Code No: RT22055 **R13** SET - 1

II B. Tech II Semester Supplementary Examinations, Dec/Jan-2015-16
FORMAL LANGUAGE AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) Write a short note on Mathematical representation of Finite State Machine?
   b) List out the properties of recursive enumerable language?
   c) Draw the NFA accepting the set of all strings whose second symbol from last is 1?
   d) Construct a regular grammar for L={ $0^n11 | n\geq1$}?
   e) List and explain four components used to form a context free grammar?
   f) Define P and NP? Give some examples that fall into the class of P and NP?
   (3M+4M+4M+4M+4M+3M)

PART-B

2. Design a Finite State Machine (FSM) that will take an arbitrary-sized integer as input, one bit at a time (starting from most significant bit), and return the remainder after this integer is divided by 3. (16M)

3. a) Show that every context sensitive language is recursive?
   b) Find the language generated by context sensitive language G={V,T,P,S} where the production P={S->aSB|abc, bB->bbc,cB->Bc} (8M+8M)

4. Construct a Deterministic Finite State Automata equivalent to the NFA given below M={(q_0,q_1,q_2), {a,b} ,δ, q_0, { q_2}} where δ is defined by the following transition table (16M)

δ	0	1
q_0	(q_0,q_1,q_2)	(q_2)
q_1	(q_0)	(q_1)
q_2	null	(q_0,q_1)

5. a) Construct a Finite Automata equivalence to the regular expression (0+1)*(00+11)(0+1)*?
   b) Construct a NFA equivalent to the regular expression (10+11)*00. (8M+8M)

6. a) Construct equivalent grammar in Chomsky Normal Form for the grammar G=({S,A,B, {a,b}, S->aAbB, A->aA/a, B->bB/b } ,S}
   b) List and explain the Properties for Equivalence of Moore and Mealy Machines? (10M+6M)

7. Define Turing Machine and design it to recognize the language L = { 0^n1^n | $n\geq1$}. Illustrate the action of turing machine in accepting the word 0^31^3 (16M)

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Code No: RT22055 **R13** SET - 1

II B. Tech II Semester Regular Examinations, May/June - 2015
FORMAL LANGUAGE AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1	a)	What is Finite State Machine? What are the elements of FSM?	(3)
	b)	What is the difference between CFG and CSG?	(3)
	c)	Consider a DFA M = (Q, $\sum$, δ, q_0, F), What is the minimum and maximum number of initial states in it?	(2)
	d)	Give the formal definition of Moore machine	(2)
	e)	What are the applications of CFG?	(3)
	f)	List out the components of turing machine	(3)
	g)	What is dead state? Give an example.	(3)
	h)	Give the formal definition of TM? Give the block diagram of TM	(3)

PART-B

2	a)	What is Computation? What are the different models of Computation? Explain	(5)
	b)	What are the different classes of automata? How they are classified? Explain in detail.	(5)
	c)	Give the formal definition of FSM? What are the examples of FSM?	(6)
3	a)	What are the different operations on strings? Explain with examples?	(3)
	b)	What are the different types of languages in automata theory? Clearly give the rules for each of these languages and the relationship among these languages	(6)
	c)	Consider a language L^*, where L={ab,cd} with $\sum$={a,b,c,d}. (i) write all words in L^* that have six or less letters/symbols (ii) What is the shortest string in $\sum^*$ that is not in the language L^*?	(7)
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4 a) Construct a DFA accepting the language L={w: |w| mod 8 ≠0}on ∑={a,b} (8)

b) Obtain a DFA to accept strings of *a's* and *b's* such that, each block of 5 consecutive symbols has at least two *a's*. (8)

5 a) What is Arden's Theorem. Explain (4)

b) Convert the following DFA to RE. (6)

	0	1
p	p	q
q	q	r
r	r	r

c) Check whether the following two DFA's are equal or not (6)

	0	1
q1	q1	q2
q2	q3	q1
q3	q2	q3

	0	1
q4	q4	q5
q5	q6	q4
q6	q7	q6
q7	q6	q4

6 a) What is Chomsky's hierarchy? Explain (5)

b) What is Unit production? What is the procedure to remove the unit productions in CFG. (4)

c) Convert the following grammar to CNF. (7)

