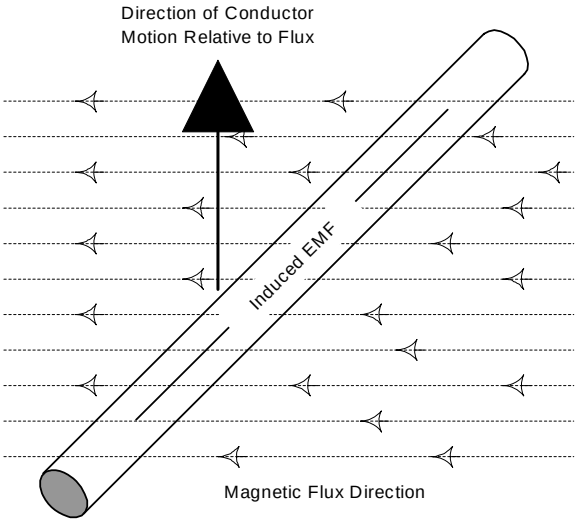
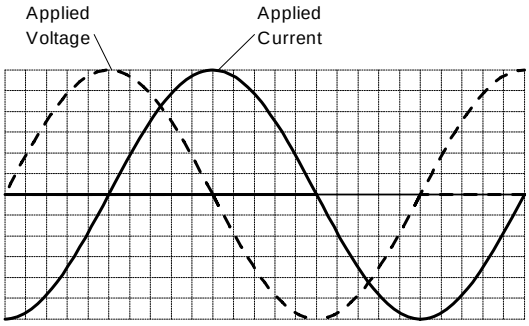


(b)

2. On diagram (b), indicate the direction of the induced emf, given the directions of magnetic lines of force and magnetic flux motion shown.

3. Diagram (c) shows the applied voltage and current sine waves applied to an inductive coil. Draw on the diagram the sine wave for the corresponding self-induced emf.



(c)

4. A transformer has emf induced in both primary and secondary windings. Indicate which winding has emf of Self-Induction and which has emf of Mutual-Induction.

Primary Winding: _____

Secondary Winding: _____

5. In transformer, the phase relationship between the applied Primary voltage and the induced voltages in the Primary and Secondary windings are:

Primary Winding	*Secondary Winding*
☐ 120^o	☐ 120^o
☐ 90^o	☐ 90^o
☐ 180^o	☐ 180^o
☐ 60^o	☐ 60^o

6. In transformer primary winding, the direction of the emf of self-induction is such that it:

(a) is always in the same direction as the applied emf

(b) opposes any change in the applied current

(c) is always assisting the applied emf

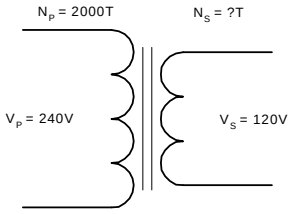
(d) only opposes decrease or fall of applied current

Something to

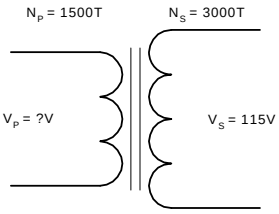
think about ...

Determine the unknown value indicated for each of the following transformers:

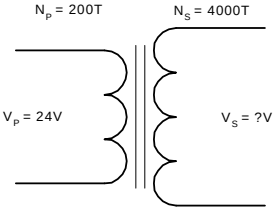
(a)



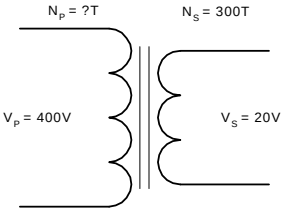
(b)



(c)



(d)



For each of the examples above, state the transformation ratio and whether the transformer is step up or step down :

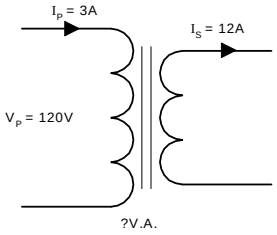
	Ratio	***Step Up – Step Down***
(a)	_____	_____
(b)	_____	_____
(c)	_____	_____
(d)	_____	_____

Something to

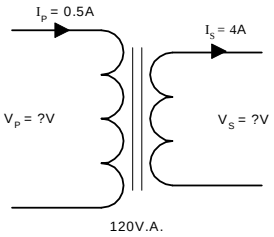
think about ...

