Finite Automation by Eliminating states.  Fig. Q4(c)	**6**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Define Leftmost Derivation , Rightmost Derivation and Parse tree. Construct LMD , RMD and Parse tree for the string aaabbabba using the following grammar. $S \rightarrow a\,B / b\,A$; $A \rightarrow a\,S / b\,A\,A / a$; $B \rightarrow b\,S / a\,B\,B / b$.	**10**	**L2**	**CO3**
	b.	Define Ambiguous grammar. Verify whether the grammar is ambiguous or not for the string id * id + id. $E \rightarrow E + E / E * E / (E) / id$	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Define PDA. Design a PDA to accept the following language: $L = \{a^n b^n \mid n \geq 1\}$.	**10**	**L2**	**CO3**
	b.	Obtain the PDA for the following CFG : $S \rightarrow aABC$ $A \rightarrow aB \mid a$ $B \rightarrow bA \mid b$ $C \rightarrow a$	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Simplify the following CFG by eliminating useless symbols. Remove $\in$ - productions and unit productions : $S \rightarrow AB / C / \in$ $A \rightarrow aA / B / \in$ $B \rightarrow bB / C$ $C \rightarrow c / D$ $D \rightarrow d / \in$ $E \rightarrow e\,E$	**10**	**L2**	**CO4**

	b.	State and prove Pumping Lemma theorem for CFL's. Show that the language L = { $0^n 1^n 2^n$ / n ≥ 1} is not context free language.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Write the Procedure for Removal of ∈ - productions. Simplify the following grammar : S → aA /aBB A → aAA /∈ B → bB / bbC C → B	**10**	**L3**	**CO4**
	b.	Define CNF. Convert the following grammar to CNF [Chomsky Normal Form]. S → aA /bB A → aAA /bS / b B → bBB / aS / a	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define Turing Machine (TM). Design a TM for the Language L = {$0^n 1^n$ / n > = 1}. Show that the string 0011 is accepted.	**10**	**L3**	**CO5**
	b.	Explain the following : i) Multitape Turing Machine ii) Non- deterministic Turing Machine.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the following : i) Recursively enumerable language. ii) Halting problem in TM.	**10**	**L3**	**CO5**
	b.	Design a TM for the Language L = {$0^n 1^n 2^n$ / n >= 1}. Show that the string 000111222 is accepted.	**10**	**L2**	**CO5**

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