Tutoria1 5

Three-Phase Circuits: Balanced Star Connected Load

1. A three-phase, four-wire, 208 V system serves a balanced star-connected load with impedances of $20\angle -30^o\ \Omega$ each. Find the line currents and draw the phasor diagram, taking $V_{AN} = 120.09\ \angle -90^o$ V.
   Ans: $I_A = 6\angle 300^o$ A or $6\angle -60^o$ A, $I_B = 6\angle 180^o$ A or $6\angle -180^o$ A, $I_C = 6\angle 60^o$ A or $6\angle -300^o$ A

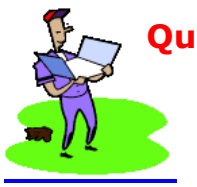
2. An ABC three-phase, 4-wire system serves a star-connected load with impedances of $10\angle 30^0\ \Omega$ each. The line current I_A drawn is found to be $12\angle -30^0$ A. Find all the line voltages, the phase voltages and the remaining line currents.
   Ans: $V_{AN} = 120\angle 0^o$ V, $V_{BN} = 120\angle -120^o$ V, $V_{CN} = 120\angle -240^o$ V,
   $V_{AB} = 208\angle 30^o$ V, $V_{BC} = 208\angle -90^o$ V, $V_{CA} = 208\angle -210^o$ V,
   $I_A = 12\angle -30^o$ A, $I_B = 12\angle -150^o$ A, $I_C = 12\angle -270^o$ A

3. A three-phase, four wire, 208 V system serves a balance star-connected load drawing a line current $I_A = 10\angle 145°$A. Find the line current I_C and the load impedance in each phase, taking V_{BC} as reference.
   Ans: $I_C = 10\ \angle -95^o$ A, $Z = 12.01\ \angle -55^o\ \Omega$

4. Given a balanced three-phase, three-wire system with a Y-connected load for which the line voltage is 230 V and the impedance of each phase is (6 + j 8) Ω. Taking V_{AB} as reference, find the line current I_A and power absorbed by each phase.
   Ans: $I_A = 13.28\ \angle -83.13^o$ A, $P_{PH} = 1058$ W

5. A balanced star load, having a power factor of 0.8 lagging, is connected to a 400 V, 3-phase, 3-wire balanced star supply. The total power consumption of the load is 3 kW. Find the impedances of the load in polar form.
   Ans: $Z = 42.67\ \angle 36.87^o\ \Omega$

6. A small plant requires the installation of a new three-phase device. The device is to be connected using a 4-wire system with a line voltage of 208 V. Each of the 3-phases has impedance of $10\angle 60^\circ\ \Omega$. Calculate the line currents for each phase and the overall power dissipated if the impedances are connected in star. Take V_{AN} as the reference voltage and phase sequence as ACB (negative sequence).
   Ans: $I_A = 12\angle -60^o$ A, $I_B = 12\angle -300^o$ A, $I_C = 12\angle -180^o$ A, P = 2161.59 W



Quiz – 3 questions
(Three Phase Supply & Generation)
– 3 questions
(Balanced Star Load)