No. of Printed Pages : 2

MCS-033

MCA (Revised)

Term-End Examination

00270

December, 2017

MCS-033 : ADVANCED DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question no. 1 is* ***compulsory****. Attempt any* ***three*** *questions from the rest.*

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1. (a) Using induction, verify that

$$\sqrt{5}\, f_n = \left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n, n \geq 1$$

where $f_n = f_{n-1} + f_{n-2}$ and $f_0 = 0$ and $f_1 = 1$. *5*

(b) Determine the number of subsets of a set of n elements, where $n \geq 0$. *5*

(c) Find the sum of the series

$$\sum_{k=0}^{\infty} \frac{(k+1)^2}{k!} = \frac{1^2}{0!} + \frac{2^2}{1!} + \dots + \frac{(n+1)^2}{n!} + \dots$$

using exponential generating functions. *5*

(d) Take three vertices x, y, z and draw all possible (3, 2) graphs on these vertices. 5

2. (a) Find the number of integer solutions of the linear equation

$$a_1 + a_2 + \ldots + a_k = n,$$

using generating function techniques, when $a_i \geq 0$. 5

(b) State and prove the handshaking theorem. 5

3. (a) Solve the recurrence relation $a_{n+1}^2 = 5a_n^2$ where $a_n > 0$ and $a_0 = 2$. 5

(b) Construct a 5 regular graph on 10 vertices. 5

4. (a) Solve the linear recurrence

$$a_n - a_{n-1} = f_{n+2} \cdot f_{n-1} \quad n \geq 1$$

where $a_0 = 2$ and f_i denotes the i^{th} Fibonacci number. 5

(b) Show that for a subgraph H of a graph G, $\Delta(H) \leq \Delta(G)$. 5

5. (a) Find all the graphs that have edge chromatic number 1. 5

(b) Show that C_6 is bipartite and K_3 is not bipartite. 5