$S \rightarrow bA \mid aB$

$A \rightarrow bAA \mid aS \mid a$

$B \rightarrow aBB \mid bSbb$

7 a) Design a total Turing machine to accept the language: L2 = {w Є {a, b, c}*| #a(w) ≤ #b(w) ≤ #c(w)} (Note: '#' means number) (12)

b) Explain about P and NP classes of languages. (4)

Code No: RT22055 **R13** SET - 2

II B. Tech II Semester Regular Examinations, May/June - 2015
FORMAL LANGUAGE AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1	a)	What is Finite State Machine? What are the advantages of FSM	(4)
	b)	Define regular expression	(2)
	c)	Consider a NFA M=(Q,∑, δ, q_0, F), What is the minimum and maximum number of states in it?	(3)
	d)	Give the formal definition of Mealy machine. Give an example	(3)
	e)	What is ambiguous grammar? Give an example	(3)
	f)	What is trap state? Give an example	(3)
	g)	Differentiate between PDA and TM with respect to tape and head	(4)

PART-B

2	a)	What is state diagram and state transition table. Explain with an example.	(5)
	b)	What are the different classes of automata? How they are classified? Explain in detail.	(5)
	c)	What are the components of FSM? Explain.	(6)
3	a)	What is push down Automata? Show how context free language is accepted by push down automata.	(8)
	b)	Consider a language L^*, where L={ab, cd} with ∑={a,b,c,d}. (i) Write all words in L^* that have six or less letters/symbols (ii) What is the shortest string in $\sum^*$ that is not in the language L^*?	(8)
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4 a) Construct a DFA accepting the language: {W∈{a,b}*: W has both ab and ba as substrings} (8)

b) Design a ε-NFA for the regular expression a*bc/ab*/c* (6)

c) Define ε-closure of a state? Give an example (2)

5 a) What are the properties of Regular sets? Explain (4)

b) Convert the following DFA to RE. (6)

	0	1
p	p	q
q	q	r
r	p	r

c) Check the following two DFA are equal or not (6)

	0	1
q1	q1	q2
q2	q3	q1
q3	q2	q3

	0	1
q4	q4	q4
q5	q6	q4
q6	q4	q6
q7	q6	q4

6 a) What is use of simplification of CFG? What is the procedure to simplify the CFG? Explain (8)

b) Simplify the following grammar. (8)

$S \rightarrow aAa$

$A \rightarrow bBB / D$

$B \rightarrow ab / \varepsilon$

$C \rightarrow aB$

7 a) Give the formal definition of TM? What are the components of TM? What is *id* of TM? (6)

b) Design a Turing Machine for the {L=ww^R/w∈(0+1)*} (10)

Code No: RT22055 **R13** SET - 3

II B. Tech II Semester Regular Examinations, May/June - 2015
FORMAL LANGUAGE AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1	a)	What is Finite State Machine? What are the disadvantages of FSM	(3)
	b)	Φ*=-------- and ε*=-------	(2)
	c)	Consider a ε-NFA M=(Q,∑, δ, q_0, F), What is the minimum and maximum number of states in it?	(2)
	d)	What is Unit Production? If you eliminate the unit productions from the given CFG, what will be the effect on the language by the resultant grammar	(3)
	e)	When you convert Є-NFA to NFA, how do you decide the final states of resultant NFA. Give an example	(4)
	f)	What is left recursion? How to eliminate the left recursion	(4)
	e)	Differentiate between PDA and TM with respect to: halt state and final state	(4)

PART-B

2	a)	Give the formal definition of FSM? What are the examples of FSM?	(5)
	b)	Write short note on classification of Automata	(5)
	c)	What is state diagram and state transition table? Explain with an example.	(6)
3	a)	Differentiate NFA with DFA	(3)
	b)	Describe on detail about recursive enumerable language	(6)
	c)	Write regular expression for the language over {0,1}: the set of all strings that contain 1011.	(7)
4	a)	What are the advantages of NFA	(4)
	b)	Design a ε-NFA for the regular expression a*/b*/c*	(6)
	c)	Construct a DFA accepting the language: {WЄ{a,b}*: W has neither aa nor bb as a substring}	(6)
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5 a) Write short note on i) optimum DFA ii) Two wag DFA. (4)

b) Convert the following DFA to RE. (6)

