MCA.I/11.14.0969 Reg. No. [ ]

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MCA DEGREE I SEMESTER EXAMINATION NOVEMBER 2014

CAS 2101 COMBINATORICS AND GRAPH THEORY
(Supplementary)

Time: 3 Hours Maximum Marks: 50

PART A
(Answer *ALL* questions)

$(15 \times 2 = 30)$

I. (a) State the principle of inclusion and exclusion.
(b) Define Rook polynomial.
(c) Find the coefficient of x^2y^4 in the expansion of $(x+y)^6$.

II. (a) Define Steiner system.
(b) Prove that if V is even then λ is even, for a design with $b = v$.
(c) What do you mean by Hadamasd matrix.

III. (a) Define isomorphism in graph theory.
(b) What do you mean by traveling salesman problem.
(c) Prove that the number of vertices of odd degree in a graph is always even.

IV. (a) Distinguish between incidence matrix and adjacency matrix in graphs.
(b) Define Planar graph.
(c) State the five color theorem.

V. (a) Define Arboresence.
(b) State Cayley's theorem.
(c) What do you mean by 'connectedness' in graph theory?

PART B

$(5 \times 4 = 20)$

VI. Solve the recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 2$, by method of generating function with the boundary condition $a_0 = 1,\ a_1 = 1$.

OR

VII. Prove that

$$\binom{n+1}{r+1} = \binom{n}{r+1} + \binom{n-1}{r} + \binom{n-1}{r-1}$$

VIII. Show that in a block design,
$r(k-1) = \lambda(v-1)$ and bk = vr.

OR

IX. Briefly explain the error correcting code with an example.

X. Prove that a connected graph is an Euler graph iff all vertices are of even degree.

OR

XI. State and prove Max-flow. Min-cut theorem

XII. Prove that a graph with n vertices is a complete graph iff its chromatic polynomial is
$P_n(\lambda) = \lambda(\lambda-1)(\lambda-2)......(\lambda-n+1)$

OR

XIII. Prove that a connected planar graph with n vertices and e edges has e-n+2 regions.

XIV. Prove that the number of simple, labelled graph with n vertices is $2\frac{n(n-1)}{2}$.

OR

XV. Prove that there are n^{n-2} labelled trees having n vertices $(n \geq 2)$.