POWER SYSTAM ANALYSIS SHORT ANSWER QUESTIONS

UNIT-I

1. What is per unit value and advantages of per unit system?

A. Per unit of any quantity is defined as the ratio actual to base value expressed in decimal.

Advantages :

- The pu impedances of machines of same type and widely different ratings lie within a narrow range.
- Per unit values referred to either side of the transformer remains same. Pu impedance of a 3 phase transformer is independent of type of winding
- Computational efforts are reduced by a great extent.
- The chance of confusion between line and phase quantities in a three phase balanced system is greatly reduced.
- Manufactures usually provide impedance values in pu.

2. **)** What is a one line / Single line diagram?

A. Single or One line diagram is a diagrammatic representation of a power system, in which the components are represented by their standard symbols and interconnection between them is shown by a straight line.

3) What is an impedance diagram and what are the approximations made while drawing it?

A. The impedance diagram is the equivalent circuit of a power system in which various components are represented by their approximate or simplified equivalent circuits.

Approximations:

1. The neutral impedance is neglected.
2. All static loads are represented as impedances.
3. Transmission line is represented by its equivalent.

4) What is a reactance diagram?

A. The reactance diagram is drawn omitting all static loads, neutral impedance, resistances, magnetizing components of each transformer and the capacitance of the transmission line from the impedance diagram.

5) What is a bus admittance matrix?

A. The matrix consisting of the self and mutual admittances of the network of a power System is called bus admittance matrix.

6) What is the need for base values?

A. The various components of a power system may operate at different voltage and power levels. So, it will be convenient if voltage, power, current and impedance ratings of these components are expressed with reference to a common value called base value.

UNIT-II

1. What is the need for load flow study?

A) The load flow study of a power system is essential to decide the best operation of essential system and for planning the future expansion of the system. It is also essential for designing a new power system.

2. What are the works involved in a load flow study?

A) The following has to be performed for a load flow study.

a) Representation of the system by single line diagram.

b) Formation of impedance diagram using the information in single line diagram.

c) Formation of network equations.

d) Solution of network equations.

3. **What are the different types of buses in a power system?**

A) The buses of a power system can be classified into three types based on the quantities being specified for the buses, which are as follows:

a) load bus or PQ bus(P and Q are specified)

b) Generator bus or voltage controlled bus or PV bus(P and V are specified)

Slack bus or swing bus or reference bus(V and delta are specified

4) What is the need for slack bus?

A. The slack bus is needed to account for transmission line losses. In a power system the total power generated will be equal to sum of power consumed by loads and losses. In a power system only the generated power and load power are specified for buses. The slack bus is assumed to generate the power required for losses. Since the losses are unknown the real and reactive power are not specified for slack bus.

5) What is a PQ bus?

A. A bus is called PQ bus when real and reactive components of power are specified for the bus. In a load bus the voltage is allowed to vary within permissible limits.

6). What is swing bus?

A. A bus is called swing bus when the magnitude and phase of the bus voltage are specified for it. The swing bus is the reference bus for load flow solution and it is required for accounting line losses. Usually one of the generator bus is selected as swing bus.

7) How many methods uses for the load flow solution ?

A.

1. Gauss-seidel method using Ybus
2. Newton- Raphson method (NR)
3. Power flow through line and slack bus power
4. Decouple load flow method
5. Fast Decouple load flow method.

UNIT-III

1. What is bus admittance matrix?

A) The matrix consisting of the self and mutual admittance of the network of a power system is called bus admittance matrix.

2. What are the methods available for forming bus impedance matrix?

A) (1) Form the bus admittances matrix and then take its inverse to get bus impedance matrix.

(2) Directly from the bus impedance matrix from the reactance diagram. This method utilizes the techniques of modification of existing bus impedance matrix due to addition of new bus.

3. Name the diagonal and off diagonal elements of bus admittance matrix?

A) The diagonal elements of bus admittance matrix are called self admittances of the matrix and off diagonal elements are called mutual admittances of the bus.

4. What is bus impedance matrix?

A) The matrix consisting of driving point impedances and transfer impedances of the network of a power system is called bus impedance matrix.

5. Write four ways of adding an impedance to an existing system so as to modify bus impedance matrix.

A) Case 1:- Adding a branch impedance Zb from a new bus P to the reference bus.

Case 2:- Adding a branch impedance Zb from a new bus P to the existing bus q.

Case 3:- Adding a branch impedance Zb from a existing bus q to the reference bus.