	0	1
p	p	r
q	q	r
r	q	r

c) Check the following two DFA are equal or not (6)

	0	1
q1	q1	q2
q2	q3	q1
q3	Q3	q3

	0	1
q4	q6	q5
q5	q6	q4
q6	q7	q5
q7	q6	q4

6 a) Define Chomsky Normal form and Greibach Normal form? What is the difference between these two normal forms. (8)

b) Convert the following CFG into GNF. (8)

$A_1 \rightarrow A_2 A_3$

$A_2 \rightarrow A_3 A_1 / b$

$A_3 \rightarrow A_1 A_2 / a$

7 a) Give the formal definition of TM? What are the different types of TMs? Explain. (6)

b) Design a Turing Machine for L = $\{wcw^R / w \in (0+1)^*\}$ (10)

Code No: RT22055 **R13** SET - 4

II B. Tech II Semester Regular Examinations, May/June - 2015
FORMAL LANGUAGE AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1	a)	What is Finite State Machine? What are the applications of FSM	(3)
	b)	If L={ ε , 00,01,10,11, 000,….111,…}, find $\bar{L}$ over the alphabet {0,1}	(3)
	c)	Consider a DFA M=(Q,∑, δ, q_0, F), What is the minimum and maximum number of final states in it?	(2)
	d)	What is useless symbol in a CFG? If you eliminate the useless symbols and productions from the given CFG, what will be the effect on the language by the resultant grammar	(3)
	e)	What is left recursion? How to eliminate the left recursion	(3)
	f)	Give the formal definition of Moore machine?	(2)
	g)	What is an infinite loop in TM? Explain with an example.	(3)
	h)	Give the differences between DFA and 2DFA with examples.	(3)

PART-B

2	a)	Give the general procedure for drawing a state diagram from transition table.	(5)
	b)	Construct a finite automata with transition for the regular expression $r = 01^*+10$	(5)
	c)	Define cellular and geographic automata.	(2)
	d)	What are the components of FSM? Explain	(4)
3	a)	Write a short note on i) Symbols ii) Alphabets and ii) Strings.	(3)
	b)	Write a short note on PDA with an example.	(6)
	c)	Write regular expression for the language over {0,1}: the set of all strings that contain 100.	(7)
4	a)	Define ε-closure of a state? Give an example	(3)
	b)	Design a DFA to accept odd number of *a's* and even number of *b's*, where ∑={a,b}. Show the acceptance of a string with an example	(7)
	c)	Design a ε-NFA for the regular expression a*b/cb*/ac*b	(6)
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5 a) List out the properties of Regular sets and Regular languages (4)

b) Minimize the following DFA, where state '0' is the start state and 3,5,6&7 are the final states. (6)

	a	b
0	1	2
1	4	5
2	3	-
3	-	-
4	4	2
5	6	-
6	7	-
7	7	-

c) Check the following two DFA are equal or not (6)

	0	1
q1	q1	q2
q2	q3	q1
q3	q2	q3

	0	1
q4	q4	q5
q5	q5	q4
q6	q7	q6
q7	q6	q4

6 a) What is normalization of CFG? What is the use of Normalization? What are the different normal forms? Explain (8)

b) Convert the following CFG into GNF. $S \rightarrow AA|0$, $A \rightarrow SS|1$ (8)

7 a) Design Turing machine to compute the function n! (Factorial of a number) (12)

b) Explain about undecidable problem (4)

Code No: RT22055 **R13** SET - 1

II B. Tech II Semester Supplementary Examinations, Nov/Dec-2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) What is the role of Automata in real world?
   b) Define Context-Sensitive Language? Give example.
   c) List down the Advantages of Non-Deterministic Finite Automata?
   d) State and explain the the Components of Regular Expression?
   e) Give an eaxmple to show the Elimination of Unit Productions?
   f) Describe Multiple Tape Turing Machine? Is it true that multiple tape turing machine is superior to single tape turing machine in the language acceptance? Justify your answer?
   (3M+4M+4M+4M+4M+3M)

PART-B

2. a) Construct a finite automata that accepts those strings over {a,b} that contain *aaa* as substring.
   b) Write a short notes on Automata Classification? (8M+8M)

3. a) Describe in detail about recursive enumerable languages?
   b) What is push down automata? Show how context free languages accepted by push down automata? (8M+8M)

