Transformers – Possible Questions

1 What is a typical secondary voltage for a voltage transformer used for high voltage protection?

2 Why are auto transformers not to be used to supply extra-low voltage electric toys?

3 A 150 kVA three phase, delta-star connected transformer has a turns ratio of 47.8 to 1. The primary is   
connected to an 11kV three phase supply and the transformer is fully loaded. (J03)   
  
a) Sketch and label a circuit diagram of the circuit.

b) Calculate the secondary phase voltage

c) Calculate the secondary line voltage

d) Calculate the primary line current

e) Calculate the secondary line current

4 A special load requires three separate double wound transformers, each having 250 turns on one winding   
and 2500 turns on the other winding. These transformers are supplied from a 400V three phase three wire   
supply. (N02)   
  
a) Use a diagram to show a method of connection to obtain 69.28 V across lines in a four wire system.   
Indicate on your diagram the secondary line to line and line to neutral voltages.

b) i) How is the output of a large transformer maintained as the load changes?

ii) Secondary phase voltage is 40V, and to obtain a 4 wire system, a star connection is needed. Calculate the secondary line voltage.

5   
a) Sketch and label a circuit diagram to show how a voltage transformer and a current transformer can be connected to meters in a single phase circuit to measure the current, voltage and power. Include in your diagram the following components. (J02)   
  
• Current transformer   
• Voltage transformer   
• Ammeter   
• Voltmeter   
• Wattmeter   
• Load   
• Metering protection   
• Earthing

b) The ammeter in the circuit in (a) is to be removed for calibration.

i) State the precautions that must be taken before removing the ammeter from a live circuit.

ii) State TWO hazards that may exist if this precaution is not taken.

6 How is the voltage regulation of a power transformer achieved with changing loads.

7 What type of winding arrangement is most likely in a three phase power transformer that has three   
connections to its primary and four connections to its secondary.

8   
a) Sketch and label a circuit diagram to show how a current operated relay and current transformer   
(CT) can be connected in a circuit to provide protection against excess current. Include in your   
diagram the following components: (N01)   
  
• CT   
• Load   
• Relay contacts   
• Relay coil

b) Explain why there are no fuses on the secondary of the CT in (a).

c) State two common secondary current ratings used for CTs.

d) Sketch and label a circuit diagram to show how a voltage transformer (VT) can be connected in a circuit to supply a reduced voltage to an indicating voltmeter.   
  
Include in your diagram the following components:   
• VT   
• Load   
• Meter   
• Meter protection.

e) State the common secondary voltage rating of voltage transformers when supplied at their full   
primary voltage.

9 What precaution must be taken before disconnecting metering from a CT in a live circuit that cannot be   
isolated? (J01)

10 List TWO practical construction methods of reducing the iron losses in a power transformer.

11   
a) A 7 kVA, single phase, 400V spot welder has three turns on the secondary and an open circuit   
voltage of 3V across the welding tips. (J01)   
i) Calculate each of the following:   
(1) the number of turns on the primary winding

(2) the full load primary current when welding

(3) the maximum welding current

ii) the welder winding resistances are as follows:   
  
• Primary winding 0.8 ohms.   
• Secondary winding 0.0005 ohms.   
  
Explain in detail why Ohms law cannot be used to calculate the current flow in each winding using this information and the voltage across the winding.

b) Describe a typical method for cooling a 100 MVA power transformer.

12 Why are the low voltage windings in large power transformers placed closest to the core?

13 Define the term voltage regulation as applied to a transformer.

14 Define the term burden as applied to a current transformer.

15   
a) A transformer supplying an electric toy with a current of 2A has a step down ratio of 20:1. Its primary   
winding consists of 2000 turns. Calculate each of the following (show all workings). (N00)   
i) number of secondary turns

ii) secondary voltage when the primary is supplied with 230V

iii) per volts turn

iv) VA rating

b)   
i) Why must the transformer in (a) be a double wound type?

