A.C. Principles

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- All relevant equations and working are to be shown in the case of calculation type questions.

SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. The value of AC voltage shown on the name plate of an appliance is the:
   (a) average value
   (b) peak value
   (c) instantaneous value
   (d) r.m.s. value

2. The value of AC voltage that has the same heating effect as the equivalent value of DCvoltage is the:
   (a) rms value.
   (b) peak value.
   (c) average value.
   (d) peak to peak value.

3. For one complete cycle of an AC supply, the current flow:
   (a) will remain constant in magnitude.
   (b) will flow in one direction only.
   (c) will flow in one direction then reverses direction.
   (d) reaches a maximum in one direction then falls to zero.

4. The standard unit of frequency is the:
   (a) Hertz (Hz)
   (b) Volt (V)
   (c) period (T)
   (d) cycle per second (CPS)

5. The term *frequency* of an AC supply is defined as the:
   (a) number of cycles completed in one minute.
   (b) number of cycles completed in one second.
   (c) time required to complete one cycle.
   (d) the amount of a cycle completed in one second.

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. The standard_____(a)__of the AC supply in Australia is 50Hz, and this means that there are50_(b)_.

   Frequency, 50 cycles per second

7. _____ will continuously change its direction of current flow with time.

   AC

8. With reference to a sinusoidal waveform, define what is meant by the following terms:
   (a) period;

   The period of a wave is the amount of time it takes to complete one cycle. Frequency is the number of complete cycles that a wave completes in a given amount of time. Usually measured in Hertz (Hz), 1 Hz being equal to one complete wave cycle per second. Frequency = 1/(period in seconds)

   (b) form factor;

   calculate the form factor by dividing the RMS value of the waveform by its average value. If the RMS value of the AC wave is 25 volts and the average value is 22.52 volts, then the form factor of the AC wave is 25/22.52=1.11.

   (c) peak value;

   the difference between the highest or lowest to zero line

   (d) average value;
   (e) peak to peak value;

B Peak-to-peak (pk-pk) is **the difference between the highest and the lowest values in a waveform**. In alternating current (AC) the peak-to-peak value is twic

   and

   (a) instantaneous value.

   The instantaneous value is the value of an alternating quantity (ac voltage, ac current or ac power) at a particular instant of time in a cycle. The instantaneous value of any variable quantity is designated by the smaller case letter of its symbol. For example, v for voltage, i for current, etc.

2. The ratio of the peak value of voltage to the rms value of voltage is known as the_(a)___, and for a sinusoidal waveform has a value of__(b)___.

   Crest Factor, 2.8284 times V_{RMS}

3. The ratio of the rms value of voltage to the average value of voltage is known as the ___(a)___, and for a sinusoidal waveform has a value of____(b)___.

Form Factor , 1.11

SEE TEACHER SOLUTION

SECTION B

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple.

4. A sinusoidal wave has a maximum value of 340 volts. Determine the instantaneous value ofvoltage at angles of:
   (a) 45^0 (240V)
   (b) 105^0 (328.4V)
   (c) 260^0 (334.8V)
   (d) 330^0 (-170V)

5. A sinusoidal wave has a frequency of 400 Hz.. Determine the period for this frequency.(2.5mS)

---

6. A sinusoidal wave has a maximum value of 500 volts. For this wave, determine:
   (a) the rms value; (353.6V)
   (b) the peak to peak value; (1000V)
   (c) the average value. (318.5V)

7. Determine the frequencies for the following periodic times:
   (a) 0.02 seconds (50Hz)
   (b) 0.0833 seconds (12Hz)
   (c) 1 millisecond (1000Hz)
   (d) 0.05 milliseconds (20kHz)

The following questions refers to Table 1 and the graph shown on page 4. Add page 4 to your submitted tutorial solution.

8. Complete the sin value row of Table 1 by determining the sine values for the angles asshown.

9. If the maximum voltage of the waveform is 120V, complete the voltage value row of Table 1 by determining the instantaneous values of voltage for the angles shown using your calculated sin values.

10. Carefully plot the results on the graph supplied, completing your waveform using either French curves or a flexicurve. **Do not finish your waveform in freehand!**