4. Construct a Deterministic Finite State Automata equivalent to the NFA given below $M=\{(q_0,q_1,q_2,q_3), \{0,1\}, \delta, q_0, \{q_3\}\}$ where δ is defined by the following transition table

δ	0	1
q_0	(q_0,q_1)	(q_0)
q_1	(q_2)	(q_1)
q_2	(q_3)	(q_3)
q_3	null	(q_2)

(16M)

5. a) Construct an NFA equivalent to the regular expression 1*0+1101 and (0+1)*.
   b) Construct the regular grammar to generate the following Language $L=\{ a^n b^m \mid n,m \geq 1\}$
   (8M+8M)

6. a) Construct equivalent grammar in Chomsky Normal Form for the grammar
   G=({S,A,B, {a,b}, S->bA/aB, A->bAA/aS/a, B->aBB/bS/b } ,S}
   b) Give an example to explain the Relation between Regular Grammar and Finite Automata?
   (10M+6M)

7. Design a Turing Machine to recognize the language $L=\{ 1^n 2^n 3^n \mid n \geq 1\}$ (16M)

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Code No: RT22055 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Construct a finite automata that accepts {0,1}+. (4M)
   b) List out the properties of recursive and recursively enumerable language. (4M)
   c) Differences between DFA and NFA with examples. (4M)
   d) What is a regular set? Give examples for it. (3M)
   e) How to remove Ambiguity from grammars? Explain with an example. (4M)
   f) Define universal Turing machine and universal language. (3M)

PART -B

2. a) Construct a finite state automata that accepts the language $\{a^ib^jc^k/i,j,k>0\}$. (8M)
   b) What is a Finite state machine? Give the mathematical representation of FSM. Explain each component. (8M)

3. a) Show that the language $L= \{a^nb^nc^n: n\geq 0\}$ is not context free. (8M)
   b) Briefly explain about various operations on Strings with suitable examples. (8M)

4. Define the DFA and regular expression. DFA accepts all strings corresponding to the expression 1*01(0+11)*. Also explain how to convert DFA to regular expression by eliminating states. (16M)

5. a) Convert the following regular expression into NFA with ∈ transition. (8M)
   i) 1*0+1101 ii) (0+1)*
   b) Give the properties of regular expressions and state and prove Arden's theorem. (8M)

6. Remove all ∈ and unit production rules from the following CFG (16M)
   S → AaA/ CA/ BaB
   A → aaBa/ CDA / aa / DC
   B → bB / bAB / bb/ aS
   C → Ca / bc / D
   D → bD / A

7. a) Design a Turing machine that accepts the language L ={ WW^R / W∈ (0+1)* and W^R is reverse of W} (10M)
   b) What is post correspondence problem? Explain with an example. (6M)

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Code No: RT22055 **R13** SET - 2

II B. Tech II Semester Regular Examinations, April/May - 2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Construct a finite automaton that accepts $\{0,1\}^*$ (4M)
   b) Write any one application of CFG with example. (4M)
   c) What are the differences between DFA and NFA? (4M)
   d) Obtain the regular expression to accept strings of a's , b's and c's such that fourth symbol from the right is a and ends with b. (4M)
   e) Differentiate Chomskey and Gueibach normal forms (3M)
   f) Role of Checking of symbols in a Turing machine. (3M)

PART -B

2. a) Construct a finite state automata that accepts those strings over {a,b} that contain aaa as substring. (8M)
   b) What is an Automaton? Give its classification. Give the applications of automata in real world. (8M)

3. a) Write detail note on recursive enumerable languages with an example. (6M)
   b) Compare and contrast between regular grammar and unrestricted grammar with example. (10M)

4. a) Convert the regular expression (ab+aba)* to a NFA. (8M)
   b) Construct a Non Deterministic Finite automaton (NDFA) with $\in$-moves for the regular expression (10+11)*00. (8M)

5. a) Briefly explain how to convert regular expression into Automata with an example. (8M)
   b) Mention the differences between DFA, NFA and e-NFA. (8M)

6. a) Construct a Greibach Normal Form grammar equivalent to the following CFG (8M)
   S → AA / 0
   A → SS / 1
   b) Prove that the following grammar of arithmetic expression is ambiguous. (8M)
   E → E+E / E*E / (E) / (id)

