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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **Ph. D Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 04 – 02- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph. D |
| **Course Code :** EEE802 | **Course Name :** Power System Modeling and Analysis |
| **Semester**:  | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **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.*

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**Part A**

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| **Answer ALL the Questions. Each question carries 10 marks. 6Q x 10M =60 Marks** |
| **1** | The Andhra Pradesh state administration has suggested supplying electricity from the Raichur Transmission Point Substation (RTPS) to Kurnool city. Consequently, KPTCL plans to construct a new transmission line connecting the RTPS to Kurnool in Andhra Pradesh. Provide comprehensive recommendations on the type of transmission line best suited for this electricity transfer, outline the necessary studies to be conducted, and develop the data sheet required to carry out the study in compliance with IEEE standards. | **10 Marks** | **L3** | **CO1** |
| **2** | Given a power system operating at steady state, apply a static power system model to calculate the system’s power balance and determine the system’s voltage and frequency profiles under different load conditions. How would you modify this model to account for load variations in real-time operation? | **10 Marks** | **L3** | **CO1** |
| **3** | In a single-area power system, describe how the Automatic Load-Frequency Control (ALFC) loop works to maintain the frequency stability following a generation-load mismatch. Provide a detailed example where the system frequency deviation is minimized after a step change in load. | **10 Marks** | **L3** | **CO2** |
| **4** | Evaluate the challenges associated with implementing ALFC in a multi-control area system. How do inter-area oscillations affect the system’s stability, and what control strategies can be employed to mitigate these issues while ensuring optimal load sharing between areas? | **10 Marks** | **L3** | **CO2** |
| **5** | Explain how you would apply the concepts of power system stability to assess the stability of a multi-machine system under sudden load disturbances. What steps would you take to ensure the system remains stable, and how would you analyze the impact of different parameters (such as generation and transmission capacity) | **10 Marks** | **L3** | **CO3** |
| **6** | Describe the methodology for contingency ranking and screening in a large-scale power system. How would you modify the contingency screening process when incorporating high levels of renewable energy generation with intermittent characteristics? | **10 Marks** | **L3** | **CO4** |

**Part B**

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| **Answer the Questions. Each question carries 20 marks 2Q x 20 = 40 Marks** |
| **7.** | **a.** | Consider a radial power system with the following load flow results: Bus 1 (generator bus): 𝑉1=1.05 pu, 𝑃1=100 MW,Bus 2 (load bus): 𝑉2=1.02 pu, 𝑃2=75 MW, 𝑄2=50 MVARThe voltage at Bus 2 decreases by 0.02pu with an increase in load by 10 MW. Use the Voltage Stability Index (VSI) to determine the stability of the voltage at Bus 2. Based on your results, explain how the system could be improved to avoid voltage collapse.  | **10 Marks** | **L3** | **CO 3** |
|  | **b.** | Given a multi-machine power system, describe how you would approach the analysis of angle stability after a large disturbance. How would you use the system’s parameters to predict whether the system would return to a stable state or experience sustained oscillations? | **10 Marks** | **L4** | **CO 3** |
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| **8.** | **a.** | Discuss how the integration of renewable energy sources and smart grid technologies is likely to influence the methodologies used in contingency analysis. Provide a scenario where the intermittency of renewable energy sources might alter contingency rankings and suggest how these factors could be modeled in future simulations. | **10 Marks** | **L4** | **CO4** |
|  | **b.** | Consider a power grid with multiple transmission lines. Using the Line Outage Distribution Factors (LODF), explain how an outage of one critical transmission line could affect the power flow across the network. Provide an example using a simplified 5-bus system. | **10 Marks** | **L4** | **CO4** |

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