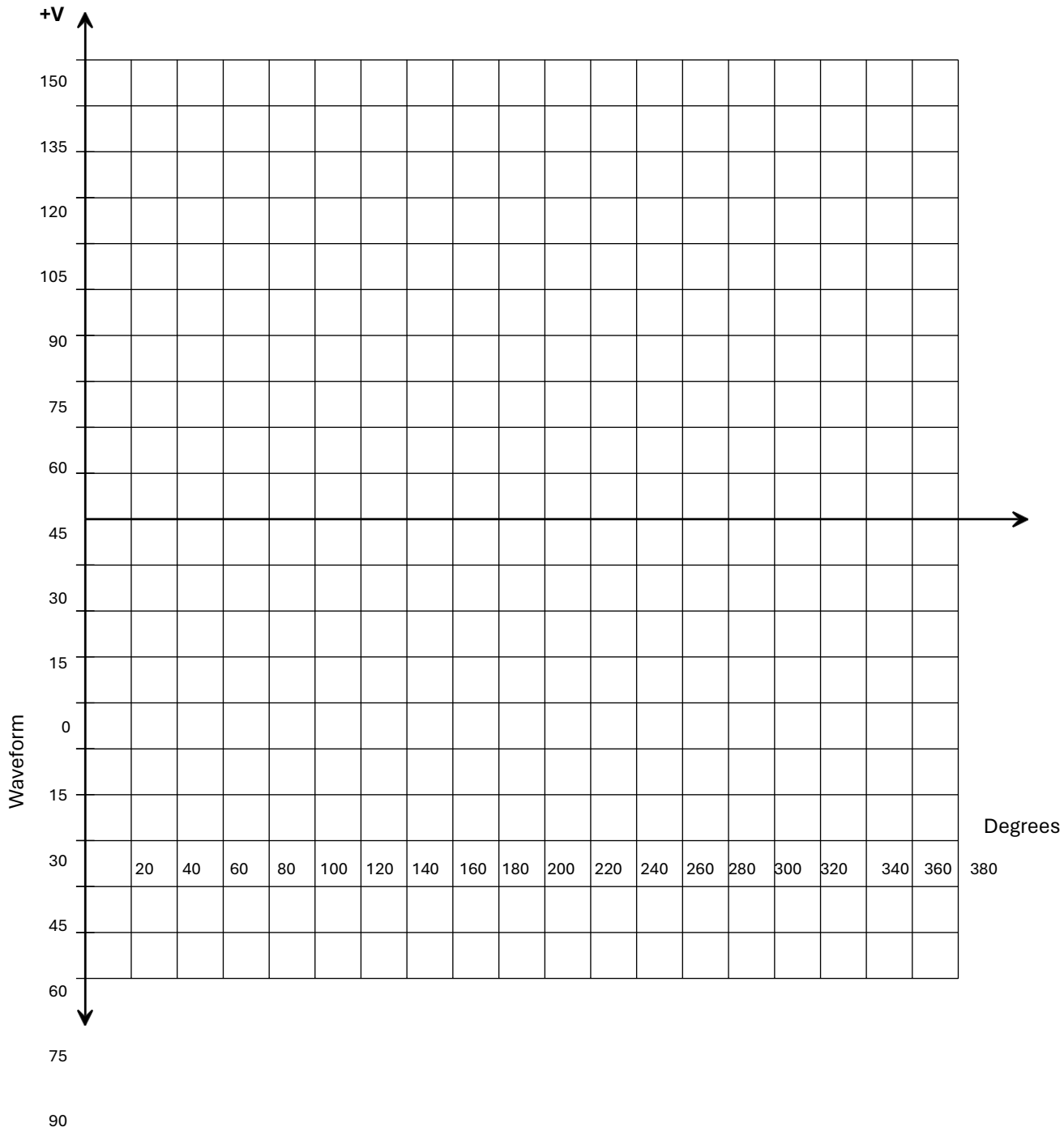
11. On your completed waveform, label the following:
   (a) the peak value,
   (b) the peak to peak value,
   (c) the periodic time,

12. Draw and label straight lines where you would expect to find the:
   (a) the rms value,
   (b) the average value.

13. From your waveform, determine the value of voltage
   at:(a) 20^0 (41V)
   (b) 100^0 (118V)
   (c) 220^0 (-077V)
   (d) 140^0 (77V)

Degrees	0	15	30	45	60	75	90	105	120	135	150	165	180
Sin Value	0	0.2588	0.5	0.707	0.866	0.965	1	0.965	0.866	0.707	0.5	0.2588	0
Voltage Value	0	31	60	84.84	103.92	115.8	120	115.8	103.92	84.84	60	31	0
Degrees	**195**	**210**	**225**	**240**	**255**	**270**	**285**	**300**	**315**	**330**	**345**	**360**	
Sin Value	-0.2588	-0.5	-0.707	-0.866	-0.965	-1	-0.9655	-0.866	-0.707	-0.5	0-.2588	0	
Voltage Value	-31	-60	-84.84	-103.92	-115.8	-120	-115.8	-103.92	-84.84	-60	-31	0	

Table 1



105

120

135

150

Sinusoidal Waveforms

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SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. When measuring the phase difference with a CRO., the CRO.
   (a) must be able to show two waveforms.
   (b) needs to have a high sensitivity.
   (c) time base must be re-calibrated.
   (d) must be set to DC input.

2. Phasors are quantities which vary in:
   (a) magnitude and time only
   (b) magnitude and direction only
   (c) magnitude, direction and time
   (d) direction only

3. If one waveform leads another, then it will pass through____and maximum values _____ the other waveform.
   (a) zero; before
   (b) zero; after
   (c) zero; simaltaneously with

4. In practice, when representing AC quantities by phasor diagram, the phasors are usually drawnto scale to represent:
   (a) rms values
   (b) instantaneous values
   (c) maximum values
   (d) average values

5. The term *phase angle* is defined as the:

(a) angle used to determine the instantaneous value of voltage or current.
(b) the angular displacement between two waveforms of the same frequency.
(c) the angular displacement between two waveforms of different frequencies.
(d) the number of degrees into a cycle where the peak value is reached.

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. Two waveshapes are said to be_____when they pass through their zero points or peak valuessimultaneously.

   Inphase

7. To represent a voltage quantity in a phasor diagram, an arrow with a/an__(a)__ head is used, whilst a current quantity is represented by an arrow with a/an____(b)____ head. Draw an example of a voltage phasor representing 100V (1.0mm = 2.5V), and an example of a current phasor representing 24A (1.0mm = 0.3A).

   Open , Closed

8. If two waveshapes do not pass through the same changes at the same time, they are said to be Phase differewnce

9. To determine the frequency of a sinewave from a CRO., you would read the_(a)___axis and use the the setting of the__(b)___switch.

