Duration: 3 Hours **Total Marks : 80**

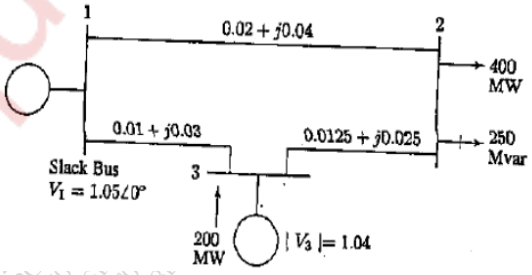
Note : 1. **Q. 1** is **compulsory.**
2. Solve any **3** questions out of remaining questions.
3. Assume suitable data if necessary.

Q.1 a) Explain the concept of equal area criterion for stability studies. (20)
b) What is the necessity of load frequency control?
c) What are assumptions made in Fast decoupled load flow studies?
d) What is the significance of penalty factor in optimal operation?

Q.2a) A 50 Hz, 4 pole, turbo generator, rated 100MVA, 11kV has an inertia constant of 8MJ/MVA.
i) Find the stored Kinetic Energy in the rotor at synchronous speed.
ii) If the mechanical input is suddenly raised to 80MW for an electrical load of 50 MW find the rotor acceleration, neglecting mechanical and electrical losses.
iii) What will be change in the rotor torque angle and rotor speed in rpm at the end of acceleration period of part ii) maintained for 10 cycles. (10)

Q.2b) Consider a power system where a single machine tied to an infinite bus through two parallel lines. Derive the critical clearing angle for stability if a sudden short circuit occurs at the midpoint of one of the parallel lines. The maximum power transmitted under pre fault, during fault and post fault is P_{maxI}, P_{maxII}, P_{maxIII}. (10)

Q.3a) For the 3 bus power system shown in the figure below with the generation at buses 1 & 3. The voltage at bus 1 is $1.05 \angle 0$ pu. V_3 is 1.04 pu with real power generation of 200 MW. A load consisting of 400 MW and 250 MVar is taken from bus 3. Line impedances are marked in pu on 100MVA base. Obtain $|V_2|^{(1)}$ and $|V_3|^{(1)}$ using accelerated GS algorithm (α=1.6).



(10)

Q.3 b) Discuss various types of busses in load flow studies and their significance . (10)

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Q.4a) A system consists of two plants connected by a tie line and a load is located at plant 2. When 125 MW are transmitted from plant 1, a loss of 15 MW takes place on the tie line. Determine the generation schedule at both the plants and power received by the load when λ for the system is Rs. 25per MWhr and the incremental fuel costs (IC) are given by the equations below:

$IC_1 = 0.025P_1 + 15$ Rs / MWhr

$IC_2 = 0.05P_2 + 20$ Rs / MWhr (10)

Q.4b) Derive the expression for the exact co-ordination equation for economic dispatch. (10)

Q.5a) Show that if the speed changer setting is changed by ΔP_c and the load demand changes by ΔP_D, the steady frequency change is given by $\Delta f = \{ 1 / (B+1/R) \}(\Delta P_C - \Delta P_D)$ (10)

Q.5b) Explain the P-V Curve and Q-V curve for voltage stability. (10)

Q. 6 Write short notes on (any two) (20)

a. Types of transactions and interchanges of energy
b. Optimal Unit commitment and reliability considerations.
c. ALFC with integral control action

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