7. a) Draw a transition diagram for Turing machine and explain it in detail. (6M)
   b) Design a Turing machine to accept the set of al palindrome over {0,1}*. Draw a transition diagram for the Turing machine of the above. (10M)
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Code No: RT22055 **R13** SET - 3

II B. Tech II Semester Regular Examinations, April/May - 2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Components of finite state automata. (4M)
   b) Give three examples of context sensitive grammar which are not context-free. (3M)
   c) Advantages and disadvantages of NDFA. (4M)
   d) What is Two-way DFA? Give its advantages of DFA. (4M)
   e) Show that the language L={ $a^n b^n$/ $n \geq 1$} is unambiguous. (4M)
   f) When do you say that a Turing machine accepts a string? (3M)

PART -B

2. a) Construct a finite state automata that recognizes all possible strings over the alphabet {0,1} ending with two consecutive zeros. (8M)
   b) Construct a finite state automata with $\in$-transition for the regular expression r=01*+10 (8M)

3. a) Show that the union of two recursive languages is recursive and the union of two recursive enumerable languages is also recursively enumerable. (8M)
   b) Explain the properties of recursive and recursively enumerable language in detail with an example. (8M)

4. a) Construct a DFA to accept the language L={w/w has both an even number of 0's and even number of 1's}. (8M)
   b) Explain the steps in the design of NFA with $\in$ - moves from NFA. (8M)

5. a) Construct a finite state automata equivalent to the regular expression (0+1)*(00+11)(0+1)* (8M)
   b) Explain the algorithm for optimization of DFA with suitable example. (8M)

6. a) Consider the CFG with the following production rules: (8M)
   S → aB/ bA
   A → bAA / aS/ a
   B → aBB / bS/ b
   Give the right most derivation and draw derivation tree for the string *abbaab*
   b) Find a Greibach normal form grammar equivalent to the following CFG. (8M)
   S → ASB/ AB
   A → a
   B → b

7. Design a Turing Machine which can multiply two positive integers. (16M)
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Code No: RT22055 **R13** SET - 4

II B. Tech II Semester Regular Examinations, April/May - 2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Draw a diagram for finite automata which represents a bank. (4M)
   b) What are context sensitive languages? Write one example. (3M)
   c) Draw a NFA which accepting the set of all strings whose second last symbol is 1. (4M)
   d) List the four components used to form a context free grammar. (4M)
   e) Chomsky normal form Vs Griebach normal form. (4M)
   f) Give examples of an undecidable problem. (3M)

PART –B

2. a) .Define the following terms, with an example for each: (8M)
      i) String ii) Alphabet iii) Powerset iv) Language
   b) Construct a finite state automata with $\in$-transition for the regular expression (ab+aba)* (8M)

3. a) Show that any non trivial property of the recursively enumerable language is undecidable. (8M)
   b) Define pumping lemma. How it is used in context free languages? (8M)

4. a) For the regular expression given below, obtain an NFA without $\in$-moves. (8M)
      (0+1)*(00+11)
   b) Discuss about equivalence of NFA and DFA. (8M)

5. a) Prove that regular sets are closed under union and complementation. (8M)
   b) Construct an NFA equivalent to the regular expression 10+(0+11)0*1 (8M)

6. a) Design a Moore machine that accepts all strings of 0's and 1's treated as binary integer number return a remainder 1 when divided by 3. (8M)
   b) Convert the following grammar into Chomsky Normal Form. (8M)
      S → aB/ bA
      A → bAA / aS/ a
      B → aBB / bS/ b

7. Design A Turing Machine to recognize the language $\{1^n2^n3^n/n\geq1\}$. (16M)

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Code No: R22055 **R10** SET - 1

II B. Tech II Semester Regular Examinations August – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) How NFA is different from DFA? Explain with an example.
   b) Design a DFA which accepts all the strings with even number of 0's and odd number of 1's over an alphabet {0,1}

2. a) State and prove the minimization of DFA with an example.
   b) Explain the finite automata with outputs Moore and mealy machines with simple examples.

3. a) What is regular expression? Explain the operations and applications of regular expressions.
   b) Convert the given regular expression **l(l|d)*l** over an alphabet {l, d} into NFA. Use extended transitions.

