

II B. Tech I Semester Regular Examinations, October/November - 2017
MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
 (Com to CSE & IT)

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 **FOUR** Questions from **Part-B**

PART -A

1. a) Explain universal quantifier (2M)
- b) Explain partition and covering (2M)
- c) Explain cyclic group (2M)
- d) Explain the principle of inclusion and exclusion (2M)
- e) In how many ways can 20 similar books be placed on 5 different shelves? (3M)
- f) Explain planar graphs with example? (3M)

PART -B

2. a) Establish the validity of the following argument "All integers are rational numbers. Some integers are powers of 2. Therefore, some rational numbers are powers of 2" (7M)
- b) Using the indirect method of proof show that $p \rightarrow q, q \rightarrow r, \neg (p \wedge r), (p \vee r)$ leads to conclusion 'r' (7M)
3. a) Explain representation of partially ordered set with suitable example? (7M)
- b) Explain different types of functions with examples? Find inverse of $2x+3/4x-5$ (7M)
4. a) Find the gcd of 42823 and 6409 using Euclidean algorithm (7M)
- b) Explain properties of integers with suitable examples? (7M)
5. a) Find the number of integer solutions of $x_1 + x_2 + x_3 + x_4 + x_5 = 30$ where $x_1 \geq 2, x_2 \geq 3, x_3 \geq 4, x_4 \geq 2, x_5 \geq 0$. (7M)
- b) Find the number of ways of giving 15 identical gift boxes to 6 persons A, B, C, D, E, F in such a way that the total number of boxes given to A and B does not exceed 6. (7M)
6. a) Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$ for $n \geq 2$ Given that $a_0 = 5, a_1 = 12$. (7M)
- b) Solve the recurrence relation $a_{n+3} = 3a_{n+2} + 4a_{n+1} - 12a_n$, for $n \geq 0$, Given that $a_0 = 0, a_1 = -11, a_2 = -15$. (7M)
7. a) Show that in a connected planar graph G with n vertices and m edges has regions $r = m - n + 2$ in every one of its diagram? (7M)
- b) Explain isomorphism of two graphs with suitable example (7M)



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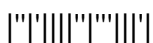
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PART -A

1. a) Explain existential quantifier (2M)
- b) Explain permutation of functions (2M)
- c) State Fermat's theorem (2M)
- d) Explain binomial theorem with example (3M)
- e) Explain general solution and particular solution of recurrence relation? (3M)
- f) Explain multi graph with example (2M)

PART -B

2. a) Show that $((P \vee Q) \wedge (\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is a tautology (7M)
- b) Explain pdnf, pcnf with suitable examples (7M)
3. a) In a distributive lattice, if $a \wedge b = a \wedge c$ and $a \vee b = a \vee c$, prove that $b = c$ (7M)
- b) Draw the Hasse's diagrams representing the positive divisors of 36 and 120 (7M)
4. a) State and prove lagrange's theorem (7M)
- b) Explain ring, integral domain and field with suitable examples? (7M)
5. a) Find the number of three digit even numbers with no repeated digits? (7M)
- b) Find the least number of ways of choosing three different numbers from 1 to 10 so that all choices have the same sum? (7M)
6. a) Find the generating functions of the following sequence (7M)
 - (i) 0,1,-2,3,-4,.....
 - (ii) 0,2,6,12,20,30,42,.....
- b) Solve the recurrence relation $2a_n - 3a_{n-1} = 0$ for $n \geq 1$ Given that $a_4 = 81$. (7M)
7. a) Define Eulerian circuit and Hamiltonian circuit, give an example of graph that has neither an Eulerian circuit nor Hamiltonian circuit. (7M)
- b) Explain kruskal's algorithm to find minimal spanning tree of the graph with suitable example? (7M)



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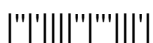
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PART -A

1. a) Explain bounded variable with example (2M)
- b) Explain transitive closure with example (2M)
- c) Explain lattice with example (2M)
- d) In how many ways can three different coins be placed in two different purses? (3M)
- e) Explain recurrence relation with example (3M)
- f) Explain Hamiltonian graph with example (2M)

