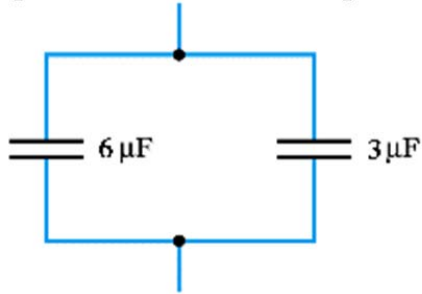


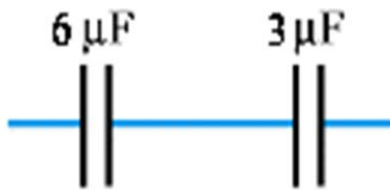
Problem set 2 TFY4185 Måleteknikk Issued 14 September 2015

1) What is the effective capacitance of the following arrangement?



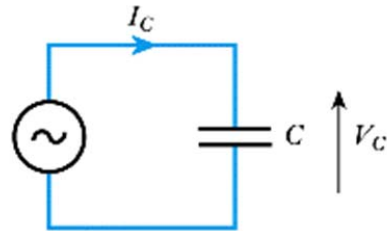
- a) $0.5\ \text{Mf}$ b) $2\ \mu\text{F}$ c) $4.5\ \mu\text{F}$ d) $9\ \mu\text{F}$

2) What is the effective capacitance of the following arrangement?

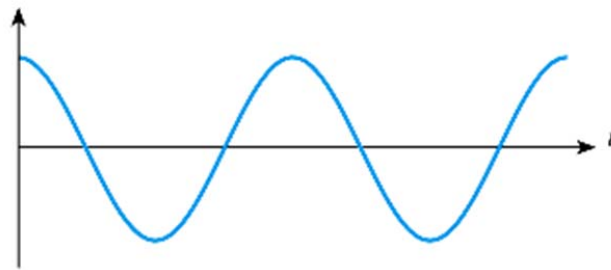


- a) $0.5\ \mu\text{F}$ b) $2\ \mu\text{F}$ c) $4.5\ \mu\text{F}$ d) $9\ \mu\text{F}$

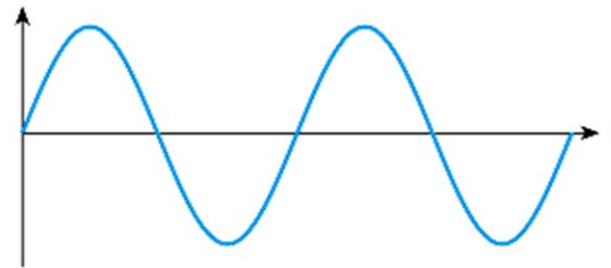
- 3) The circuit in (a) below shows an arrangement that applies a sinusoidal voltage across a capacitor. Given the relationship between the voltage and the current in a capacitor, which of the following statements is correct?



(a)



(b)



(c)

- a) (b) represents the voltage V_C and (c) represents the current I_C .
b) (b) represents the current I_C and (c) represents the voltage V_C .

4) The current in a 25 mH inductor changes at a constant rate of 7 A/s. What voltage is induced across this coil?

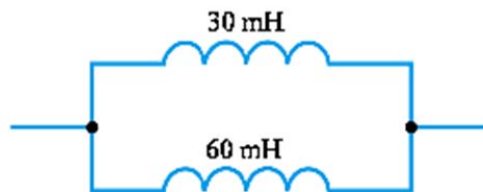
- a) 3.57 mV b) 175 mV c) 350 mV d) 1.75 V

5) Calculate the inductance of this arrangement.



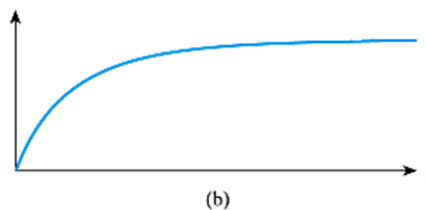
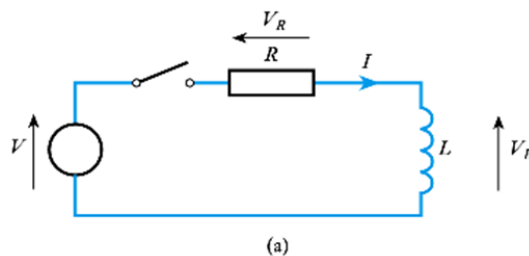
- a) 2mH b) 20 mH c) 90 mH d) 120 mH

6) Calculate the inductance of this arrangement.



