Code No: RT21052 **R13** SET - 1

II B. Tech I Semester Regular Examinations, Dec - 2015
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE AND ENGINEERING
(Com. to CSE, IT, ECC)

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) Show that $P \rightarrow (Q \rightarrow R)$ and $(P \wedge Q) \rightarrow R$ are logically equivalent. (4M)
   b) Find the prime factors of 30, 81, 289. (3M)
   c) What is the difference between Subset and proper subset (4M)
   d) What is a Rooted Trees? (4M)
   e) Define momoid with an example? (3M)
   f) Explain product rule. (4M)

PART –B

2. a) Show that $R \vee S$ follows logically from the premises $C \vee D$, $(C \vee D) \rightarrow \sim H$, $\sim H \rightarrow (A \wedge \sim B)$ and $(A \wedge \sim B) \rightarrow (R \vee S)$ (8M)
   b) Obtain PDNF of the fallowing: $\neg(P \vee (\neg P \wedge \neg Q \wedge R)$ (4M)
   c) Obtain PDNF of the fallowing: $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$ (4M)

3. a) Find the integers u and v such that 512u+320v=64. (8M)
   b) Use the mathematical induction to prove that $1^3 + 2^3 + \ldots + n^3 = [(n(n+1))/2]^2$, whenever n is a positive integer. (8M)

4. a) Determine the number of positive integers n where $1 \leq n \leq 2000$ and n is not divisible by2,3 or 5 but is divisible by 7. (6M)
   b) If A={1,2,3,4} and R,S are relations on A defined by R={(1,2),(1,3),(2,4),(4,4)} S={(1,1),(1,2),(1,3),(1,4),(2,3),(2,4)} find R o S, S o R, R^2, S^2, write down there matrices. (5M)
   c) Draw the Hasse diagram for the partial ordering $\{(A,B) | A \subseteq B\}$ on the power set P(S), where S={a,b,c}. (5M)

5. a) What is Walk, Trail, Paths and circuit? Explain with suitable graphs examples. (8M)
   b) How to determine adjacency matrix for a graph. Explain properties of adjacency matrix by taking suitable graph with minimum 5 nodes and more than 5 edges. (8M)

6. Consider the six digits 1, 2, 3, 5, 6, and 7. Assuming that repetitions are permitted, answer the following: i) How many ways 4 digit numbers can be formed from the six digits 1, 2, and 3,5,6,7? ii) How many of these numbers are less than 4000? iii) How many of these numbers in (i) are even? iv) How many of these numbers in (i) are odd? v) How many of these numbers in (i) are multiple of 5? vi) How many of these numbers in (i) contain both the digits 5,7? (16M)

7. Find the first five terms of the sequence defined by each of the following recurrence relations and initial conditions: i) $a_n = a^2_{n-1}$, $a_1 = 2$.
   ii) $a_n = na_{n-1} + n^2 a_{n-2}$, $a_0 = 1$, $a_1 = 1$ iii) $a_n = a_{n-1} + a_{n-3}$, $a_0 = 1$, $a_1 = 2$, $a_2 = 0$ (16M)
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Code No: RT21052 **R13** SET - 2

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PART –A

1. a) Show that ~(P v (~P ∧ Q)) and (~P ∧ ~Q) are logically equivalent. (4M)
   b) Find the prime factors of 100, 119, 147 and 544. (4M)
   c) What is a Power set? If S={a, b, c} then P(S) is? (3M)
   d) What is Spanning Tree? Give example. (4M)
   e) Define Groups and applications of it? (4M)
   f) Explain sum rule with an example (3M)

PART -B

2. a) Show that R∧ (PvQ) is a valid conclusion from the premises PvQ, Q→R, P→M and ¬M. (8M)
   b) Obtain PDNF of following: (¬P) v Q (4M)
   c) Obtain PCNF of following: (P→Q) ∧(Q↔R) (4M)

3. a) Find the integers u and v such that 28844u+ 15712v=4 (8M)
   b) Use mathematical induction to prove that $1^2 + 3^2 + 5^2 + \ldots + (2n+1)^2 =$ ((n +1) (2n+1)(2n+3))/3, Whenever n is a non-negative integer. (8M)

4. a) Determine the number of positive integers n where 1≤n≤100 and n is not divisible by2,3 or 5. (6M)
   b) Which elements of the poset /({2,4,5,10,12,20,25},/) are maximal and which are minimal? (5M)
   c) Let X={(1,2,3} and f,g,h and s be functions from X to X given by f={(1,2),(2,3),(3,1)}, g={(1,2),(2,1),(3,3)}, h={(1,1),(2,2),(3,1) and s={(1,1),(2,2),(3,3)}. (5M)

5. a) What is Cut vertex, Cut set and Bridge? Explain by taking suitable graphs. (8M)
   b) How to determine adjacency matrix for a graph. Explain properties of adjacency matrix by taking suitable graph with minimum 6 nodes and more than 5 edges. (8M)

6. Answer the following: (16M)
   i) In how many ways can six men and four women sit in a row?
   ii) In how many ways can they sit in a row if all the men sit together?
   iii) In how many ways can they sit in a row if just the women sit together?
   iv) In how many ways can they sit in a row if men sit together?

