Basic Electrical Engineering

2nd Semester

Work Sheet-9

Three Phase Circuits

1. Three loads, each of resistance 50Ω are connected in star to a 400V, 3-phase supply. Determine (a) the phase voltage, (b) the phase current and (c) the line current. **[(a) 231V (b) 4.62 A (c) 4.62 A]**

2. If the loads in question T5.20 are connected in delta to the same supply determine (a) the phase voltage, (b) the phase current and (c) the line current. **[(a) 400V (b) 8 A (c) 13.86 A]**

3. A star-connected load consists of three identical coils, each of inductance 159.2mH and resistance 50Ω. If the supply frequency is 50 Hz and the line current is 3A determine (a) the phase voltage and (b) the line voltage. **[(a) 212V (b) 367V]**

4. Three identical capacitors are connected (a) in star, (b) in delta to a 400V, 50 Hz, 3-phase supply. If the line current is 12 A determine in each case the capacitance of each of the capacitors**. [(a) 165.4μF (b) 55.13μF]**

5. Three coils each having resistance 6Ω and inductance *H* are connected (a) in star and (b) in delta, to a 415V, 50 Hz, 3-phase supply. If the line current is 30 A, find for each connection the value of *L***. [(a) 16.78mH (b) 73.84 mH]**

6. A 400V, 3-phase, 4 wire, star-connected system supplies three resistive loads of 15kW, 20kW and 25kW in the red, yellow and blue phases respectively. Determine the current flowing in each of the four conductors.

7. [*IR* =64.95A, *IY* =86.60A *IB* =108.25A, *IN* =37.50A]

8. A 3-phase, star-connected alternator delivers a line Current of 65A to a balanced delta-connected load at a line voltage of 380V. Calculate (a) the phase voltage of the alternator, (b) the alternator phase current and (c) the load phase current. [(a) 219.4V (b) 65A (c) 37.53A]

9. Three 24μF capacitors are connected in star across a 400V, 50 Hz, 3-phase supply. What value of capacitance must be connected in delta in order to take the same line current? **[8μF]**

10. Determine the total power dissipated by three 20Ω resistors when connected (a) in star and (b) in delta to a 440V, 3-phase supply. **[(a) 9.68kW (b) 29.04 kW]**

11. A balanced delta-connected load has a line voltage of 400V, a line current of 8A and a lagging power factor of 0.94. Draw a complete phasor diagram of the load. What is the total power dissipated by the load? **[5.21 kW]**

12. Three inductive loads, each of resistance 4Ω and reactance 9Ω are connected in delta. When connected to a 3-phase supply the loads consume 1.2kW. Calculate (a) the power factor of the load, (b) the phase current, (c) the line current and (d) the supply voltage. **[(a) 0.406 (b) 10A (c) 17.32A (d) 98.53V]**

13. The input voltage, current and power to a motor is measured as 415V, 16.4A and 6kW respectively. Determine the power factor of the system. **[0.509]**

14. A 3-phase, star-connected alternator supplies a delta connected load, each phase of which has a resistance of 15Ω and inductive reactance 20Ω. If the line voltage is 400V, calculate (a) the current supplied by the alternator and (b) the output power and kVA rating of the alternator, neglecting any losses in the line between the alternator and the load. **[(a) 27.71A (b) 11.52kW, 19.20 kVA]**

15. Each phase of a delta-connected load comprises a resistance of 40Ω and a 40μF capacitor in series. Determine, when connected to a 415V, 50 Hz, 3-phase supply (a) the phase current, (b) the line current, (c) the total power dissipated, and (d) the kVA rating of the load. **[(a) 4.66A (b) 8.07A (c) 2.605kW (d) 5.80 kVA]**

16. A 440V, 3-phase a.c. motor has a power output of 11.25kW and operates at a power factor of 0.8 lagging and with an efficiency of 84%. If the motor is delta connected determine (a) the power input, (b) the line current and (c) the phase current. **[(a) 13.39kW (b) 21.97A (c) 12.68A]**

17. A 3-phase network is shown in Fig. with phase voltage Van = 120∠0V. Determine: (a) Ia (b) $V_{a'n}$ (c) the total power loss in the line resistances, and (d) total power input to the network **[(a) 2∠-53.1° A; (b) 124.96∠-2.9° V; (c) 48 W; (d) 480 W]**