16 Sketch a power triangle and show on it Var, VA, W and phase angle.

17 How is the output voltage of a large power transformer maintained as the load changes.

18   
a) A transformer when fully loaded supplies 15A at 100V from the 230V mains. Its primary winding has   
2000 turns. Calculate the:   
i) number of secondary turns

ii) full load primary current

iii) VA rating of the transformer

b) How would a transformer of this size in (a) usually be cooled?

c) List TWO types of losses associated with all transformers.

d) Explain in detail why an increase in secondary current causes an increase in primary current in a   
double wound transformer.

19 State the effect an increase in load has on the secondary voltage of a transformer.

20 State the main limiting factor for the kVA rating of a power transformer.

21 What precaution must be taken before disconnecting a meter from the secondary of a current transformer,   
which is on a live circuit that cannot be isolated?

22 A 400V, three phase supply is connected through a three phase loss free transformer with a turn ratio of   
1:1, which has its primary connected in delta and it’s secondary in star to a load comprising 10 ohms   
resistors connected in delta.   
i) Sketch a diagram of the circuit.

ii) Calculate the:   
(1) secondary phase voltage

(2) secondary line voltage

(3) phase current in the load

(4) line current to the load

(5) line current to the transformer

iii) Name TWO losses that are associated with the iron circuit of a transformer

23. (a) Draw and label the circuit diagram of a wattmeter connected to measure the power of a load by using a   
current transformer and a voltage transformer.

(b) A 150 kVA, three-phase, delta-star-connected step-down transformer has a phase-turns ratio of 27.5 to 1.   
The primary is connected to a 6.6 kV, threephase supply, and the transformer is fully loaded.   
  
(i) Calculate the secondary phase voltage.

(ii) Calculate the secondary line voltage.

(iii) Calculate the primary line current.

24. (a) The three phase low voltage supply to a factory is required to be at a voltage that is not commonly used.   
The factory is supplied by a 150 kVA, three-phase, delta-star-connected step-down transformer has a   
phase- turns ratio of 43.3 to 1. The primary is connected to an 11 kV, three-phase supply, and the   
transformer is fully loaded. (ET 24)   
  
(i) Draw a diagram of the circuit, showing primary and secondary windings.

(ii) Calculate the secondary phase voltage.

(iii) Calculate the secondary line voltage.

(iv) Calculate the primary line current.

(v) Calculate the maximum secondary line current the transformer can deliver under full load conditions.

(v) Calculate the maximum secondary line current the transformer can deliver under full load conditions.

25. A three-phase three-wire 11 000V supply is available for the primary connection of the delta connected   
transformer to a commercial site. You have taken the current measurements at the three-phase, four-wire   
secondary side of the transformer and have recorded the following maximum demands: (ET26)   
  
Red = 145A White = 130A Blue = 120A   
The line voltage on the secondary side is 400V.   
  
  
(a) Using the information above, determine:   
  
  
  
(i) The load in kVA of the heaviest loaded phase.

(ii) The minimum sized kVA rating of the three phase distribution transformer required to supply load for this site.

(b) Using the information given above and from your calculations in (a), determine the maximum line current in   
the three-phase 11 000V system

26. A three phase, delta-star connected transformer has a turns ratio of 956:20. The primary is connected to an   
11kV three phase supply and the transformer is fully loaded. (ET28)   
  
(a) Calculate the secondary phase voltage.

(b) Calculate the secondary line voltage.

(c) If the full load primary line current is 13.12A, calculate the full load kVA rating of the transformer.

(d) Calculate the full load secondary line current.

(e) When the transformer was tested on full load the single- phase terminal VPH dropped to 222 volts. Calculate   
the percentage regulation on the transformer

27. A 11kV/415V, three-phase, delta-star transformer has a 5% impedance. When fully loaded a phase current   
of 3.03A flows in its primary windings. Assume there are no internal losses.   
  
(a) Calculate the full-load secondary line current.

(b) Calculate the kVA rating of the transformer

(c) (i) Calculate the fault level in kVA which would be produced at the transformer secondary terminals.

(ii) Calculate the prospective short circuit current that would flow if a short circuit of negligible impedance occurs   
across the transformer output terminals.