This question paper contains 3 printed pages.

6126 *Your Roll No ....*

MCA / II Sem.

J

Paper MCA - 202 - DISCRETE MATHEMATICS
(Admissions of 2009 and onwards)

Time 2 hours *Maximum Marks 50*

(Write your Roll No on the top immediately on receipt of this question paper)

Attempt all questions.
Parts of a question must be answered together.

1. a) Determine the discrete numeric function corresponding to the following generating function

$$A(x) = \frac{x^4}{(1 + x - 12x^2)}$$ *04*

b) Obtain the generating function for the fibonacci sequence of number, i e $f_n = f_{n-1} + f_{n-2}$ for $n \geq 2$ and $f_0 = 0$ and $f_1 = 1$. *04*

c) Solve the recurrence relation

$$a_r - 5a_{r-1} + 6a_{r-2} = 3^r$$ *04*

2 a) Let B(x), ε(x), G(x) be the statements "x is a book", "x is expensive" and "x is good" respectively.

Express each of the following statements using quantifiers, logical connectives and B(x), ε(x) and G(x), where the universe of discourse is the set of all objects

(i) No books are expensive

(ii) All expensive books are good. *03*

PTO

b) For the formula

$$(P \rightarrow (Q \wedge R)) \wedge (\sim P \rightarrow (\sim Q \wedge \sim R))$$

Obtain the

(i) principal disjunctive normal form

(ii) principal conjuctive normal form. *2½ +2½ = 5*

3 a) Let $Z_n = \{0, 1, 2, \ldots, n-1\}$. Let $\oplus$ be a binary operation on Z_n s.t for a and b in Z_n,

$$a \oplus b = \begin{cases} a + b & \text{if } a + b < n \\ a + b - n & \text{if } a + b \geq n \end{cases}$$

(i) show that $(Zn, \oplus)$ is a group.

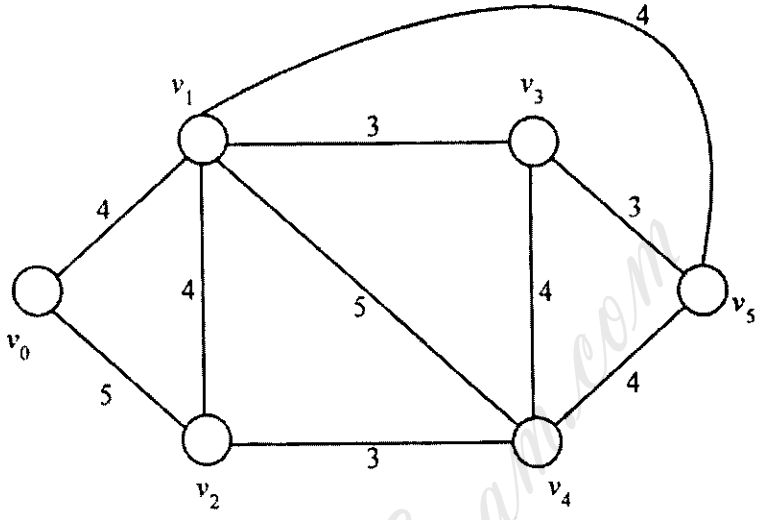
(ii) Does $(Zn, \oplus)$ form an abelian group ? Give reasons *4+2*

b) Define a ring. Give an example. *03*

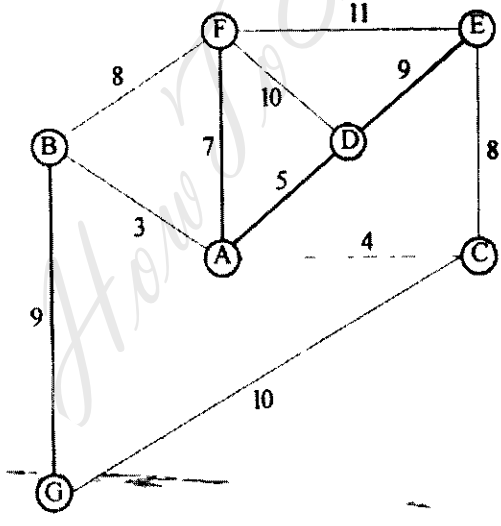
4 a) Approximate $\sum_{k=1}^{n} k^2$ using integrals. *04*

b) Prove that the rate of growth of an exponential function, $f(n) = a^n$, $a > 1$, is greater than any polynomial function. *04*

5 a) Apply Dijkstra's Algorithm to determine a shortest path between v_0 and v_5, where the numbers associated with the edges weights of the edges. *06*



b) Determine a minimum spanning tree using Kruskal's Algorithm for the graph given below. *04*



c) For the following weights, construct an optimal binary prefix code using Huffman's procedure. For each weight in the set give the corresponding code word.

weights : 5, 7, 8, 15, 35, 40 *03*

100