Determine the unknown values indicated for each of the following transformers:

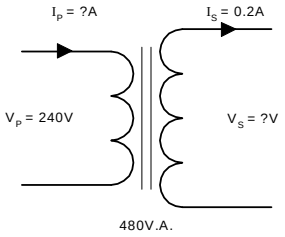
(a)



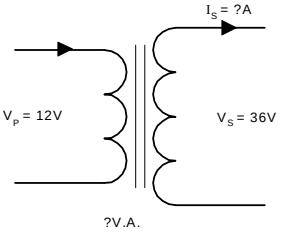
(b)



(c)



(d)



Something to

think about ...

Answer the following questions relating to transformer phase relationships:

1. The phase relationship of the induced secondary voltage of a transformer to the applied primary voltage is:

   (a) in phase;

   (b) 180^{o} out of phase

   (c) 90^{o} out of phase

   (d) dependent on the load

2. The phase relationship of the induced secondary voltage of a transformer to the secondary current is:

   (a) in phase;

   (b) 180^{o} out of phase

   (c) 90^{o} out of phase

   (d) dependent on the load

3. The phase relationship of the primary magnetising current of a transformer to the primary voltage is:

   (a) in phase;

   (b) 180^{o} out of phase

   (c) 90^{o} out of phase

   (d) dependent on the load

4. The power factor of the primary current of a transformer is determined by the:

   (a) power factor of the supply

   (b) resistance and inductance of the primary winding

   (c) power factor of the load

   (d) resistance and inductance of the secondary winding

9. The power factor of the primary current of a transformer is determined by the:

   (a) power factor of the supply

   (b) resistance and inductance of the primary winding

   (c) power factor of the load

   (d) resistance and inductance of the secondary winding

10. With a transformer supplying a capacitive load, the primary current will be:

   (a) leading the secondary current

   (b) lagging the primary voltage

   (c) in phase with the primary voltage

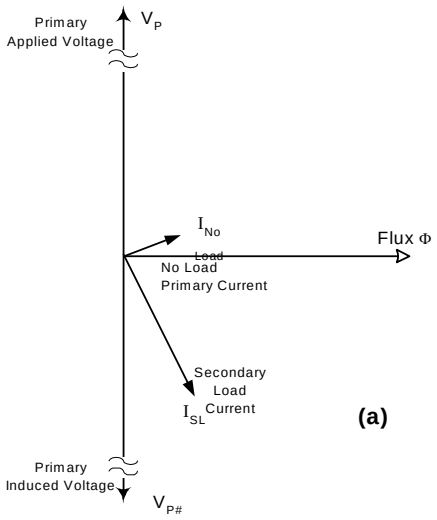
   (d) leading the primary voltage

Something to think about ...

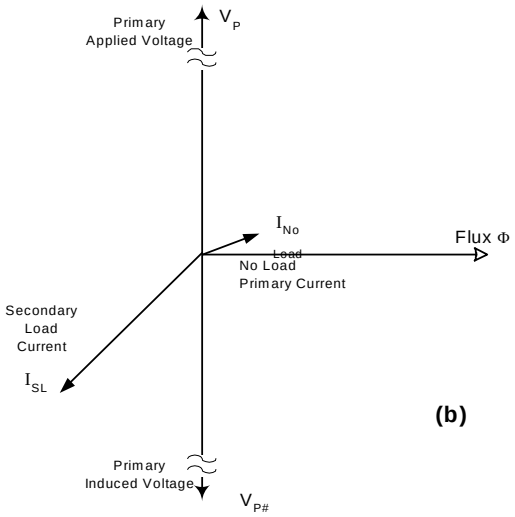
Answer the following questions relating to transformer operation:

11. Complete each of the following phasor diagrams to show the resultant primary current.

(a)



(b)



12. The mutual flux of a transformer is the resultant of the primary flux and secondary flux. The relationship between the primary and secondary flux is:

(a) the secondary flux always assists the primary flux

(b) the secondary flux only assists the primary flux with a capacitive load

(c) the secondary flux only opposes the primary flux with an inductive load

(d) the secondary flux always opposes the primary flux

13. The phase relationship between the load component of the primary current and the load component of the secondary current is that they are:

