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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **Ph.D. Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 31- 01- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph.D. |
| **Course Code :** MAT807 | **Course Name :** Algebraic Graph Theory |
| **Semester**:  | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **20** | **20** | **30** | **30** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 10marks. 6Q x 10M=60Marks** |
| **1** | If v and w are non-adjacent vertices with the same neighbours, and if x is an eigenvector with eigenvalue λ, then show that either v or w have the same label or λ = 0. | **10 Marks** | **L2** | **CO1** |
| **2** | Explain the most fundamental relationship between eigenvalue and its geometric properties  | **10 Marks** | **L2** | **CO2** |
| **3** | Prove that the biclique partition number of Kn is n-1 | **10 Marks** | **L2** | **CO3** |
| **4** | State and prove Reconstruction theorem with a suitable examples. | **10 Marks** | **L2** | **CO4** |
| **5** | Show that the maximum exponent of primitive matrix of order n(n≥2) is (n-1)2+1.  | **10 Marks** | **L2** | **CO1** |
| **6** | If G be a graph with adjacency matrix A, then show that bp(G) ≥max{n-(A),n+(A)} where n-(A) and n+(A) are the number of negative and positive eigenvalues of A. | **10 Marks** | **L2** | **CO2** |

**Part B**

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| **Answer the Questions. Each question carries 20 marks 2Q x 20 = 40 Marks** |
| **7.** | **a.** | Prove that the transitive permutation group G on is primitive if and only if every non-diagonal orbital graph is connected. | **8 Marks** | **L3** | **CO3** |
| **b.**  | Examine that if n be a positive integer and let K be a divisor of n, then the maximum number of 1-factors of K-regular nxn bipartite graph is (K!)n/K. | **12** **Marks** | **L3** | **CO3** |
|  |
| **8.** | **a.** | Prove that a graph G has adjacency matrix A, then for k = 0, 1, . , the ij-entry of Ak is the number of vi –vj walks of length k. | **10 Marks** | **L3** | **CO4** |
| **b.** | Show that the coefficient polynomial of graph G satisfy (i) C1=0 (ii) –C2 is number of edges of G (iii)-C3 is twice the number of triangles in G.  | **10 Marks** | **L3** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***