   X , Time/div

10. Briefly describe how you could determine:
    (a) if two waveshapes are in phase;-------- Pass through zero line at the same time
    (b) if two waveshapes are out of phase;------ Pass through zero line differently
    (c) if out of phase, which one leads or lags the other. That cross zero line first.

11. Phasors are normally drawn to scale to represent____quantities.

    Vector

12. The relationship between frequency and periodic time states that frequency is_____(a) toperiodic time. This can be written mathematically as_____(b)_____

    Ratio , F=1/T

13. Phasors are said to rotate in a/an_____direction.

Anti clockwise

14. Briefly describe how you could prove that the rms value of a sinewave is 0.707 of the peak peakvalue of a sinewave. Accompany your answer with a clearly labelled diagram.

SECTION B

SEE TEACHER SOLUTION

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple.

15. A display of a sinusoidal waveform on a CRO. is 2.8 divisions high and 8 divisions long. If the VOLTS/DIV is set to 10V, and the SWEEP TIME/DIV is set to 1mS, determine:
    (a) the peak value of voltage (28V)
    (b) the expected rms value of voltage (19.8V)
    (c) the frequency of the waveform (125Hz)

16. Two sinusoidal waves with a frequency of 50 Hz are displayed on a CRO. If the horizontal displacement between the waveforms is measured to be 3.5mS, determine the phase anglebetween the two waveshapes (63^0)

17. Draw a phasor diagram to represent a voltage V1 of 240V and a second voltage V2 of 180V, such that V1 leads V2 by 50^0. Use a scale of 1.0mm = 2.0V, and make V1 the reference.

18. Draw a phasor to represent a current I1 of 2.5A, a second current I2 of 3A and a third current I3 of 1.75A, drawn to scale of 1.0mm = 25mA. I1 leads I2 by 30^0, and I3 lags I2 by 45^0. Use I2 as your reference phasor.

19. The diagram of figure 1 represents two sinusoidal waveforms of the same frequency. If the VOLTS/DIV switch is set to 10V, and the SWEEP TIME/DIV switch is set to 5mS, determine:
    (a) the peak values of voltage for waveforms V1 and V2; (V1pk=30V; V2pk=36V)
    (b) the peak to peak values of voltage for waveforms V1 and V2; (V1pk-pk=60V; V2pk-pk=72V)
    (c) the expected rms values of the two waveforms; (V1=21.2V;V2=25.5V)
    (d) the frequency of the waveforms; (20Hz)
    (e) the phase angle between the two waveforms; (57.6^0)
    (f) if V1 leads or lags V2.
    (g) draw a phasor diagram to represent the two voltages, using a scale of 1.0mm = 0.2V.

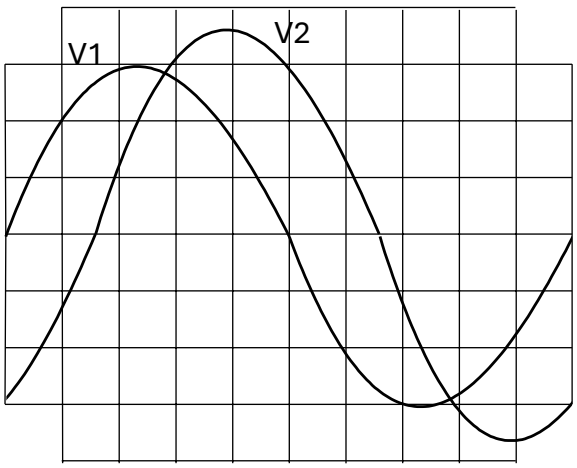

Figure 1

Phasor Quantities

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SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. Current phasors are represented by an arrow with a/an____head, whilst voltage phasors arerepresented by an arrow with a/an__head.
   (a) closed, open
   (b) open, open
   (c) open, closed
   (d) closed, closed

2. The resultant of two or more voltages differing in phase angle may be determined by:
   (a) algebraic addition
   (b) averaging the voltage values
   (c) phasor addition
   (d) numerical addition

3. To find the phasor difference of two phasor quantities, the method to use is:
   (a) tip to tail.
   (b) tip to tip.
   (c) tail to tail.
   (d) non existent.

4. If a phasor is used to show a_____quantity, it will be drawn above the_____reference line.
   (a) lagging, horizontal
   (b) leading, horizontal
   (c) leading, vertical
   (d) lagging, vertical

5. The resultant of two voltages, having the same phase angle but different numerical values can bedetermined by:
   numerical addition

numerical subtraction
phasor subtraction
algebraic addition

NOTES

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. When adding phasor quantities, the method used is described as ___(a)___ to ___(b)___, but when subtracting phasor quantities, the method used is described as_(c) to_(d)_.

   Head Tail / Tail Tail

7. Phasor addition or subtraction is used to add or subtract quantities which are differing in__.

   Directions

8. When solving for series circuits using phasor diagrams, the reference to use is circuit_(a)__, whilst for parallel circuits, the reference to use is circuit__(b)__. These references are used because they are_(c) to all parts of their respective circuits.

   Current, Voltage the same

9. Briefly explain why it is important for phasors to be drawn accurately and to scale.

   To get correct answer

10. If a phasor quantity leads the reference phasor, it is drawn ___(a)___ the reference, and if a phasor quantity lags the reference phasor, it is drawn_(b) the reference.