PART -B

2. a) Show that from (a) $(\exists x) (F(x) \wedge S(x)) \rightarrow (y) (M(y) \rightarrow W(y))$ (7M)
 (b) $(\exists y) (M(y) \wedge \neg W(y))$ The conclusion $(x) (F(x) \rightarrow \neg S(x))$ follows (7M)
- b) Write all implications and equivalences of statement calculus (7M)
3. a) By means of example show that $A \times B \neq B \times A$ and $(A \times B) \times C \neq A \times (B \times C)$ (7M)
- b) Let $f: R \rightarrow R$ and $g: R \rightarrow R$, where R is the set of real numbers. Find fog and gof where $f(x) = x^2 - 2$ and $g(x) = x+4$. State where these functions are injective, surjective, bijective? (7M)
4. a) Explain Euclidian algorithm to find The Greatest Common Divisor of two numbers with suitable example? (7M)
- b) (i) Prove that the inverse of the product of two elements of a group is the product of their inverses in reverse order? (ii) Prove that if "a" is any element of group G then $(a^{-1})^{-1} = a$ (7M)
5. a) In a sample of 200 logic chips, 46 have a defect D1, 52 have a defect D2, 60 have a defect D3, 14 have defects D1 and D2, 16 have defects D1 and D3, 20 have defects D2 and D3, and 3 have all the three defects. Find the number of chips having (i) at least one defect, (ii) no defect. (7M)
- b) Prove the identity $C(n+1, r) = C(n, r-1) + C(n, r)$ (7M)
6. a) Solve the recurrence relation $a_n = 10a_{n-1} + 29a_{n-2}$ for $n \geq 3$ Given that $a_1 = 10, a_2 = 100$. (7M)
- b) Solve the recurrence relation $2a_{n+3} = a_{n+2} + 2a_{n+1} - a_n$, for $n \geq 0$, Given that $a_0 = 0, a_1 = 1, a_2 = 2$. (7M)



7. a) Define spanning tree of a graph, and explain DFS algorithm to find spanning tree (7M)
of a graph with suitable example?
- b) Explain union, intersection and symmetric difference of the graphs with suitable (7M)
example?



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PART -A

1. a) Explain contra positive with example (2M)
- b) Explain properties of binary relations (3M)
- c) Define compatibility of relation and give suitable example (3M)
- d) Explain sum rule with example (2M)
- e) Define generating function and give suitable example (2M)
- f) Explain adjacency matrix of the graph? (2M)

PART -B

2. a) Explain pdnf ? find pdnf of $P \rightarrow ((P \rightarrow Q) \wedge \neg(Q \vee \neg P))$ (7M)
- b) Verify the validity of the following argument "every living thing is a planet or an animal. Joe's gold fish is alive and it is not a planet. All animals have hearts. Therefore Joe's gold fish has a heart. (7M)
3. a) If A,B and C are any three sets then prove that (i) $A \cup (B - A) = A \cup B$ (7M)
 (ii) $A - (B \cup C) = (A - B) \cap (A - C)$
- b) Let $X = \{ 1,2,3,4,5,6,7 \}$ and $R = \{ (x, y) / x - y \text{ is divisible by } 3 \}$. Show that R is an equivalence relation. Draw the graph of R. (7M)
4. a) Show that every cyclic group is abelian group, but the converse is not true. (7M)
- b) Show that intersection of any two subgroups of a group G is also a sub group of G. (7M)
5. a) A women has 20 close relatives and she wishes to invite 7 of them to dinner. In how many ways she can invite them in the following situations: (7M)
 - (i) Two particular persons will not attend separately.
 - (ii) Two particular persons will not attend together.
- b) State and prove multinomial theorem? Determine the coefficient of $x^3y^3z^2$ in the expansion of $(2x - 3y + 5z)^8$ (7M)
6. a) Solve the recurrence relation $a_n + 7a_{n-1} + 8a_{n-2} = 0$ for $n \geq 2$ (7M)
 Given that $a_0 = 2, a_1 = -7$.
- b) Solve the recurrence relation $a_n + a_{n-1} - 8a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$, (7M)
 Given that $a_0 = 1, a_1 = 5, a_2 = 1$.
7. a) Show that the complete graph K_5 and complete bipartite graph $K_{3,3}$ are not planar? (7M)
- b) Prove that a connected graph is a tree if and only if it is minimally connected. (7M)