- a) 2mH b) 20 mH c) 90 mH d) 120 mH

7) The circuit in (a) below shows an arrangement that applies a step voltage across a combination of a resistor and an initially unexcited inductor. What quantity is shown plotted against time in the graph in (b)?



- a) The inductor voltage V_L b) The current I

8) Which one of the following statements is correct in relation to alternating waveforms?

- a) In a capacitor, the voltage leads the current.
- b) In an inductor, the voltage leads the current.
- c) In a capacitor, the current leads the voltage.
- d) In an inductor, the current leads the voltage.

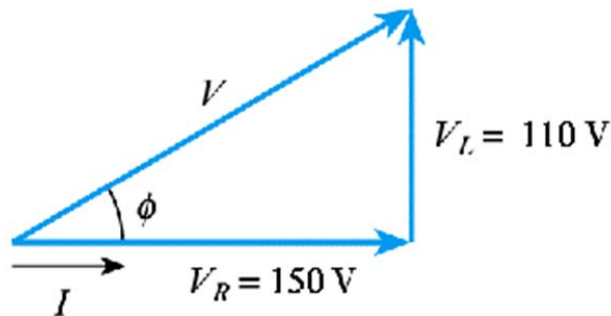
9) Calculate the reactance of an inductor of 15 mH at a frequency of 60 Hz.

- a) 0.9Ω
- b) 2.7Ω
- c) 5.7Ω
- d) 6.3Ω

10) Calculate the reactance of a capacitor of 470 μF at an angular frequency of 150 rad/s

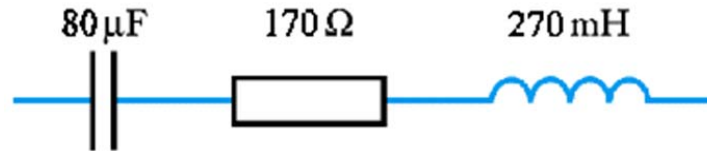
- a) 14.2Ω
- b) 56.1Ω
- c) 89Ω
- d) 130Ω

11) The diagram below shows a phasor representation of the voltage V across a combination of a resistor and an inductor. Calculate the magnitude and phase of the voltage V .



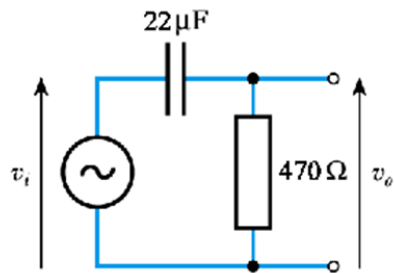
- a) The magnitude is 186 V and the phase angle is 36 degrees
- b) The magnitude is 168 V and the phase angle is 54 degrees
- c) The magnitude is 168 V and the phase angle is 36 degrees
- d) The magnitude is 186 V and the phase angle is 54 degrees

- 12) Determine the complex impedance of the following series arrangement at a frequency of 60 Hz.



- a) $239 + j69\ \Omega$ b) $239 + j135\ \Omega$ c) $170 + j135\ \Omega$ d) $170 + j69\ \Omega$
- 13) Which of the following combinations of components represents an impedance of $110 + j\ 314\ \Omega$ at a frequency of 100 Hz?
- a) A resistor of $100\ \Omega$ in series with a capacitor of $5\ \mu\text{H}$
b) An inductor of $50\ \text{mH}$ in series with a capacitor of $5\ \mu\text{H}$
c) A resistor of $314\ \Omega$ in series with an inductor of $5\ \text{mH}$
d) A resistor of $110\ \Omega$ in series with an inductor of $500\ \text{mH}$
- 14) If a sinusoidal voltage $v = V_p \sin \omega t$ is applied across a capacitor, C , what is the average value of the power dissipated in the capacitor?
- a) 0 b) CV_p^2 c) V_p^2 / C d) $2CV_p^2$
- 15) The voltage across a component is measured as 80 V r.m.s. and the current through it is 4 A r.m.s. If the current leads the voltage by 20° what is the apparent power in the component?
- a) 109 VA b) 116 VA c) 301 VA d) 320 VA
- 16) The voltage across a component is measured as 80 V r.m.s. and the current through it is 4 A r.m.s. If the current leads the voltage by 20° what is the active power in the component?
- a) 109 W b) 116 W c) 301 W d) 320 W
- 17) An amplifier has an output impedance Z_o of $70 + j\ 35\ \Omega$. What value of load impedance will permit maximum power transfer?
- a) $70\ \Omega + j\ 35\ \Omega$ b) $70\ \Omega - j\ 35\ \Omega$ c) $-70\ \Omega - j\ 35\ \Omega$ d) $70\ \Omega + j\ 35\ \Omega$

18) Calculate the cut-off frequency f_c of the following circuit.