    Above, below

11. List three advantages of using phasor diagrams for phasor addition or subtraction over using waveform diagrams for waveform addition or subtraction.

We can simplify the calculation of AC circuit behaviour, especially in steady-state conditions. Phasor analysis allows us to transform complex waveforms into simpler phasors and analyze the magnitude and phase relationships between voltages and currents in AC circuits.

SECTION B

SEE TEACHER CALCULATION

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple. Any question solved by phasor diagram should be drawn accurately to scale on 5mm graph paper attached to your solution.

12. Using a scale of 1mm = 1.0 volts, determine the resultant of the voltages Va and Vb in the diagram of figure 1 by phasor diagram. Clearly label all voltages and angles on your diagram. [120V @ 17^0 lag]

13. A heating element is connected in parallel to a 240 volt, 50Hz single phase motor. The current drawn by the heating element is 10A, and is in phase with the supply voltage, whilst the current drawn by the motor is 7A, and lags the supply voltage by 70^0 . Using a scale of 1mm = 0.1A, determine the current drawn from the supply, and the resultant circuit phase angle. [14A @ 28^0 lag]

14. A capacitor is connected in series with a resistor. The voltage across the capacitor is 190 volts leading by 90^0, and the voltage across the resistor is 147 volts, and is in phase with the circuit

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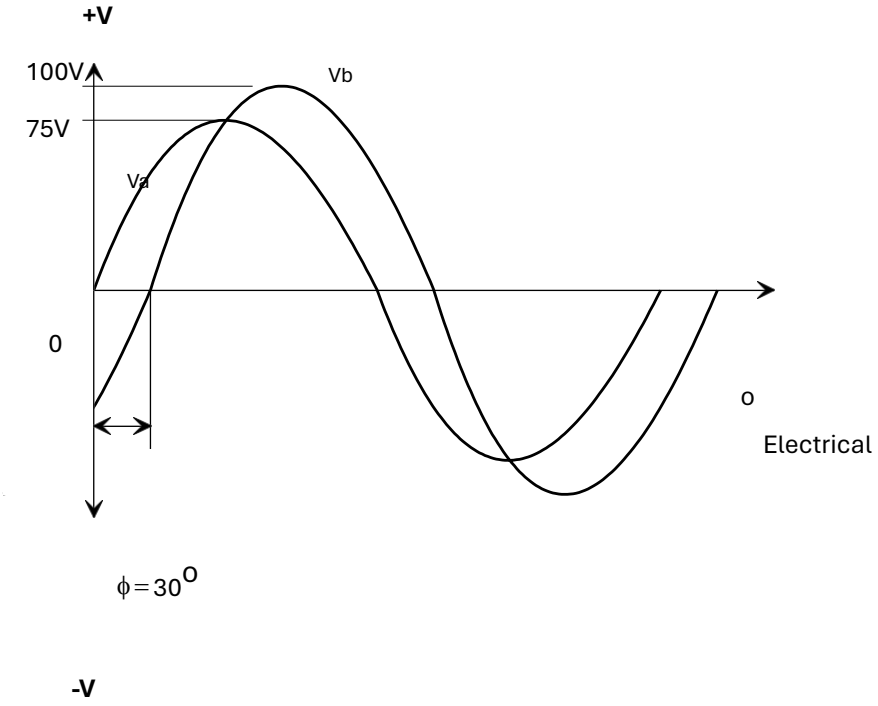

Figure 1

current. Using a scale of 1mm = 2.0V, determine the value of voltage connected across the supply, and the resultant circuit phase angle. [240V @ 52^0 lead]

15. A 240 volt, 50Hz single phase motor draws 18A from the supply at a lagging phase angle of 40^0. A capacitor connected across the motor draws 7A at a leading phase angle of 90^0. Using a scale of 1mm = 0.2A, determine the current drawn from the supply, and the resultant circuit phase angle. [14.5A @ 18.5^0 lag]

16. For the circuit of figure 2, determine the value and phase angle for the branch current I2. Use a scale of 1mm = 0.05A. [4.5A @ 90^0 lead].

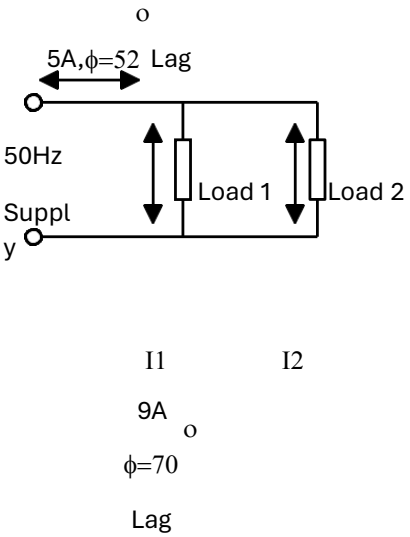

Figure 2

NOTES

Resistance & Capacitance in AC Circuits

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SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. The phase angle (ϕ) between voltage and current in a purely resistive circuit is:
   (a) 180 electrical degrees.
   (b) 90 electrical degrees.
   (c) 45 electrical degrees.
   (d) 0 electrical degrees.

2. The opposition to current flow in a purely capacitive circuit is known as____and is measuredin _____
   (a) capacitive reactance, ohms
   (b) resistance, ohms
   (c) capacitive reactance, farads
   (d) impedance, farads

3. The phase angle (ϕ) between voltage and current in a purely capacitive circuit is:
   (a) 180 electrical degrees.
   (b) 90 electrical degrees.
   (c) 45 electrical degrees.
   (d) 0 electrical degrees.

