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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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

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| **School:** SOE | **Program:** Ph.D. |
| **Course Code :** MAT845 | **Course Name** : Control of complex systems and networks |
| **Semester**: | **Max Marks**:100 | **Weightage**:50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **30** | **30** | **40** | **-** | **-** |

**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** | Write a short note on decentralized control, Pinning control, and Partial control of networks. | **10Marks** | **L** | **CO3** |
| **2** | Write the brief notes of Laplacian matrix of a graph with example. | **10 Marks** | **L** | **CO1** |
| **3** | Explain complex system and complex network of dynamical system. | **10 Marks** | **L** | **CO1** |
| **4** | Explain the standard model of a network dynamical systems with example. | **10 Marks** | **L** | **CO2** |
| **5** | Prove the synchronization results for Kuramoto oscillators by using Lyapunov function. | **10 Marks** | **L** | **CO3** |
| **6** | Explain network systems on time varying graphs with example. | **10 Marks** | **L** | **CO1** |

**Part B**

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| **Answer the Questions. Each question carries 20 marks 2Q x 20 = 40 Marks** |
| **7.** |  | Explain the sufficient conditions for synchronization of Control of nonlinear dynamical networks. | **20 Marks** | **L** | **CO3** |
|  |
| **8.** |  | State and prove Gershgorin disks theorem. | **20 Marks** | **L** | **CO2** |

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