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

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
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) Test the validity of the following argument: (4M)
   Some intelligent boys are lazy.
   Ravi is an intelligent boy.
   : Ravi is lazy.
   b) Find the HCF of 96 and 404 by prime factorization method. (3M)
   c) Show that $A\cup(B-C) = (A\cup B)-(A\cup C)$ (3M)
   d) Define Walk of a graph with an example. (4M)
   e) Prove that every subgroup of an abelian group is a normal subgroup. (4M)
   f) Discuss the applications of Generating functions. (4M)

PART –B

2. a) Find the disjunctive normal forms of the following: (8M)
   i) $\neg(P \vee Q)\leftrightarrow(P \wedge Q)$
   ii) $P\rightarrow\{ (P\rightarrow Q) \wedge (\neg Q \vee \neg P)\}$
   b) Show that the premises $a\rightarrow(b\rightarrow c)$, $d\rightarrow(b\wedge\neg c)$, $a\wedge b$ are inconsistent. (8M)

3. In each of (i)-(iv) you are given integers m and n, where n is positive. In each case, find integers q and r such that $m=qn+r$ and $0\leq r<n$. (16M)
   (a) m= 216 , n=80 (b) m=4129, n=232 (c) m=30, n=6 (d) m= - 4129, n= 232

4. a) Let A={1, 2,3 ,4} and f and g be functions from A to A given by (8M)
   f={(1,4), (2,1), (3,2),(4,3)} and g={ (1,2), (2,3), (3,4), (4,1)}
   prove that f and g are inverse of each other.
   b) Define Relation and function. Consider the following relations on the set A={1,2,3}: f={(1,3),(2,3),(3,1)}; g={(1,2), (3,1)}; h={(1,3),(2,1),(1,2),(3,1)} which of these are functions? (8M)

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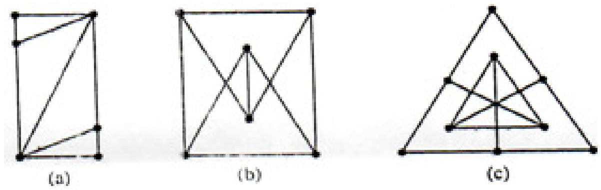
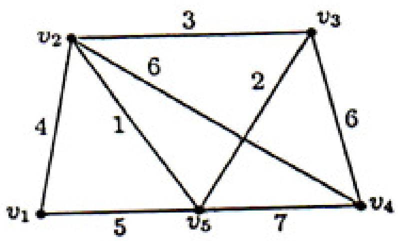
5. a) Discuss about planar and non-planar graph with an example. (8M)
Show that the following graphs are planar by redrawing them.



b) Using Prim's algorithm, find a minimal spanning tree for the weighted graph shown below: (8M)



6. a) In how many ways can the letters of the word CORRESPONDENTS can be arranged so that (8M)
i) There are exactly two pairs of consecutive identical letters?
ii) There are at least three pairs of consecutive identical letters?

b) Find the number of positive integer less than 10,000 and are divisible by 5 or 7? (8M)

7. a) Solve the recurrence relation $f_n=2f_{n-1}-2f_{n-2}$ where $f_0=1$ and $f_1=3$. (8M)

b) Find the recurrence relation and the initial condition for the sequence 0, 2, 6, 12, 20, 30, 42, …. Hence find the general terms of the sequence. (8M)

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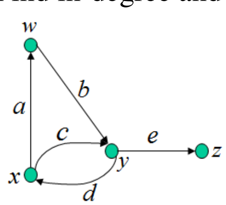
PART –A

1. a) Disclose the definition of proposition with an example. (3M)
   b) Obtain the PDNF of $\neg P \vee Q$. (3M)
   c) Discuss about finite and infinite sets. (4M)
   d) Find in-degree and out-degrees of the given graph (4M)



   e) Find the right cosets of the following: $H=[[1],[3]]$ in $<Z_6,+>$ (4M)
   f) Solve the recurrence relation $F_n= -F_{n-1}+4F_{n-2} +4F_{n-3}$ where $F_0=8$, $F_1=6$ and $F_2=26$. (4M)