4. Adding extra resistance to a purely resistive circuit will cause the phase angle (ϕ) betweenvoltage and current to:
   (a) increase.
   (b) decrease.
   (c) remain unchanged.
   (d) become maximum.

NOTES

5. The capacitive reactance of a capacitor is inversely proportional to the ___ and _____ value.
   (a) supply frequency, capacitance
   (b) supply current, capacitance
   (c) supply frequency, supply voltage
   (d) supply voltage, capacitance

6. Adding extra capacitance to a purely capacitive circuit will cause the phase angle (ϕ) betweenvoltage and current to:
   (a) increase.
   (b) decrease.
   (c) remain unchanged.
   (d) become maximum.

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

7. The power dissipation in an AC circuit is known as the__(a)___power, and for a capacitivecircuit is equal to_____(b)___.

   True, Reactive power

8. In a purely resistive circuit, the circuit current and the circuit voltage are____.

   Inphase

9. If extra resistance is added to a purely resistive circuit, the equivalent circuit resistance can befound by_.

   Numerical Addition

10. In a purely capacitive circuit, the circuit current and the circuit voltage are_(b)___, and thecurrent(b)___the voltage by____(c)___.

    90 degree out of page , leads 90 degree

11. The capacitive___(a)___of a capacitor is measured in ohms because it_(b)___current flow.

    Reactance , opposes

12. A capacitor "looks" like an___(a)___circuit to a DC supply once it is charged, but "looks" like a____(b)___ circuit to an AC supply due to the charge and discharge____(c)___ that are continuously flowing.

    Open, reactive , the electrical charges

13. A purely resistive AC circuit can be treated in the same manner as a_(a)___circuit. This is because the phase angle (ϕ) in a resistive circuit is_(b)___.

Resistive , Zero

SECTION B

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple. Any question solved by phasor diagram should be drawn accurately to scale on 5mm graph paper attached to your solution.

SEE TEACHER SOULTION

14. A circuit of 20Ω resistance draws 16A when connected to an AC supply. Determine:
    (a) the voltage applied to the circuit, (320V)
    (b) the power consumed by the circuit, (5.12kW)

15. A heating element is connected to a 240 volt, 50Hz supply. If the rating of the heater is 1.5kW,determine the current flowing in the circuit. (6.25A)

16. Determine the capacitive reactance of a 47μF capacitor when connected to a 32V, 50Hz supply.(67.7Ω)]

17. Determine the current taken by a 390μF capacitor when connected to a 240V, 50Hz supply.(29.4A)

18. A capacitor takes 3A when connected to a 240V, 50Hz supply. Determine:
    (a) the capacitive reactance of the capacitor; (80Ω)
    (b) the capacitance of the capacitor. (39.8μF)

19. A capacitor takes 6A when connected to a 240V, 50Hz supply. Determine how much current thecapacitor will take if it is reconnected to a 115V, 400Hz supply. (23A)

20. For the circuit of figure 1, determine:
    (a) the resistances of R1 and R2; (4.8Ω; 3.43Ω)
    (b) the current taken from the supply; (12A)
    (c) the equivalent resistance of the circuit; (2Ω)
    (d) the power dissipated by each resistive (120W; 168W)
    (e) the total power dissipated by the circuit, (288W)
    (f) draw the phasor diagram for the circuit .

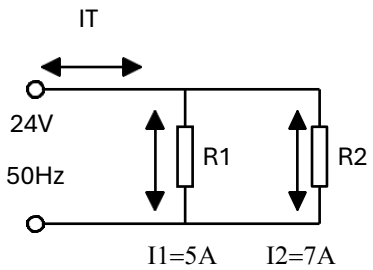

Figure 1

21. For the circuit of figure 2, determine:
    (a) the capacitive reactances of C1 and C2; (56.8Ω; 81.6Ω)
    (b) the capacitances of C1 and C2; (56μF; 39μF)
    (c) the current taken from the supply; (7.16A)
    (d) the equivalent capacitive reactance of the circuit; (33.5Ω)
    (e) the equivalent capacitance of the circuit (95μF);
    (f) the total power dissipated by the circuit, (0W)
    (g) draw the phasor diagram for the circuit .

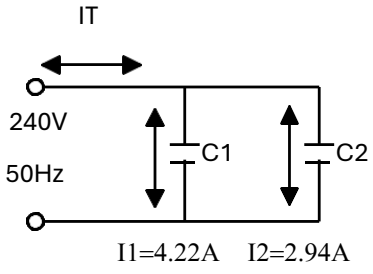

Figure 2

NOTES

Inductance in AC Circuits

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SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. The phase angle (ϕ) between voltage and current in a purely inductive circuit is:
   (a) 0 electrical degrees.
   (b) 45 electrical degrees.
   (c) 90 electrical degrees.
   (d) 180 electrical degrees.

2. The opposition to current flow in a purely inductive circuit is known as_____and is measuredin _____
   (a) resistance, ohms
   (b) inductive reactance, ohms
   (c) inductive reactance, henries
   (d) impedance, henries

3. Adding extra inductance to a purely inductive circuit will cause the phase angle (ϕ) betweenvoltage and current to:
   (a) increase.
   (b) decrease.
   (c) remain unchanged.
   (d) become maximum.

4. Inductors (such as ballasts) are used to control current in AC circuits as they:
   (a) have a low power loss.
   (b) have a good power factor.
   (c) are cheaper than resistors.
   (d) have a low value of reactance.

