MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-EE 601/PC-EEE 601 Power System-II

UPID : 006603

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(I) What is the expression of fault current in case of LG fault?

(II) What will be nature of stability if the torque angle δ continuously increases?

(III) What is the purpose of Buchholz relay?

(IV) What is the difference between per unit impedances of a transformer referred from the primary and secondary side?

(V) What is the main criterion for selecting the size of a distributor for a radial distribution system?

(VI) In which bus of the power network, voltage magnitude and angle are unknown?

(VII) A 100 kVA transformer has a reactance of 6%. What will be value of its reactance at 300 kVA base?

(VIII) What do you mean by distribution system?

(IX) For which condition, a voltage-controlled bus is treated as a load bus in subsequent iteration?

(X) What is the value of positive sequence component of voltage at the point of fault in case of 3-phase fault?

(XI) A 11 kV, 10 MVA alternator has impedance of 0.10 p.u when referred to its ratings as bases. What will be the new value for base as 110 kV, 20 MVA ?

(XII) What is the function of feeder in distribution system?

Group-B (Short Answer Type Question)

Answer any three of the following : [5 x 3 = 15]

2. What are the fundamental requirements of protective relaying? Depending upon their (i) construction and principle of operation and (ii) time of operation, how relays are classified? [5]

3. What do you mean by sub-station? Classify the substations. [5]

4. A single phase transformer is rated as 2.5 kVA, 11/0.4 kV. If the leakage reactance is 0.96 ohm when referred to low-voltage side, then determine its leakage reactance in per unit. [5]

5. A 2-wire d.c. ring distributor is 300 m long and is fed at 240 V at point A. At point B, 150m from A, a load of 120 A is taken and at C, 100m in the opposite direction , a load of 80 A is taken. If the resistance per 100m of single conductor is 0.03 Ohm, find [5]
(i) current in each section of distributor
(ii) voltage at points B and C

6. A generator of negligible resistance having 1.0 per unit voltage behind transient reactance is subjected to different types of faults. [5]

Type of Fault	Resulting fault current in p.u
3-phase	3.33
L-L	2.23
L-G	3.01

Calculate the per unit values of 3 sequence –reactance.

Group-C (Long Answer Type Question)

Answer any three of the following : [15 x 3 = 45]

7. (a) What do you mean by Per Unit (pu) system? [2]

(b) What are the advantages of Per Unit (pu) system? [5]

(c) An 11/0.4 kV, 200kVA transformer has an equivalent impedance of (2.4+j12.4) Ohms referred to the hv side. Determine the base values for the p.u. system, the per-unit equivalent impedance and the equivalent impedance drop at one-half rated current. [8]

8. (a) [6]

What are the compaisons between overhead distribution system and underground distribution system?

(b) What are the advantages of double end fed distribution system over single end fed distribution system? [2]

(c) A 2-wire dc distributor cable AB is 2 km long and supplies loads of 100 A, 150A, 200A and 50A situated 500m, 1000m, 1600m and 2000m from the feeding point A. Each conductor has a resistance of 0.01 Ohm/1000m. Calculate the potential difference at each load point if a p.d. of 300V is maintained at point A. [7]

9. (a) Classify different kind of distribution system along with relevant diagrams. [6]

(b) A 250m, 2-wire dc distributor fed from one end is loaded uniformly at the rate of 1.6A/metre. The resistance of each conductor is 0.0002 Ohm/metre. Find the voltage necessary at feed point to maintain 250 V (i) at the far end (ii) at the mid point of the distributor. [7]

(c) What are the advantages of ac system over dc system? [2]

10. (a) What are the comparisons between Gause-Seidel method and Newton-Raphson method? [5]

(b) Why generator bus is called PV bus? [2]

(c) The following is the system data for a load flow solution: [8]

The line admittances:

Bus code	Admittance(p.u.)
1-2	2-j8.0
1-3	1-j4.0
2-3	0.666-j2.664
2-4	1-j4.0
3-4	2-j8.0

The schedule of active and reactive powers:

Bus code	P(P.u)	Q(P.u)	V(P.U.)	Remarks
1	-	-	1.06	Slack
2	0.5	0.2	1+j0.0	PQ
3	0.4	0.3	1+j0.0	PQ
4	0.3	0.1	1+j0.0	PQ

If bus 2 is taken as generator bus with voltage magnitude=1.04 p.u and reactive power constraint is

$$0.1 \leq Q2 \leq 1.0$$

Determine the voltages starting with a flat voltage profile and assuming accelerating factor as 1.0.

11. (a) Derive sequence voltages in case of solidly earthed L-G fault with the help of symmetrical component method. [5]

(b) Find out different sequence current components in term of positive sequence current component, fault current and draw the sequence impedance network for L-G fault. [5]

(c) A 3-phase star connected alternator is rated 30 MVA, 13.8 kV and has following sequence reactance values: [5]

X_1=0.25p.u., X_2=0.35p.u., X_0=0.10p.u. The neutral of the alternator is solidly grounded. Determine the alternator line currents when a double line-to-ground fault occurs on its terminals. Assume that the alternator is unloaded and is operating at rated voltage when the fault occurs.

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