4. a) What is Context-sensitive language? How Linear Bounded Automata is related with it? Explain.
   b) Explain the procedure for the inter conversion of regular grammars and finite automata with an example.

5. Minimize the grammar G given into equivalent grammar by removing useless symbols and productions from it. And also explain the reasons for minimization of grammar.
   S→aAa A→Sb|bcc|DaA C→abb|DD E→ac D→aDA

6. a) Define Push Down Automata (PDA). Discuss about the languages accepted by PDA
   b) Design Nondeterministic PDA for the language **L = { $0^n 1^n$| n>=1}**

7. Explain the following:
   a) Types of Turing machines used for computable functions.
   b) Unrestricted grammars.
   c) Recursive and recursively enumerable languages.

8. a) Explain what is undecidable problem and post correspondence problem?
   b) Consider the grammar G: **E→+EE |*EE |-EE |x |y.** Construct the left most and right most parse trees for the string ***+*-xyxy***
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Code No: R22055 **R10** SET - 2

II B. Tech II Semester Regular Examinations August – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) What is a relation? Explain representation and properties of relations.
   b) Design DFA which accepts all the strings ending with ***101*** over an alphabet {0,1}

2. a) Describe the formal notation for NFA with epsilon closure and the uses of epsilon closure.
   b) For regular expression **(0|1)*011,** draw the NFA with ϵ-closures and convert it into NFA.

3. a) How to find out equivalence of two DFA's. Explain with an example.
   b) Explain the closure properties of regular expressions.

4. a) What is regular grammar? How to convert left linear grammar into right linear grammars
   b) Derive left and right most derivations for the input string ***a=b*c+d/e*** for the given grammar
   E→E+E|E-E|E*E E→E/E E→(E)|id

5. a) What is ambiguous grammar? Explain how to eliminate the ambiguity from following the grammar **E→E+E| E-E|E*E|E/E|(E)|id**
   b) What is left recursion and left factoring in Context Free Grammars explain with examples?

6. Explain PDA definition model and Construct the PDA that accepts the language **L={$a^n b^n$ | n >=1}**. Give the graphical representation for PDA obtained. Show the instantaneous description of the PDA on the input string ***aaaabbbb***

7. a) Explain with neat diagram working of Turing machine and the types of Turing machines.
   b) Design Turing machine to accept all set of palindromes over {0, 1}*. And also write the transition diagram and instantaneous description on the string ***10101***

8. Write short notes on the following.
   a) NP complete and NP hard problems.
   b) Universal Turing machine.
   c) Halting problem of a turning machine.
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Code No: R22055 **R10** SET - 3

II B. Tech II Semester Regular Examinations August – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. Explain the following:
   a) Operations on strings and languages
   b) Finite State Machines
   c) DFA for formal language which does not contain ***100*** as substring over an alphabet {0, 1}.

2. Design NFA to recognize the set of strings such as ***lab, calb, dabl*** over an alphabet {*a, b, c, d, l*} and convert each NFA to equivalent DFA

3. a) Explain the algebraic laws of regular expressions.
   b) Explain the procedure for the conversion of DFA into regular expression like ***(1|0)*110(1|0)**** *over an alphabet {0,1}.*

4. a) What is Context-Free grammar? Explain each tuple in its representation.
   b) What is derivation? Explain the types of derivations for the grammar which defines arithmetic expressions.

5. a) Differentiate Chomsky and Greibach Normal forms.
   b) Convert the following grammar G into CNF
   S→aAD A→aB|bAB B→b D→d

6. a) Convert the following Grammar G to PDA that accepts the same language by empty stack **S→0S1|A A→A0|S|c**
   b) Explain the graphical notation of PDA with an example and acceptance of context free languages by PDA.

7. a) Define Turing machine. Explain with diagram, general structure of multi tape Turing machine.
   b) Design Turing machine to accept language **L = { WW ^{R} | W Є (a+b)*}**

8. a) Explain about NP complete and NP hard problem.
   b) Write short notes on Halting problem of Turing machines.
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Code No: R22055 **R10** SET - 4

II B. Tech II Semester Regular Examinations August – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) What is finite automaton model? How it is useful for the acceptance of strings and languages explain with an example.
   b) Design a language recognizer which consists of any number of 0's followed by number of 1's followed by number of 2's.

2. a) State and prove the theorem for equivalence of NFA and DFA.
   b) Design a finite state machine to find out the residues of 3.

