MANMOHAN TECHNICAL UNIVERSITY
Office of the Controller of Examinations
2083 Bhadra Exam (2026 August) Model Question

School: Engineering	**Level:** Master	**Time:** 3 Hours
Program: M.Sc.P.S.E.	**Year/Part:** I/I	**Full Marks:** 50
Subject: EG804EE - Power System Dynamics and Stability		**Pass Marks:** 25

✓ *Candidates are required to give their answers in their own words as far as practicable.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Assume suitable data if necessary.*

GROUP A (Attempt any FIVE Questions) **[5x3=15]**

1. Explain the concept of Park's transformation. Explain its mathematical significance in converting three-phase synchronous machine equations into direct (d) and quadrature (q) axis frame
2. Describe the three standard static load representations: Constant Impedance (Z), Constant Current (I) and Constant Power (P) models.
3. Define Critical Fault Clearing Time (t_{cr}) and Critical Clearing Angle (δ_{cr}). How do they impact transient stability?
4. A synchronous generator supplying an infinite bus experience a sudden increase in mechanical input power. Explain qualitatively how the rotor angle, electrical power and frequency change immediately after the disturbance
5. Differentiate between local oscillation mode, inter-area oscillation mode and control mode in a multi-machine power system.
6. Explain why a power system with all eigenvalues having negative real parts is considered stable. What information is provided by the imaginary part of the eigenvalues?

GROUP B (Attempt Any SEVEN Questions) **[7x5=35]**

1. Explain how numerical methods are applied to solve the non-linear swing equation during transient stability analysis. Outline the basic step-by-step algorithm.
2. Discuss the dynamic mechanism of voltage instability and voltage collapse. Explain how P-V and Q-V curves are utilized to determine system voltage stability margins.
3. A generating station connected to an infinite bus undergoes a three-phase fault near its terminals. (a) Explain the sequence of events from fault inception to post-fault oscillation. (b) Discuss how fault location, clearing time, and generator inertia influence system stability
4. Describe the operation, tuning principles and functional requirements of a Power System Stabilizer (PSS) and Power Oscillation Damping (POD) controllers in mitigating low-frequency inter-area oscillations.
5. A transmission line delivers 1.0 pu power. Maximum transferable power is 2.0 pu.
   Calculate a) Initial power angle. b) Power angle after the transmitted power increases to 1.5 pu. Comment on the effect on transient stability margin.
6. Describe the step-by-step process of Modal Analysis using linearized system dynamics. How are left and right eigenvectors used to calculate participation factors to locate key oscillating generators?
7. Explain the operating principle of Automatic Generation Control (AGC) in a multi-area power system. Discuss the role of Area Control Error (ACE) in maintaining system frequency and scheduled tie-line power exchange.
8. A generator has a maximum power transfer capability of 2.5 pu and initially transfers 1.25 pu power. Calculate
   a. Initial power angle of the generator.
   b. New power angle if the transferred power increases to 2.0 pu.
   c. Discuss the impact of this change on transient stability margin.

∞∞ ***The End*** ∞∞