(a) always in phase with each other

(b) always at a phase angle of 90^o to each other

(c) always at a phase angle of 180^o to each other

(d) at a phase angle to each other dependent on the load power factor

14. The primary current of a transformer with no load connected to the secondary is:

(a) zero

(b) enough to supply a magnetising current only

(c) enough to supply the transformer losses only

(d) enough to supply a magnetising current and the transformer losses

Low Voltage Transformer Supply

Isolating Transformers
(Clause 4.14.3.1) Equipment may be connected through an isolating transformer in accordance with Clause 7.4

Other Transformers
(Clause 4.14.3.2) Where low voltage transformer output complies with AS/NZS 61558 series, earthing ……. :

Autotransformers

(Clause 4.14.4) An autotransformer shall not be used to supply electrical equipment , including circuit wiring, having a voltage rating ……. :

Step-up Transformers

(Clause 4.14.5) Where a transformer raises the voltage above that of the supply, no connection:

Something to

think about ...

Refer to AS/NZS 3000:20071.7.4.5 to answer the following questions relating to protection by electrical separation:

1. Describe briefly how protection by electrical separation is intended to protect against shock current:

Clause: _____

2. State three approved types of sources supplying a separated circuit:

Clause: _____

3. State the maximum permissible voltage of a separated circuit: _____

Clause: _____

Something to

think about ...

Answer the following questions relating to transformer regulation and impedance:

1. A transformer has an output voltage on no-load of 400V, while the full-load output is 390V. What is the % regulation?

2. A transformer is rated at 110V full load, with 3% impedance. What is the expected open-circuit (no-load) output voltage?

3. A transformer is rated at 500kVA at 400V, with 2.5% impedance. If a direct short-circuit occurred on the secondary output, what would be the maximum prospective fault current?

Something to

think about ...

Answer the following questions relating to transformer connections:

1. When two 4:1 ratio transformers are connected together to achieve an overall ratio of 8:1, they should be connected with:

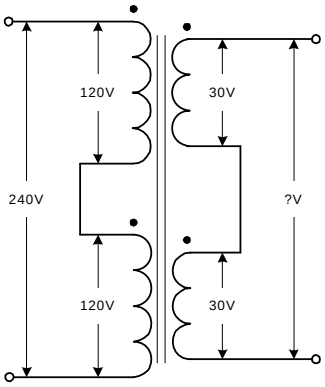
   (a) series primaries and series secondaries

   (b) series primaries and parallel secondaries

   (c) parallel primaries and series secondaries

   (d) parallel primaries and parallel secondaries

2. Insert the required value where indicated:



(a) Series-Series

Both primaries and secondaries are in series, giving:

Output Voltage: _____

Overall Ratio: _____

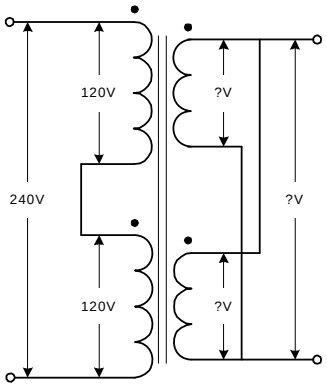
(b) Series-Parallel

The primaries are in series, the secondaries in parallel, giving:

Secondary Voltage: _____

Output Voltage: _____

Overall Ratio: _____



Something to

think about ...

Answer the following questions regarding transformer harmonics:

1. The term “third harmonic” refers to a frequency that is:

   (a) **the third highest of a set of frequencies**

   (b) **one third of the fundamental frequency**

   (c) **the third lowest of a set of frequencies**

   (d) **three times the fundamental frequency**

2. Harmonic frequencies are significant because they:

   (a) **increase the output power of the transformer**

   (b) **decrease the transformer power factor**

   (c) **produce circulating currents within the transformer windings**

   (d) **increase the transformer efficiency**

3. The term “tertiary” means “third”. Tertiary windings in a transformer are additional or third windings between the primary and secondary windings, and are:

   (a) **additional delta windings in which harmonic currents can circulate harmlessly**

   (b) **windings that are designed to produce third harmonics**

   (c) **intended to produce circulating currents within the transformer windings**

   (d) **included to decrease the transformer power factor**