3. Draw and explain the basis construction of regular expressions and also convert the regular expression ***(01|1)**** into equivalent DFA over an alphabet {0,1}

4. a) Explain the Chomsky hierarchy of languages.
   b) Differentiate right linear and left linear grammars with an example.

5. a) Explain and prove the usage of Pumping Lemma for Context free languages?
   b) What is ambiguous grammar? Check out ambiguity for the given grammar G and consider the input string as ***aaabab***
   S→AbB A→aA|є B→aB|bB|є

6. a) Obtain PDA for the following grammar
   S→AS|є A→0A1|A1|01
   b) What is deterministic PDA? Differentiate acceptance by final state and acceptance by empty state.

7. a) Explain the general structure of multi tape and non deterministic Turing machines and show that these are equivalent to basic Turing machines.
   b) Design Turing machine and its transition diagram to accept the language $\mathbf{L = \{a^n\ b^n \mid n >= 1\}}$

8. Write short notes on the following:
   a) Classes of P and NP problems
   b) Decidable and un-decidable problems
   c) LR(0) Grammars
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Code No: R22055 **R10** SET - 1

II B. Tech II Semester Supplementary Examinations January – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. Describe the following:
   a) Alphabet, String, Language, Empty String. b) NFA.
   c) Transition Diagram. d) **δ** in NFA with **ε** (Epsilon) moves

2. a) Write an algorithm to minimize a given FA
   b) Minimize the following FA

S	0	1
→ a0	a0	a3
a1	a2	a5
a2	a3	a4
a3	a0	a5
a4	a0	a6
a5	a1	a4
(a6)	a1	a3

3. a) Design a Moore Machine to determine the residue mod 4 for each binary string treated as integer.
   b) Design a Mealy machine that uses its state to remember the last symbol read and emits output '**y**' whenever current input matches to previous one, and emits n otherwise.

4. Construct the Left Linear Grammar for the following Regular Expressions:
   a) (11+0)* (00+1)*
   b) 10+ (0+11)0*1

5. Design DPDA for the language L={ $\mathbf{a^n b^{2n}}$ / **n>0**}

6. a) Explain in brief the properties of recursive and recursively enumerable languages
   b) Prove that PCP is undecidable

7. Design Turing Machine over ∑={1} to accept the language L={1^m/m is odd}

8. Write about:
   a) Multi tape Turing Machine b) NP Hard and NP Complete problem

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Code No: R22055 **R10** SET - 2

II B. Tech II Semester Supplementary Examinations January – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. Define and explain briefly about the following:
   a) A Deterministic Finite State Automaton.
   b) Notation For configuration for such an automaton.
   c) The notation such that an automaton produces output ' *u*' on input '*w*'.
   d) The notation such that an automaton computes a function

2. a) Construct NFA for given NFA with Є –moves Figure 1.

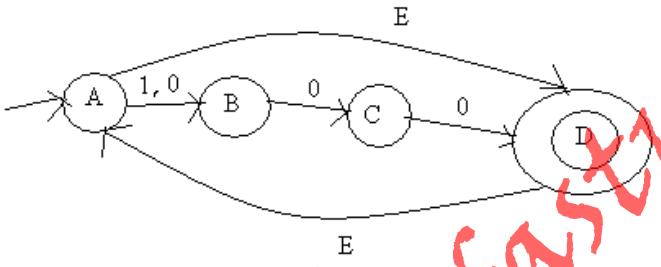


Figure 1.

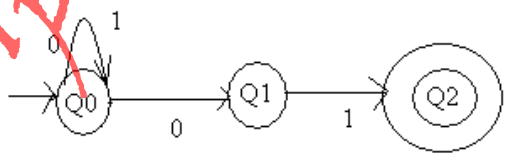
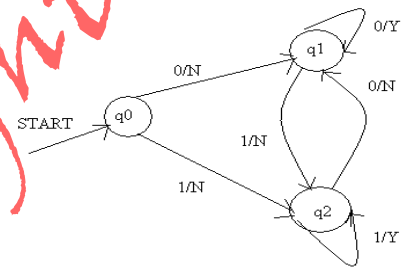


Figure 2.

   b) Construct DFA for given NFA Figure 2.

