

0713-315

Power System Analysis

Complex Engineering Problem: Fault Analysis in a 5-Bus Power System (5 Marks)

Problem Statement:

A **5-bus** power system consists of:

- Bus 1: Synchronous generator (G1), **100 MVA, 132 kV**, sub-transient reactance = **0.2 pu**
- Bus 2: Connected to Bus 1 via a **132/66 kV** transformer (T1), **X = 0.1 pu**
- Bus 3: Connected to Bus 2 via a **66 kV** transmission line, **X = 0.25 pu**
- Bus 4: Another generator (G2), **50 MVA, 66 kV, X'' = 0.25 pu**, connected to Bus 3
- Bus 5: Industrial load center connected to Bus 3 via a line of **X = 0.2 pu**

A three-phase symmetrical fault occurs at Bus 3.

All reactances are in per unit on a 100 MVA base. Assume appropriate conversion and values where needed.

Tasks:

1. (2 Marks - Analyze) Draw the single-line diagram and develop the reactance diagram in per unit on a 100 MVA base. Clearly indicate all buses and impedances.
2. (2 Marks - Apply) Calculate the fault current at Bus 3 and determine the fault level in MVA.
3. (1 Mark - Evaluate) Briefly discuss how the inclusion of G2 (at Bus 4) affects the fault current contribution at Bus 3 and what implications this has for protection coordination.

Submission Guidelines:

1. Students must provide a comprehensive solution with a proper explanation.
2. The solution must be entirely handwritten. A PDF file is to be submitted via the designated portal (will be shared soon).
3. It is imperative that both the **Name and Student ID** are clearly displayed at the beginning of the submission.
4. [Intentionally skipped to keep original numbering consistent]
5. The submission deadline is **June 7, 2025**. Submissions made before **May 25, 2025**, will receive bonus marks for early submission.
6. To avoid potential **REGRET**, it is strongly advised that students refrain from copying this assignment from others. Both the individual who copies and the individual who facilitates the copying will face equal consequences, which will adversely affect their overall grade in this course.