5. The inductive reactance of a inductor is _____ to the supply frequency and _____ to the circuit inductance value.
   (a) proportional, inversely proportional
   (b) proportional, proportional
   (c) inversely proportional, inversely proportional
   (d) inversely proportional, proportional

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. The power dissipation for an inductive circuit is equal to___(a)____. This is because the energyis returned to the supply when the (b) collapses.

   Zero, Current

7. Inductive reactance is an example of_____Law "in action".

   Lenz

8. In a purely inductive circuit, the circuit current and the circuit voltage are__(b)___, and the current___(b)___ the voltage by___(c)___. This is due to the____(d)___ that is continuously generated in the inductor.

   90 degree out of phase, lags 90 degree , induced voltage

9. The inductive ___(a)___ of an inductor is measured in ___(b)___ because it opposes current flow.

   Reactance , Ohm

10. An "ideal" inductor has___(a)___resistance, whilst a practical inductor has_(b)___.

    Zero, small

11. As the frequency of a supply connected to an ideal coil increases, the ___(a)____(b)___ of the coil increases.

Inductive reactance

SECTION B

SEE TEACHER SOLUTION

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple. Any question solved by phasor diagram should be drawn accurately to scale on 5mm graph paper attached to your solution.

12. When connected to a 24V, 50Hz supply, an ideal inductor draws 1.2A. Determine the reactance of the inductor. (20Ω)

13. If a coil of negligible resistance has an inductance of 0.05 henry, determine its inductive reactance if connected to a:
    (a) 50Hz supply, (15.7Ω)
    (b) 33Hz supply, and (10.4Ω)
    (c) 1kHz supply. (314Ω)

14. A coil of negligible resistance draws 0.5A when connected to a 240V, 50Hz supply. Determinethe inductance of the coil. (1.53H)

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15. An ideal 153mH inductor is rated to be used on a 240V, 50Hz supply, but instead is connected toa 200V, 400Hz supply. Determine the current flowing in the inductor for both of these conditions. (@50Hz: 5A; @400Hz: 0.52A)

16. A coil of negligible resistance draws 1A when connected to a 32V, 120Hz supply.
    (a) Determine how much current it will draw from a 415V, 50hz supply. (31.1A)
    (b) Draw a phasor diagram for each of the operating conditions. Pick a suitable scale for eachdiagram, noting the scales you have used next to your phasor diagrams.

R.L & R.C Series AC Circuits

Please note the following requirements in relation to tutorial work -

- All tutorial work is to be completed on ruled A4 pad paper, with multiple pages stapled together. Write on one side only of the answer sheets, and all work is to be completed in ink.
- In the case of multiple choice type questions, the question number and corresponding answer letter are to be written on the answer sheet.
- In the case of short answer type questions, the question and part number with your word or phrase choice is to be written on the answer sheet.
- All relevant equations and working are to be shown in the case of calculation type questions.

SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. The phase angle (ϕ) between voltage and current in an R.L. series circuit is between:
   (a) 0^0 and 90^0 lagging.
   (b) 0^0 and 90^0 leading.
   (c) 90^0 and 180^0 lagging.
   (d) 90^0 and 180^0 leading.

2. Adding extra inductance to an R.L. series circuit will cause the phase angle (ϕ) between voltageand current to:
   (a) remain unchanged.
   (b) increase.
   (c) become maximum.
   (d) decrease.

3. The opposition to current flow in any ac circuit containing_____and reactive components isknown as_____and is measured in ohms.
   (a) capacitive , reactance
   (b) inductive reactance
   (c) resistive, impedance
   (d) inductive, impedance

4. Adding extra resistance to an R.C. series circuit will cause the phase angle (ϕ) between voltageand current to:
   (a) remain unchanged.
   (b) increase.
   (c) become maximum.
   (d) decrease.

NOTES

5. If the inductive reactance and resistance of an R.L. series circuit are equal, the circuit phaseangle will be:
   (a) 45^0 lead
   (b) 45^0 lag
   (c) 30^0 lead
   (d) 60^0 lag

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. To decrease the phase angle in an R.L. series circuit, either (a) the circuit resistance, or (b) the circuit inductance.
   Increase , decrease

7. In an impedance triangle for an R.L. series circuit, the circuit resistance is (a) with the reference, the circuit (b) will (c) the reference, whilst the circuit impedance is the (d). Accompany your answer with a diagram to show the relationships for a series R.L. circuit.
   Inphase ,current, lag , vector sum

8. The circuit phase angle for an R.C. circuit is between (a) and (b), and the currentwill (c) the voltage.

   Current and Voltage, lead

9. To increase the phase angle in an R.C. series circuit, either (a) the circuit resistance, or (b) the circuit (c).
   Decrease, increase, capacitance

10. Increasing the supply frequency to an R.L. series circuit will cause the circuit phase angle to _____.
    Increase

11. Decreasing the supply frequency to an R.C. series circuit will cause the circuit phase angle to _____.
    Increase

12. When using an impedance triangle to solve for series R.L or R.C circuits, the phase angle ismeasured between the circuit (a) and the circuit (b)

    Resistance, Impedance

SECTION B

SEE TEACHER SOLUTION

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed

in the appropriate multiple or sub-multiple. Any question solved by phasor diagram should be drawn accurately to scale on 5mm graph paper attached to your solution.