PART -B

2. Which of the following is not valid: (16M)
   i) $\{\forall x \{P(x)\rightarrow Q(x)\}, \quad \exists y\, p(y)\}\Rightarrow \exists z\, Q(z)$
   ii) $\{\exists x\, P(x)$ and $\exists x\, Q(x) \} \Rightarrow \exists x \{P(x) \wedge Q(x) \}$
   iii) $\{\exists x \{F(x) \wedge S(x) \}\rightarrow \forall y \{M(y)\rightarrow W(y)\}$ and $\exists y \{M(y)\wedge\neg W(y)\} \}$
   $\Rightarrow \forall x\{ F(x)\rightarrow\neg S(x)\}$
   iv) $\{\forall x\{C(x)\rightarrow P(x)\}$ and $\exists x\{C(x) \wedge L(x) \}\}\Rightarrow \exists x\{P(x) \wedge L(x)\}$

3. a) Let a,b, q and r be the integers such that a=bq + r. Prove that gcd(a,b) = gcb(b,r) (8M)
   b) Find d=gcd(4977+405) and find the integers u an v such that d= 4977u+405v (8M)

4. a) Let A be a given finite set and $\rho(A)$ its power set. Let $\subseteq$ be the inclusion relation on the elements of $\rho(A)$. Draw Hasse diagram of $\langle \rho(A),\subseteq \rangle$ for (i) A={a}; (ii) A={a,b}; (iii) A={a, b, c}; (iv) A= {a, b, c, d} (8M)
   b) If A={1, 2,3,4}, B{w, x, y, z} and f={(1,w),(2,x),(3,y),(4,z)}then Prove that f is both one-to-one and onto. (8M)
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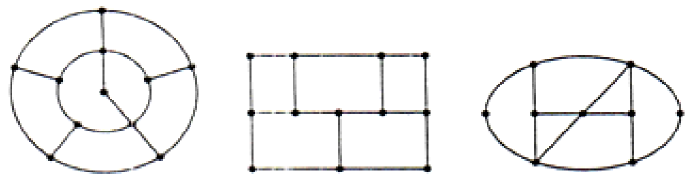
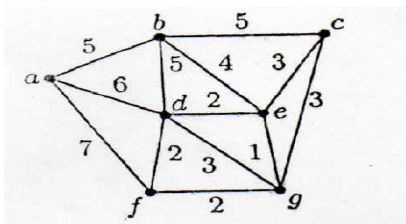
5. a) Show that the following graphs are Hamiltonian: (8M)



(a) (b) (c)

b) Write the Kruskal's algorithm and find minimal spanning tree of the weighted graph shown below: (8M)



6. a) Find the number of permutations of the letters of the word MASSASAUGA, (8M)
i) In how many of these, all four A's are together?
ii) How many of these of them begin with S?

b) In how many way can 6 men and 6 women be seated in a row (8M)
i) If any person may sit next to any other?
ii) If men and women must occupy alternate seats?

7. Solve the recurrence relation $\mathbf{a^2_{n+2}-5a^2_{n+1}+6a^2_n=7n}$ for $n \geq 0$ where $\mathbf{a_0=a_1=1}$. (16M)

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PART –A

1. a) What is tautological implication? Give an example. (3M)

b) Find the LCM and HCF of 6 and 20 by prime factorization method. (4M)

c) If A,B,C are any three sets, then prove that A-(B $\cup$ C) = (A-B) $\cap$ (A-C) (4M)

d) Define Euler circuit with an example. (3M)

e) In a group G having more than one element, if $x^2=x$ for every $x \in G$, prove that G is abelian. (4M)

f) Solve the recurrence relation $F_n=6F_{n-1}-9F_{n-2}$ where $F_0=1$ and $F_1=6$. (4M)

PART -B

2. a) Check whether the following statements is tautology or not (8M)

$\sim P \leftrightarrow \sim Q \leftrightarrow (Q \leftrightarrow R) \wedge \overline{P}$

b) Show that the following premises are inconsistent (8M)

i) If jack misses many classes through illness, then he fails high school.

ii) If jack fails high school, then he is uneducated.

iii) If jack reads a lot of books, then he is not uneducated.

iv) Jack misses many classes through illness and reads a lot of books.

3. a) Suppose n=100, Illustrate the procedure to find all primes less than or equal to a fixed positive integer n>1. (8M)

b) Check whether the following are prime or not? (8M)

337, 577, 252, and 157

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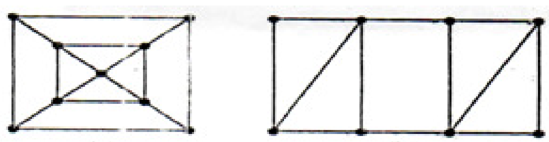
4. a) Let a={1,2,3,4} and f and g are functions from A to A given by f= {(1,4), (2,1), (3,2), (4,3)} and g= {(1,2),(2,3),(3,4),(4,1)} prove that f and g are inverse of each other. (8M)

b) For the Fibonacci sequence $F_0, F_1, F_2, \ldots$. Prove that (8M)

$$Fn = \frac{1}{\sqrt{5}}[\left(\frac{1+\sqrt{5}}{2}\right)^n - (\left(\frac{1-\sqrt{5}}{2}\right)^n)]$$