7. Let a1=2n+5(3n) for n=0,1,2…..
   a) Find a_i such that 0<= i<5 (6M)
   b) Show that $a_2=5a_1-6a_0$, $a_3=5a_2-6a_1$ and $a_4=5a_3-6a_2$. (5M)
   c) Show that $a_n=5a_{n-1}-6a_{n-2}$, for all integers 'n' with n>=2 (5M)
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Code No: RT21052 **R13** SET - 3

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PART –A

1. a) Show that (P^Q)->(P^Q) is a toutalogy. (4M)
b) What are relatively Prime numbers? Give example. (3M)
c) List the properties of union operation. (4M)
d) Write Prim's algorithm. (4M)
e) Write any three properties of Lattices (3M)
f) What is the pigeonhole principle. (4M)

PART -B

2. a) Show that $J \wedge S$ is a valid conclusion from the premises $P \rightarrow Q$, $Q \rightarrow \neg R$, R, $P \vee (J \wedge S)$. (8M)
b) Obtain PCNF of the following: i) $\neg(P \vee Q)$ ii) $\neg(P \leftrightarrow Q)$ (8M)

3. a) Explain Division theorem. (8M)
b) Use mathematical induction to prove that $1^2+2^2+3^2+\ldots+n^2=(n(n+1)(2n+1))/6$ whenever n is positive integer. (8M)

4. a) Determine the number of positive integers n where $1 \leq n \leq 250$ and find how many of them divisible by 3,5 or 7. (6M)
b) Let X={2,3,6,12,24,36) and a relation $' \leq$' be such that $x \leq y$ if x divides y. Draw the Hasse diagram of $(x,\leq)$. (5M)
c) Let X={1,2,3,4} and a mapping $f:X \rightarrow X$ be given by f={(1,2},(2,3),(3,4),(4,1)}. Find the composition function f^2,f^3 and f^4. (5M)

5. a) What is distance and diameter of a graph explain by taking suitable graphs. (8M)
b) How to determine adjacency matrix for a graph. Explain properties of adjacency matrix by taking suitable graph with minimum 7 nodes and more than 8 edges. (8M)

6. Find n if (16M)
i) P(n,2)=72 ii) P(n,4)= 42p(n,2) iii)2P(n,2)+50=p(2n,2)

7. a) Solve the recurrence relation of the sequence of numbers $\mathbf{f_n=f_{n-1}+f_{n-2}}$ **,n>=2** With the initial condition $\mathbf{f_0=1,f_1=1}$. (8M)
b) What is a Generating function and explain the operations on generating functions? (8M)

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Show that ((~P∧(~Q ∧ R)) v (Q ∧ R) v (P ∧ R)) and R are logically equivalent. (4M)
   b) Find the GCD of 42823 and 6409? (3M)
   c) List the properties of difference operation. (4M)
   d) What is a Decision Tree? Give an example. (4M)
   e) What is poset? Show an example. (4M)
   f) Find the generating function for a sequence 2,2,2,2,2,2. (3M)

PART -B

2. a) Show that SvR is tautologically implied by (P v R) ∧ (P→R) ∧(Q→S) (8M)
   b) Obtain PCNF of the fallowing: i) $\neg(P\rightarrow Q)$ ii) $\neg(P\leftrightarrow Q)$ (8M)

3. a) Use the Euclidean Algorithm to find gcd(1819,3587) (8M)
   b) Use mathematical induction to prove that $1+2+2^2+...+2^n=2^{n+1}-1$ for all non negative integers n. (8M)

4. a) Determine the number of positive integers n where $1\leq n\leq 1000$ and n is not divisible by2,3 or 5 but is divisible by 7. (6M)
   b) Draw the Hasse diagram representing the partial ordering {(a,b)|a divides b} on {1,2,3,4,6,8,12}. (5M)
   c) Let A={a,b,c} and R and S be relations on A whose matrices are as given bellow: (5M)

$$M_R=\begin{bmatrix}1 & 0 & 1\\ 1 & 1 & 1\\ 0 & 1 & 0\end{bmatrix} \qquad M_S=\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 1\\ 1 & 0 & 1\end{bmatrix}$$

5. a) What is connectedness in a directed graphs? And also explain connected and weakly connected, unilateral connected and strongly connected graph. Show some example graphs. (8M)
   b) How to determine adjacency matrix for a graph. Explain properties of adjacency matrix by taking suitable graph with minimum 4 nodes 6 edges. (8M)

6 How many bit strings of length 8 contain (16M)
   i) Exactly five 1's? ii) An equal number of 0's and 1's?
   iii) At least four 1's? iv) At least three 1's and at least three 0's?

7. By using an iterative approach , find the solution to each of the recurrence relation with the given critical condition (16M)
   i) $a_n= 3a_{n-1}$, $a_0=2$ ii) $a_n=2a_{n-1}$, $a_0=1$ iii) $a_n=na_{n-1}$, $a_0=5$ iv) $a_n=2na_{n-1}$ $a_0=1$
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