13. Determine the impedance of a series R.L circuit consisting of a 220Ω resistor and a 1.59H idealinductor when connected to a 240V, 50Hz supply. (546Ω)

14. If a 120Ω resistor is connected in series with 0.75H ideal inductor, determine how much currentwill flow if connected to a 415V, 50Hz supply. (1.57A)

NOTES

15. Determine the impedance if the 220Ω resistor of Q12 is now connected in series with a 22μF capacitor when connected to a 240V, 50Hz supply. (263Ω)

16. A 560Ω resistor is connected in series with a 5.68μF capacitor. Determine the current flowing in this circuit if connected to a 240V, 50Hz supply. (303mA)

17. An R.L. series circuit draws 0.333A when connected to a 32V, 50Hz supply. Determine the value of the circuits resistance and inductance if the circuit phase angle is measured to be 60^0lag. (R=48Ω; L=265mH)

18. When connected to a 200V, 400Hz supply, an R.C. series circuit draws 2A. If the circuit phase angle is found to to 45^0, determine the value of the circuits resistance and capacitance. (R=70.7Ω; C=5.6μF)

19. When connected to a 50Hz supply, an R.L. series circuit draws 0.4A. If the voltage drop acrossthe resistor is 16V, and the voltage drop across the ideal inductor is 12V, determine:
    (a) the voltage applied to the circuit by phasor diagram using a scale of 1mm = 0.2V; (20V)
    (b) the circuit phase angle. (37^0 lag)
    (c) the resistance of the resistor; (40Ω)
    (d) the reactance of the inductor; (30Ω)
    (e) the circuit impedance; (50Ω)
    (f) the inductance of the inductor; (95.5mH)
    (g) the minimum power rating for the resistor. (6.4W)

20. When connected to a 50Hz supply, an 80Ω resistor connected in series with a 33μF capacitor draws a current of 2A . Determine by phasor diagram the voltage applied to the circuit and the circuit phase angle using a scale of 1mm = 2V. (250V; $\phi = 50^0$ lead)

Series R.L.C Circuits

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SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. If the circuit phase angle in an R.L.C. series circuit is between 0^0 and 90^0 lagging, then the _____ is higher than the _____ .
    (a) capacitive reactance, inductive reactance

NOTES

4. Series resonance occurs when:
   (a) $X_L = Z$
   (b) $X_C = Z$
   (c) $X_L = X_C$
   (d) $X_L + X_C = R$

5. As the voltage drops in a series R.L.C. circuit are _____, they are added by _____ .
   (a) out of phase, phasor addition
   (b) in phase, phasor addition
   (c) out of phase, numerical addition
   (d) in phase, numerical addition

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. To decrease the phase angle in a series R.L.C. circuit, either ___(a)___ the circuit effective reactance, or ___(b)___ the circuit resistance.

7. At series resonance, the circuit impedance is a ___(a)___ value, and the circuit current is a ___(b)___ value.

8. If resonance occurs in a power series R.L.C. circuit, the ___(a)___ across the reactive components can become ___(b)___ .

9. Increasing the supply frequency to a series R.L.C. circuit with a leading phase angle will cause the inductive reactance to ___(a)___, the capacitive reactance to ___(b)___, and the circuit phase angle to ___(c)___.

10. Decreasing the supply frequency to a lagging R.L.C. series circuit will cause the circuit phase angle to _____.

11. When a series circuit is operating at resonant frequency, ___(a)___ reactance equals ___(b)___, and impedance equals ___(b)___, and the circuit current is ___(c)___

SECTION B

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple. Any question solved by phasor diagram should be drawn accurately to scale on 5mm graph paper attached to your solution.

12. A 27Ω resistor is connected in series with a 250mH inductor and a 33μF capacitor. If connected to a 50Hz supply, determine the impedance of the circuit. (32.4Ω)

13. Determine the supply current if a 50Ω resistor is connected in series with an inductor with a reactance of 60Ω and a capacitor with a reactance of 80Ω when connected to a 240V, 50Hz supply. (4.46A)

4 / Xl=Xc
5/Out of phase / phasor addition
6/Decrease/ Increase
7/Minimum , Maximum
8/Voltage/maximum
9/Increase/ Decrease/ Decrease
10/ Decrease

11/Zero/ resistance/maximum

SEE TEACHER SOLUTION

14. A 200mH inductor is connected in series with a 100μF capacitor and an unknown resistor. Determine the value of the unknown resistor if the circuit draws 5A when connected to a 240V, 50Hz supply. (36.6Ω)

15. For the circuit of figure 1, determine the:
    (a) reactance of the inductor (235.6Ω)
    (b) reactance of the capacitor (159Ω)
    (c) impedance of the circuit (280.6Ω)
    (d) current flowing in the circuit (1.48A)
    (e) voltage drop across the inductor (348V)
    (f) voltage drop across the capacitor (235V)
    (g) voltage drop across the resistor (399V)
    (h) circuit phase angle (15.8^0 lag)

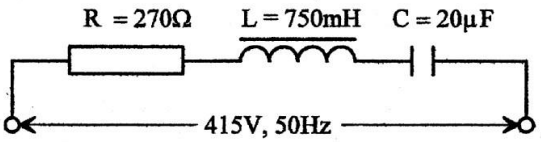

Figure 1

16. If the circuit of figure is connected to a variable frequency power supply, determine the resonant frequency of the circuit. (41Hz)

17. When connected to a 50Hz supply, an 560Ω resistor connected in series with a 2.71H ideal inductor and a 5μF capacitor draws a current of 400mA . Determine by phasor diagram the voltage applied to the circuit and the circuit phase angle using a scale of 1mm = 2V. (240V;21^0lag)

Parallel A.C. Circuits

Please note the following requirements in relation to tutorial work -

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- In the case of short answer type questions, the question and part number with your word or phrase choice is to be written on the answer sheet.
- All relevant equations and working are to be shown in the case of calculation type questions.

SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter of your choice on your answer sheet.

1. The phase angle (ϕ) between voltage and current in an R.C. parallel circuit is between:
   (a) 0^0 and 90^0 lagging.
   (b) 0^0 and 90^0 leading.
   (c) 90^0 and 180^0 lagging.
   (d) 90^0 and 180^0 leading.

2. Adding extra inductance to an R.L. parallel circuit will cause the phase angle (ϕ) betweenvoltage and current to:
   (a) remain unchanged.
   (b) increase.
   (c) become maximum.
   (d) decrease.

3. In a parallel resonant circuit, circuit impedance is a____, and circuit current is a_____.
   (a) maximum, maximum
   (b) minimum, minimum
   (c) maximum, minimum
   (d) minimum, maximum

4. Adding extra capacitance to a leading R.L.C. parallel circuit will cause the phase angle (ϕ) between voltage and current to:
   (a) remain unchanged.
   (b) increase.
   (c) become maximum.
   (d) decrease.

5. In a parallel L.C. circuit, the component with the largest____will determine the phase anglefor the circuit.
   (a) current
   (b) voltage
   (c) reactance
   (d) resistance

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

6. To decrease the phase angle in an R.L. parallel circuit, either_(a)___the circuit resistance, or ___(b)___the circuit inductance.
   Increase/ Decrease

7. Increasing the frequency of the supply to an R.L.C. parallel circuit will cause the resistivecurrent to_(a)_____, the inductive current to_____(b) and the capacitive current to_____(c)___

   Unchange, Decrease, increase

8. The circuit phase angle for an R.L. parallel circuit is between_(a)___and_____(b)___, and thecurrent will_(c)___the voltage.

   0 to -90, lag

The phase angle in a parallel RL circuit is betweem 0 to -90 degrees. Use VR to find IR then use V2πfL V 2 π f L to find IL . Use the magnitude of Voltage for V and frequency for f . The phase angle will be arctan(ILIR) a r c t a n (I L I R) .

9. To increase the phase angle in an R.C. parallel circuit, either_(a)___the circuit resistance, or ___(b)___the circuit_____(c)___.
   Decrease/ Increase

10. Increasing the supply frequency to an R.L. parallel circuit will cause the circuit phase angle to _____.
    Increase

11. Decreasing the supply frequency to an R.C. parallel circuit will cause the circuit phase angle to _____.

Increase

12. At parallel resonance, the circulating___(a)___ between the reactive components can be ___(b)___

Current , Large

NOTES

SECTION B

SEE TEACHER SOLUTION

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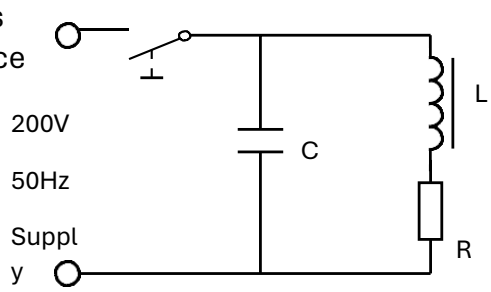
13. For the circuit of figure 1, if the capacitive reactance is 25Ω, the inductive reactance is 30Ω and the resistance is 10Ω, determine
    (a) the impedance, current and phase angle for the capacitive branch; (25Ω, 8A, 90^0 lead)
    (b) the impedance, current and phase angle for the inductive branch; (31.6Ω, 6.33A, 71.5^0 lag)
    (c) the supply current and circuit phase angle; (2.83A,45^0 lead) (1mm = 0.1A
    (d) the circuit impedance. (70.6Ω)



Figure

NOTES

14. For the circuit of figure 1, if the capacitor is 25μF, the inductor is 250mH and the resistance is15Ω, determine:
    (a) the capacitive current and phase angle; (1.57A, 90^0 lead)
    (b) the inductive current and phase angle; (2.5A, 79^0 lag)
    (c) the supply current and circuit phase angle; (1A, 61.6^0 lag) (1mm = 25mA)
    (d) the circuit impedance (200Ω)

15. If a 120Ω resistor is connected in parallel with 382mH inductor with a resistance of 35Ω, determine how much current will flow if connected to a 415V, 50Hz supply. (5.4A)
    (1mm = 50mA)

16. An L.C. parallel circuit is connected to a single phase 240V, 50Hz supply. If the current through the capacitor 12A, and the current through the inductor is 16A at a phase angle of 60^0 lagging, determine the:
    (a) impedance of the inductor; (15Ω)
    (b) resistance of the inductor; (7.5Ω)
    (c) impedance of the capacitor; (20Ω)
    (d) current drawn from the supply; (8.2A) (1mm = 0.2A)
    (e) circuit phase angle. (13.1^0 lag)
    (f) circuit impedance; (29.3Ω)

17. An 80Ω resistor connected in parallel with a 33μF capacitor is connected to a 250V, 50Hz supply. Determine by phasor diagram the current drawn from the supply and the circuit phase angle using a scale of 1mm = 0.05A. (4A; $\phi = 40^0$ lead)