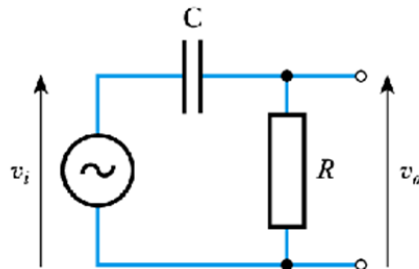


- a) 15.4 Hz b) 15.4 rad/s c) 96.7 Hz d) 96.7 rad/s

19) Which of the following statements is not correct?

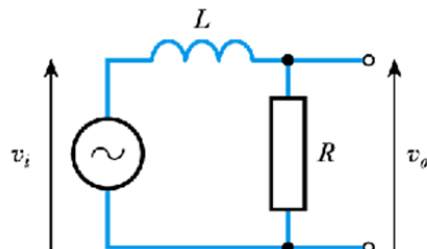
- a) Two octaves above 5 Hz is 20 Hz.
b) Three octaves below 64 Hz is 8 Hz.
c) Two decades below 10 MHz is 10 kHz.
d) Three decades above 470 Hz is 470 kHz.

20) What are the characteristics of the following circuit?



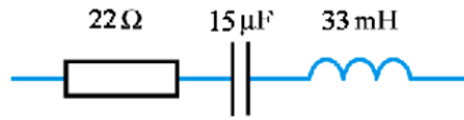
- a) A high-pass network b) A low-pass network

21) What are the characteristics of the following circuit?



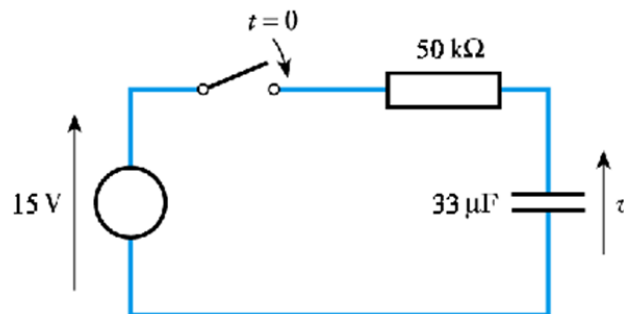
- a) A high-pass network b) A low-pass network

22) Calculate the resonant frequency of the following arrangement.



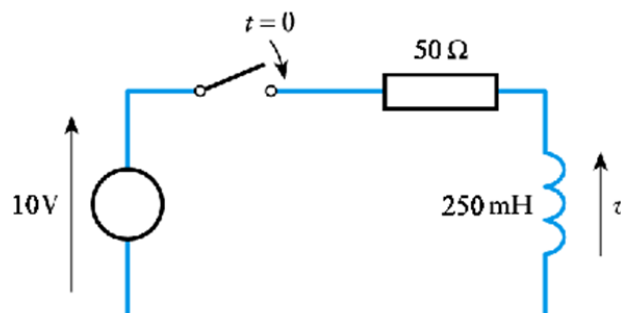
- a) 53 Hz b) 128 Hz c) 226 Hz d) 1421 Hz

23) The switch in the following circuit closes at $t = 0$. If the capacitor is initially discharged, calculate the voltage on the capacitor at $t = 3$ s.



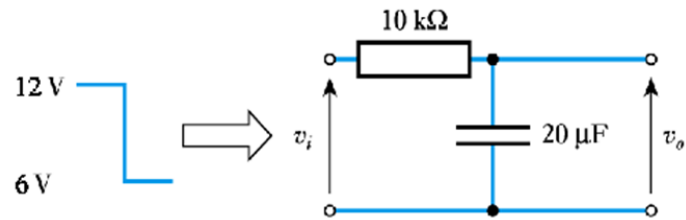
- a) 2.43 V b) 12.6 V c) 13.8 V d) 14.2 V

24) The switch in the following circuit closes at $t = 0$. If the inductor is initially de-energised, calculate the time at which the current in the coil reaches 150 mA.



- a) 1.44 ms b) 4.82 ms c) 6.93 ms d) 12.7 ms

25) Derive an expression for the output voltage of the following circuit, for the period after $t = 0$.



- a) $v = 12 - 6e^{-t/0.2}$ b) $v = 6 - 6e^{-t/0.2}$ c) $v = 6 + 6e^{-t/0.2}$ d) $v = 12 - 12e^{-t/0.2}$