ROLL NO. ___________________

Code: AC65 Subject: DISCRETE STRUCTURES

AMIETE – CS (NEW SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Number of elements in the power set of set A × B where A = {ϕ, {ϕ}} and B = {1, 2} is

(A) 16 **(B)** 8
(C) 64 **(D)** 4

b. Number of reflexive relations that can be defined on set A = {1 ,2, 3, 4} is

(A) 1024 **(B)** 64
(C) 65536 **(D)** 4096

c. An odd number can be written as

(A) Difference of two consecutive integers.
(B) Difference of two consecutive even integers.
(C) Sum of two consecutive odd integers.
(D) None of these.

d. The logical expression for the statement "If it is red pen then it is mine" can be written for P = "It is red pen", Q = "It is mine".

(A) $P \rightarrow Q$ **(B)** $Q \rightarrow P$
(C) $P \leftrightarrow Q$ **(D)** $P \vee Q$

e. Explicit formula for the recurrence equation f(n) – f(n – 1) = 1; f(0) =1 is

(A) n + 1 **(B)** n – 1
(C) n + 2 **(D)** 2n + 1

f. The number of maximal elements in a Poset can be

(A) Exactly one. **(B)** At least one.
(C) At the most one. **(D)** Zero

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g. Which of the following is not a type of function?

(A) One to one into **(B)** One to many onto
(C) Many to one onto **(D)** Many to one into

h. A subgroup H of a group G is said to be Normal if

(A) Every subset of the subgroup is a group.
(B) Left Coset is equal to Right Coset for every element in the group.
(C) Every Coset is a group in itself
(D) H is the only subgroup of G.

i. Even parity is achieved by padding additional

(A) Even number high bits to make number of high bits even
(B) Odd number of low bits to make number of high bits even.
(C) Odd number of high bits to make number of high bits even.
(D) Odd number of low bits to make number of low bits even.

j. $p \rightarrow q$ has true value if

(A) p is false **(B)** p is true
(C) q is false **(D)** None of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Prove that any set is subset of itself. And hence show that a NULL set is subset of every set. **(8)**

b. For any sets A and B show that
$| A \cup B | = |A| + |B| - |A \cap B|$ **(8)**

Q.3 a. If p = "It rains" and q = "I will go" then write the following expression in English language
(i) $p \vee q$ (ii) $p \wedge q$
(iii) $p \rightarrow q$ (iv) $q \rightarrow p$ **(8)**

b. Show that $p \vee (q \wedge r) \leftrightarrow (p \vee q) \wedge (p \vee r)$ is a tautology. **(8)**

Q.4 a. Give
(i) a direct proof
(ii) an indirect proof
(iii) proof by contradiction
For the following statement: "If n is an odd integer, then n+11 is an even integer" **(8)**

b. State any four rules of Interference. Explain them with an example. **(8)**

Q.5 a. Solve the recurrence equation $a_n = 2a_{n-1} + 7n; \quad a_1 = 1$ **(8)**

b. Prove using mathematical induction that $1 + 2^n < 3^n$ for $n > 1$. **(8)**

Q.6 a. If R_1 and R_2 are equivalence relations on A, then show that $R_1 \cap R_2$ is an equivalence relation. **(8)**

b. Let A = {1, 2, 3, 5, 6, 10, 15, 30} be a set and R be a relation of divisibility on A. Show that R is a partial order on A and draw a Hasse diagram of R. Is R a linear order relation? **(8)**

Q.7 a. Define a computable function. Show that integer addition is a computable function **(8)**

b. Show that composition of function is a not a commutative operation however it is an associative operation. **(8)**

Q.8 a. Let G be a group. Show by mathematical induction that if ab = ba, then

$$(ab)^n = a^n b^n \text{ for } n \in Z^+.$$ **(8)**

b. Let H and K be subgroups of a group G. Prove that
(i) $H \cap K$ is a subgroup of G and
(ii) $H \cup K$ need not be a subgroup of G. **(8)**

Q.9 Write short notes on **TWO** of the followings:

(i) Generator Matrix
(ii) Group Codes
(iii) Ring with unity **(8+8)**