1. True power is measured in____and is a measure of the____.
   (a) volt-amps; power supplied
   (b) volt-amps ; power consumed
   (c) watts; power consumed
   (d) watts; power supplied

2. In a purely resistive circuit there is no:
   (a) apparent power
   (b) true power
   (c) average power
   (d) reactive power

3. In a power triangle, apparent power is represented by the:
   (a) side adjacent the phase angle
   (b) hypotenuse
   (c) side opposite the phase angle
   (d) cosine of the phase angle

4. Power factor is a ratio of:
   (a) reactive power to apparent
   (b) true power to reactive power
   (c) apparent power to true power
   (d) true power to apparent power

---

5. The power consumed in a circuit is determined by:
   (a) apparent power times the power factor
   (b) apparent power divided by the power factor
   (c) reactive power times the power factor
   (d) true power plus the power factor

1. A heating element connected to a 240V, 50Hz supply draws 10A. Determine the:
   (a) the circuit phase angle. (0^{O})
   (b) apparent power of the circuit; (2400VA)
   (c) true power consumed by the circuit. (2400W)

2. A capacitor connected to a 240V, 50Hz supply draws 12A. Determine the:
   (a) the circuit phase angle. (90^{O} leading)
   (b) apparent power of the circuit; (2880VA)
   (c) true power consumed by the circuit. (0W)

3. A single phase 240V, 50Hz circuit draws 5A from the power supply, and operates at alagging power factor of 0.8. Determine the:
   (a) the circuit impedance; (48Ω)
   (b) the circuit phase angle. (36.8^{O})
   (c) true power consumed by the circuit; (960W)

4. A single phase load draws 2.5A from a 32V, 50Hz supply. If the power consumed by thecircuit is 60W, determine the:
   (a) the circuit impedance; (12.8Ω)
   (b) apparent power of the circuit; (80VA)
   (c) circuit power factor; (0.75)
   (d) circuit phase angle; (41.4^{O})
   (e) reactive power of the circuit; (52.9VAr)

5. A 240V, 50Hz, single phase circuit operates at a lagging phase angle of 30^{O} . If the power consumed is 1.5kW, use a power triangle to determine the apparent and reactive power forthe circuit. Use a scale of 1mm = 15VA/W/VAr (S = 1.732kVA; Q = 863VAr)

1. When power factor correction is used, the:
   (a) circuit current decreases
   (b) true power decreases
   (c) reactive power power increases
   (d) apparent power remains constant

NOTES

2. The value of power factor correction capacitor used is often given in:
   (a) VA
   (b) W
   (c) VAr
   (d) Ω (Xc)
1. A 240V, 50Hz single phase inductive load operates at a constant 2.4kW input power. Determine the circuit current when:
   (a) the power factor is at 0.2 lag; (50A)
   (b) the power factor has been improved to 0.9 lag. (11.1A)

2. Draw a power triangle for a 1500W load operating at 0.5 lagging power factor, using a scale of 1mm = 50W = 50VA = 50 VAr. Also show on your power triangle the new apparent and reactive power if the power factor is improved to 0.95 lagging. (1600VA, 500VAr)

NOTES

3. For the circuit of figure 1, determine:
   (a) the supply current (scale: 1mm = 0.25A). (19.5A)
   (b) the phase angle (16.5^{O} lag)
   (c) the power factor; (0.96 lag)
   (d) the apparent power; (4.68kVA)
   (e) the true power; (4.49kW)
   (f) the reactive power. (1.33kVAr)

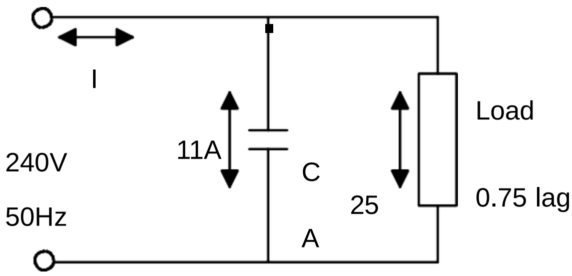

Figure 1

4. For the circuit of figure 2, determine:
   (a) the kVAr rating of a capacitor required to improve the power factor to 0.9 lag. Use a scale of 1mm = 100W = 100VA = 100VAr. (10.1kVAr)
   (b) the new value of apparent power. (3.4kVA)
   (c) the new value of circuit current. (14.2A)

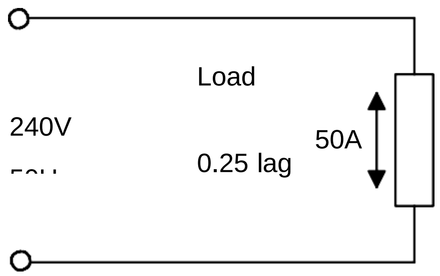

Figure 2

5. A single phase 240V, 50Hz circuit draws 15A from the power supply, and operates at a lagging power factor of 0.8. Determine the kVAr rating and value of capacitance required to improve the power factor to unity. (2.16kVAr; 119μF)

