AMIETE – CS (OLD SCHEME)

Code: AC10 **Subject: DISCRETE STRUCTURES**
Time: 3 Hours **Max. Marks: 100**

JUNE 2011

NOTE: There are 9 Questions in all.

- **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. Let S = {a, b,ϕ} then number of elements in power set P(P(S)) is

(A) 8 **(B)** 16
(C) 256 **(D)** 512

b. Number of reflexive relations that can be defined on a set A with 4 elements is

(A) 1024 **(B)** 4096
(C) 16 **(D)** 2048

c. How many nodes of degree two you can find in a complete binary tree T having 20 leaf nodes?

(A) 8 **(B)** 18
(C) 19 **(D)** 20

d. Which of the following production rule generates a language in {0, 1} that terminates in substring "01".

(A) P = {S→0S, S→1S, S→01} **(B)** P = {S→01S, S→10S, S→1}
(C) P = {S→0A, A→1S, S→01} **(D)** P = {S→00S, S→11S, S→01}

e. In how many ways can a party of 7 persons arrange themselves around a circular table?

(A) 7! **(B)** 8!
(C) 6! **(D)** 7

f. A bounded Poset has

(A) Only least element **(B)** Only greatest element
(C) Both least and greatest element **(D)** Only minimal element

g. The proposition (p v (p→q)) is equivalent to which of the following?

(A) ¬p v (p→q)) **(B)** q
(C) F **(D)** T

h. Converse of the statement 'I stay only if you go' is

(A) I shall not stay if you don't go. **(B)** I stay if you don't go.
(C) I shall not stay if you go. **(D)** If you go then I shall not stay.

i. A regular language is produced by

(A) Type I grammar **(B)** Type II grammar
(C) Type III grammar **(D)** Type 0 grammar

j. Two matrices A and B of order m x n and p x q respectively, are said to be conformal for multiplication if

(A) m is equal to p **(B)** n is equal to p
(C) n is equal to q **(D)** m is equal to q

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

Q.2 a. Let A = {a, b, c, d, e} and R = {(a, a), (a, b), (b, c), (c, e), (c, d), (d, e)} then compute (i) R^2 and (ii) R^∞ **(8)**

b. Prove that the relation "congruence modulo *3*" is an equivalence relation in the set of integers. **(8)**

Q.3 a. Show that $n^3 + 2n$ is divisible by 3. **(8)**

b. Prove that the sum of two rational numbers is a rational number. Using the proof show that the sum of a rational number and an irrational number is an irrational number. **(8)**

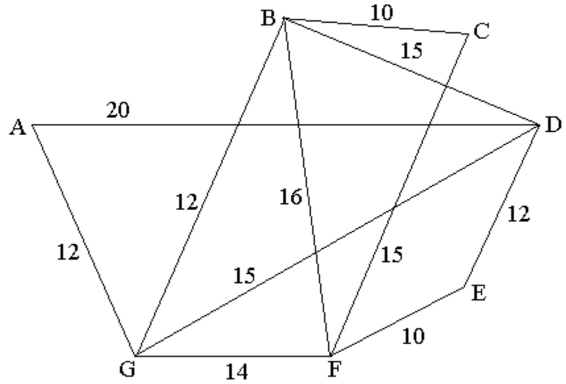
Q.4 a. Let L be a distributive Lattice. For any a, b, c $\in$ L, show that if $a \wedge b = a \wedge c$ and $a \vee b = a \vee c$ then $b = c$ **(8)**

b. Simplify the Boolean function: $F(x, y, z) = \sum (0, 1, 2, 3, 4, 6)$ **(8)**

Q.5 a. Without using truth table, prove De Morgan's law of addition and multiplication of Boolean variables x and y i.e.
(i) $(x + y)' = x' \bullet y'$
(ii) $(x \bullet y)' = x' + y'$ **(8)**

b. Prove that $p \rightarrow q \equiv \neg p \vee q$ **(8)**

Q.6 a. Find minimum spanning tree using Krushkal's algorithm of the following graph. **(10)**



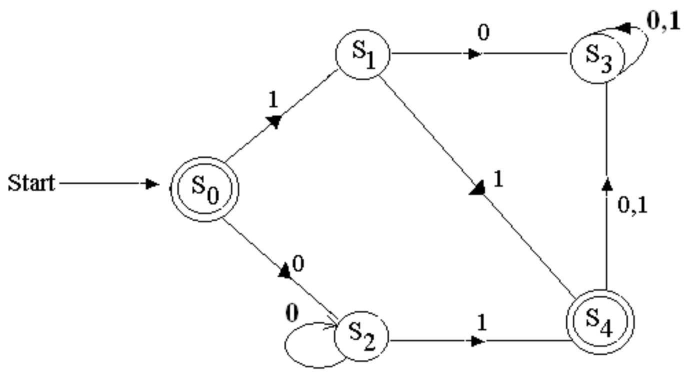
b. Define the following terms: Quotient graph, Bipartite graph, Regular graph. **(6)**

Q.7 a. State and prove Pigeonhole principle. **(8)**

b. In a class there are 35 girls and 25 boys. 5 students are selected at random from the class. What is the probability that out of five at least two are girl? **(8)**

Q.8 a. State and prove pumping lemma for regular language. **(8)**

b. Simplify the following FSM. **(8)**



Q.9 Write a short note on the following:

(i) Transitive Closure
(ii) Principle of Mathematical Induction
(iii) Isomorphic graph
(iv) Types of Grammar **(4×4)**