UNIT-III

Load Flow Analysis :— is a numerical analysis of the flow of electric power in an interconnected system. A power flow analysis usually uses simplified notations such as a one-line diagram and per unit system, and focuses on various aspects of AC power parameters, such as voltages, voltage angles, real power and reactive power. It analyses the power systems in normal steady state operation.

OR

It is a computational procedure (numerical algorithms) required to determine the steady state operating characteristics of a power system network from the given line data and Bus data

Power flow or load flow studies are important for planning future expansion of power systems as well as determining the best operation of existing systems. The principal information obtained from the power-flow study is the magnitude and phase angle of the voltage at each bus, and the real and reactive power flowing in each line.

Bus – A Bus in a power system is defined as the ~~vertice~~ vertical line at which the several components of the power system like generator, loads, and feeders, etc. are connected. The buses in a power system are associated with four quantities. These quantities are the magnitude of the voltage, the phase angle of the voltage, active or true power and the reactive power.

OR

A bus is a node where a line or several lines are connected and may also include several components such as loads and generators in a power system. Each Bus or node is correlated with one of four quantities (1) magnitude of voltage, (2) phase angle of voltage (3) active power or ~~true~~ true power, and (4) reactive power.

In a specific load flow, two out of four quantities have a definite value, while the other two will need to be determind by calculating using power flow equations. The unknown and known variables are not fixed and vary depending on the bus type.

Depending upon which quantities have been specified, the buses are classified in the following three categories-

Generation Bus :- The generation bus, also known as the PV Bus voltage-controlled bus, or generator bus, represents the generator stations found in a power system. The quantities specified for this type of bus are voltage magnitude and the ~~real~~ real power. It means that the unknown variables for the generation bus are the phase ~~and~~ angle of voltage and reactive power.

Generator in the power system are connected to this type of bus. Therefore, the bus voltage corresponds to the generator's voltage, and the generation of active power is correlated to the generator rating specific to the Bus.

The voltage magnitude of the generator bus is kept steady by adjusting the synchronous generator's field current. Real power generation for every generator is assigned concerning economic dispatch.

Load Bus :- At this bus the real and reactive components or power are specified. It is desired to find out the voltage magnitude and phase angle through the load flow solution.

It is required to specify and P_D & Q_D at such a bus as at a load Bus voltage can be allowed to vary with in permissible values e.g. 5%. Also phase angle of the voltage is not very important for the load.

No generater is connected to the load Bus. ~~Voltage is this type of~~ The load bus is the most numerous bus type typically found in the power system.

Slack Bus :- In load flow analysis losses remain unknown until the load flow solution is complete. It is for this reason that generally one of the generator buses is made to take the additional real and reactive power to supply transmission losses. That is why this type of bus is also known as the slack or swing bus. At this Bus, the voltage magnitude V and phase angle δ are specified. whereas real and reactive powers P_G & Q_G are obtained through the load flow solution.

Bus type	Quantities specified	Quantities to be obtained
Load Bus	P, Q	$\|V\|$, δ
Generator Bus	P, $\|V\|$	Q, δ
Slack Bus	$\|V\|$, δ	P, Q