5. a) Show that the following graphs are Hamiltonian but not eulerian. (8M)



(a) (b)

b) Write DFS algorithm and discuss with an example. (8M)

6. a) How many positive integers n can we form using the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 5,000,000? (8M)

b) Find the number of distinguishable permutations of the letters in the following work (i) PEPPER (ii) CALCULUS (iii) BANANA (iv) DISCRETE (8M)

7. Find a generating function for the recurrence relation (16M)

$\mathbf{a_{n+2}-5a_{n+1}+6a_n=2}$, for $n\geq 2$ where $\mathbf{a_0=3, a_1=7}$.

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PART –A

1. a) Construct the truth table for $(\neg P \land (\neg Q \land \neg R)) \lor (Q \land R) \lor (P \land R)$ (3M)

b) Calculate $\Phi(n)$ for n = 1200 and n = 2008. (4M)

c) Let $A=\{\{b,c\},\{\{b\},\{c\},b\}$ and $B=\{a,b,c\}$. then find $A \cap B$, $A \cup B$, $A - B$, $B - A$, $A \Delta B$. (4M)

d) Illustrate the advantages of Matrix representation of graph. (3M)

e) Discuss about Semi-group Homomorphism with example. (4M)

f) Solve the recurrence relation $F_n=8F_{n-2}-16F_{n-4}$ for $n\geq 4$ where $F_0=1$, $F_1=4$, $F_2=28$ and $F_3=32$. (4M)

PART -B

2. a) Prove that each of the following is tautology : (8M)

i) $[P \lor (Q \land R)] \lor \neg[P \lor (Q \land R)]$

ii) $[(P \lor Q) \land \neg(\neg P \land (\neg Q \lor \neg R))] \land (\neg P \land \neg Q) \lor (\neg P \land \neg R)$

b) Obtain PDNF of the following: (8M)

i) $(\neg P \lor \neg Q) \rightarrow (P \Leftrightarrow \neg Q)$

ii) $(P \rightarrow (Q \land R)) \land (\neg P \rightarrow (\neg Q \land \neg R))$

3. a) Define Congruence and discuss basic properties of congruence with proof. (8M)

b) Find all solutions to each of the following congruences: (8M)

(i) $2x \equiv 1 \bmod 3$. (ii) $3x \equiv 4 \bmod 8$.

(iii) $6x \equiv 3 \bmod 15$. (iv) $8x \equiv 7 \bmod 18$.
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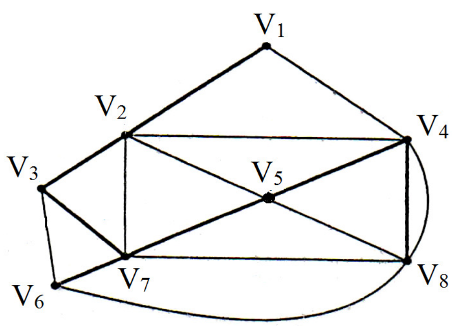
4. a) Find an explicit definition of the function f(n)=a^n defined recusively by $a_{0=3}, a_n = 2a_{n-1} + 1$ for n ≥ 1. (8M)

b) Given the relation matrix M_R of a relation R on the set {a,b,c} , find the relation matrices of $\widetilde{R}, R^2 = R^\circ R, R^3 = R^\circ R^\circ R, and\ R^\circ \widetilde{R}$ (8M)

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

5. a) What is Euler trail and Euler circuit? Prove that the complete bipartite graph $K_{2,3}$ contains an Euler trail. (8M)

b) What is a spanning tree and minimum spanning tree? Find all the spanning trees of the graph shown in fig. (8M)



6. a) Find the number of distinguishable permutations of the letters in the following work (i) BASIC (ii) STRUCTURES (iii) ENGINEERING (iv) MATHMATICS (8M)

b) In how many way can 3 men and 3 women be seated at around table (8M)

i) If two particular women must not sit together?

ii) If each women is to be between two men?

7. a) The number of virus effected files in a system is 1000 (to start with) and this increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day. (8M)

b) Solve the recurrence relation $\mathbf{a_n+4a_{n-1}+4a_{n-2} = 8}$ for n$\geq$ 2 where $\mathbf{a_0=1, a_1=2}$. (8M)

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