A 50-MVA, 65-kV, three-phase synchronous generator has a synchronous reactance of 30 Ω/phase and negligible armature resistance.

a. The generator is delivering rated power at 0.8 power factor lagging at the rated terminal voltage to an infinite bus bar. Determine the magnitude of the generated emf per phase and the power angle δ. [4 marks]

b. If the generated emf is 36 kV per phase, what is the maximum three-phase power that the generator can deliver before losing its synchronism? [2 marks]

c. The generator is delivering 48 MW to the bus bar at the rated voltage with its field current adjusted for a generated emf of 46 kV per phase. Determine the armature current and the power factor. State whether power factor is lagging or leading? [4 marks]