3. a) Design a Moore machine to determine the residue mod 5 for each ternary string (base3) treated as ternary integer.
   b) Convert the following Mealy machine into equivalent Moore machine.



4. Construct Minimum state DFA for the following Regular expression ((ab)* U (bc)*)ab

5. a) Give CFG for generating odd palindromes over the string {a,b}
   b) Design PDA for L={WCW^R /W€(0+1)*

6. Write and explain Closure properties of CFL's

7. Design Turing Machine for the language L= {$\mathbf{a^n b^n c^n}$ / n>1 }

8. Discuss about:
   a) Church's hypothesis b) NP Problems

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Code No: R22055 **R10** SET - 3

II B. Tech II Semester Supplementary Examinations January – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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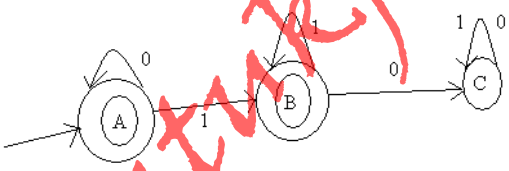
1. Describe the following:
   a) Operations on sets
   b) Relation and its properties
   c) Prefix, suffix, concatenation, empty string
   d) DFA

2. a) Show that for every NFA there exists an equivalent DFA.
   b) Construct DFA equivalent to the NFA $\{p,q,r,s\},\{0,1\},\delta_2,p,\{q,s\}\}$

	0	1
P	Q,S	Q
Q	R	Q,R
R	S	P
S	--	P

3. Give a regular expression for the set of all strings over {a, b} accepting all strings which have number of a's divisible by 6 and number of b's divisible by 8.

4. a) Obtain regular grammar for the following FA



   b) What is the language accepted by above FA?

5. Convert the following Grammar into CNF
   S → AbcD / abc
   A → aASB / d
   B→ b/ cb
   D → d

6. Write and Explain Closure Properties of Regular sets.

7. Design Turing Machine over $\sum=\{0,1\}$ to accept the language $L=\{0^m1^m/m>0$

8. Write Short Notes on:
   a) Turing Machine b) Undecidability c) Universal Turing Machine.
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Code No: R22055 **R10** SET - 4

II B. Tech II Semester Supplementary Examinations January – 2014
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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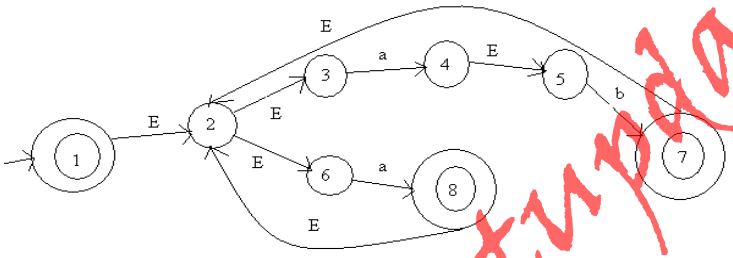
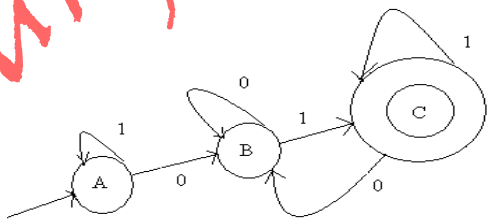
1. a) Design DFA which accepts even no. of 0's over { 0 , 1 }
   b) Design DFA which accepts Language L={100,101}

2. For the following NFA with Є -moves convert it in to an NFA without Є -moves and show that NFA with Є -moves accepts the same language.



3. Construct FA for the following regular expressions
   a) (0+1)*(1+00)(0+1)* b) 0+10* +01*0

4. a) Obtain a Right Linear Grammar for the language L = $\{a^n b^m \mid n>=2 , m>=3\}$
   b) Obtain a Left Linear Grammar for the DFA shown below.



5. Convert the following Grammar into GNF
   E → E+T / T
   T → T * F / F
   F → (E) / a

6. Construct PDA for the Language L={w c wR | w Є (a +b) * , where w^R is reverse of w }.

7. a) Design Turing Machine for the language L= { $\mathbf{a^n b^n c^n}$ / n>1 }
   b) State and prove Rice's theorem

8. Write short note on:
   a) Post Correspondence problem. b) LR(0) Grammar.
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