1. Positive phase sequence is represented by:
   (a) B-A-C
   (b) C-B-A
   (c) A-B-C
   (d) A-C-B

2. Single phase loads can be connected to a three phase distribution system that is:
   (a) delta connected with three wires
   (b) delta connected with four wires
   (c) star connected with three wires
   (d) star connected with four wires

1. A three phase supply has a line voltage of 415V. Determine the supply phase voltage ifconnected in:
   (a) star. (240V)
   (b) delta. (415V)

2. A three phase generator has a maximum generated voltage of 340V. Determine theinstantaneous value of voltage for all three phases when A phase is at an angle of 45^{O} .
   (A phase: 240V; B phase: 88V; C phase: -328V)

****

1. The line voltage of a star connected system is:
   (a) $\sqrt{3}$ Vp
   (b) $\sqrt{2}$ Vp
   (c) 0.5Vp
   (d) equal to Vp

Tutorial 5

1. In a star connected system, the phase angle between the line voltage and phase voltage is:() 120^{O}
   () 90^{O}
   () 30^{O}
   () 0^{O}

2. The line current of a star connected system is:
   () $\sqrt{3}$ Ip
   () Ip $/\sqrt{3}$
   () 0.5Ip
   () equal to Ip

1. The minimum number of fixed wattmeters required to measure the power consumed by athree phase, four wire unbalanced system is:
   () one
   () two
   () three
   () four

2. If the phase currents and power factors are equal in a three phase system, then the system issaid to be:
   () balanced
   () unbalanced
   () star connected
   () delta connected

3. The power factor for a balanced three phase system is the ratio of:() true power to reactive power
   () apparent power to reactive power
   () true power to apparent power
   () reactive power to true power

4. The total power in a three phase system can be measured using a single wattmeter providedthe:
   () load is balanced
   () load is unbalanced
   () load is star connected
   () neutral is not connected

1. The power factor of a three phase load can be determined using the two watt meter methodprovided:
   (a) the power factor is greater than 0.5
   (b) the neutral is not connected
   (c) the load is balanced
   (d) there is no current in the middle phase

2. An indication that harmonics are present in a three phase supply system would be:
   (a) erratic motor behaviour
   (b) low transformer currents
   (c) low nuetral currents
   (d) lower power consumption

3. When measuring power using the two watt meter method, if W1 reads zero, and W2 reads100W, the circuit power factor will be:
   (a) unity
   (b) zero
   (c) 0.5 leading
   (d) 0.5 lagging

4. When measuring a balanced three phase load using the two watt meter method, if bothwattmeter readings are equal, the power factor is equal to:
   (a) unity
   (b) zero
   (c) 0.5 leading
   (d) 0.5 lagging

5. To measure the total power in any three phase unbalanced load, the minimum number ofwattmeters required is:
   (a) 1
   (b) 2
   (c) 3
   (d) 4

1. A 415V uses the two wattmeter method to measure its total power consumption. If W1indicates -750W and W2 indicates 2 kW, determine:
   (a) the Total power supplied to the load; (1250W)
   (b) the Power factor for the load; (0.254 lead)
   (c) the Line current for the load; (6.85A)
   (d) the Impedance of each phase of the load if the load is star

   connected. (35Ω)Explain why the power factor is leading from these

   results.

****

Star Delta Interconnected Systems

1. For the circuit of figure 3, determine the:
   (a) line voltage output of the transformersecondary; (200V)
   (b) phase voltage of the heating load;(115V)
   (c) line current from the transformer tothe load; (5A)
   (d) power used by the load, assuming the power factor is unity (1.732kW)

2. A delta connected transformer secondarysupplies a star connected inductive load. The power consumption of the load is measured at 15kW at a power factor of 0.695. If the phasecurrent of the load is 30A, determine the:
   (a) line voltage output of the

transformer; (415V)

(b) phase voltage of the load; (240V)

(c) phase angle for the load; (46^{O} lag)

(d) current in the transformer windings. (17.32A)

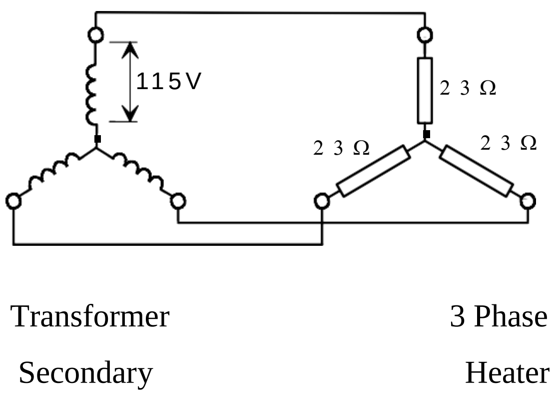

Figure 3

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