Case 4:- Adding a branch impedance Zb between two existing bus h and q.

UNIT-IV

1. What are the assumptions made in short circuit studies of a large power system network?

Answer: • Representing each machine by a constant voltage source behind proper reactances which may be X", X' or X.

• Pre fault load currents are neglected

. • Transformer taps are assumed to be nominal.

• Shunt elements in the transformer model that account for magnetizing current and core loss are neglected.

• A symmetric three phase power system is considered. • Shunt capacitance of the transmission line is ignored.

• Series resistances of transmission lines are neglected.

• The negative sequence impedance of alternators are assumed to be the same as their positive sequence impedance.Z1=Z2

2. What are the reactances used in the analysis of symmetrical faults on the synchronous machines as its equivalent reactance?

Answer:

1. Sub transient reactance Xd "

2. Transient reactance Xd '

3. Synchronous reactance Xd

3. What is the reason for transients during short circuits?

Answer: The faults or short circuits are associated with sudden change in currents. Most of the components of the power system have inductive property which opposes any sudden change in currents so the faults (short circuit) are associated with transients.

4. Define short circuit interrupting MVA of a circuit breaker

Answer: The short circuit interrupting MVA of a circuit breaker is the volt-amperes (power) flowing through it at the moment of opening its contacts due to a fault. It is estimated by the following equations

$$\textbf{Short circuit interrupting MVA} = \sqrt{3}\left|V_{pL}\right|\left|I_{fL}\right|$$

$$\textbf{Short circuit interrupting MVA} = \left|V_{pL,p.u}\right|\left|I_{fL,p.u}\right| \ MVA_b$$

5.What is interrupting short circuit current rating of circuit breaker? How it is estimated

Answer: The interrupting short circuit current rating of the circuit breaker is the maximum current that may flow through it when its contact open due to fault. It is estimated by multiplying the transient short circuit current by a factor of 1.0 to 1.5.The value of the factor depends on the speed of the breaker

6. **What is the need for short circuit analysis?**

Answer: The short circuit studies are essential in order to design or develop the protective schemes for various parts of the system. The protective scheme consists of current and voltage sensing devices, protective relays and circuit breakers. The selection of these devices mainly depends on various currents that may flow in the fault conditions.

UNIT-V

1). What are positive sequence components?

A. The positive sequence components of a three phase unbalanced vectors consists of three Vectors of equal magnitude, displaced from each other by 120 degrees in phase and having the Same phase sequence as the original vectors.

2). What are negative sequence components?

A. The negative sequence components of a three phase unbalanced vectors consists of three Vectors of equal magnitude displaced from each other by 120 degree in phase and having the phase sequence opposite to that of the original vectors.

3) What are zero sequence components?

A. The zero sequence components of a three phase unbalanced vectors consists of 3 vectors of equal magnitude and with zero phase displacement from each other.

4) When do you call a fault symmetrical and unsymmetrical?

A. A fault is called symmetrical fault if the fault current is equal in all the phases. The fault is unsymmetrical fault if the fault current is not equal in all the phases.

5) How many types of fault occurs in the 3 P power system ?

A. Faults in the 3 P system can be classified under the following :-

a. single line to ground (LG) fault

b.line to line (LL) fault

c. Double line to ground (LLG) fault

d. Thee Phase short circuit (LLL) fault

e. three phase to ground (LLLG) fault

UNIT-VI

1) How Stability in a power system is characterized?

Answer: Stability in power system is characterized by rotor angle stability and voltage stability

2) What is steady state or small signal stability?

Answer: A power system is study state stable for particular steady state operating condition if, following any small disturbance, it reaches a steady state operating condition which is identical or close to the pre-disturbance operating condition example of small disturbance: small load changes takes place in the grid.

3) What is Transient Stability?

Answer: A power system is transient stable for a particular steady state operating conditions and for particular large disturbances or series of disturbances if the system after the following a sequence of disturbances reaches an acceptable steady state operating condition example of large disturbance: tripping of transmission lines, short circuit fault, load throw-off

4) Factors that determine the power transfer capability in transmission system?

Answer: Factors that determine the power transfer capability of the transmission system are:

Voltage regulation

Thermal Limits

System Stability

5) What are the methods to increase the power transfer capability in a power system?

Answer: To increase the power levels for the transmission of power from sending end to receiving end, either characteristic impedance of the transmission line can be increased (by providing compensation devices in the network) or by increasing the transmission voltage levels power transfer capability can be increased.