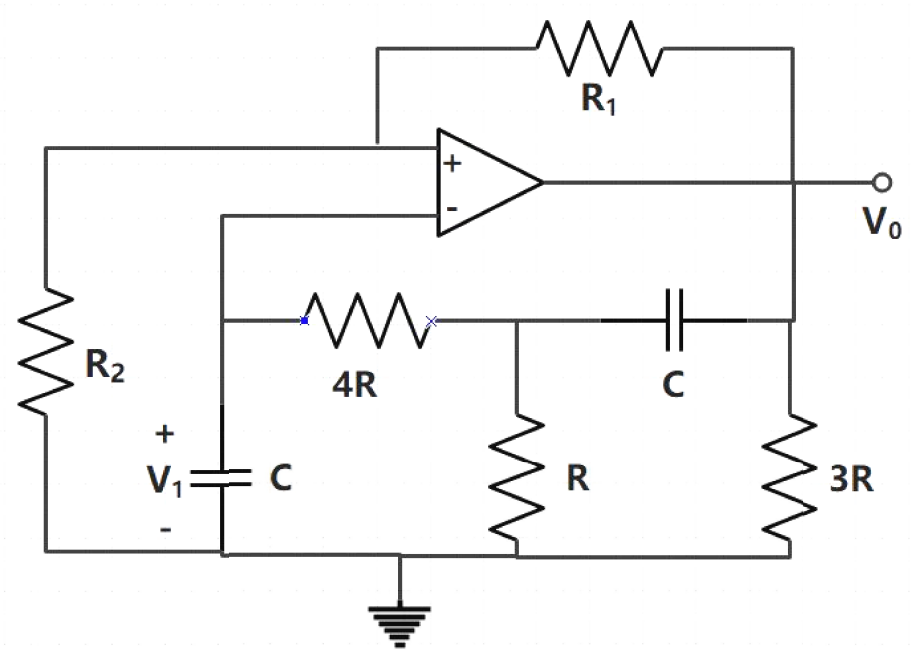
VE215 Quiz #4

Chapter 9 and Chapter 10 are covered in this quiz.

Problem #1

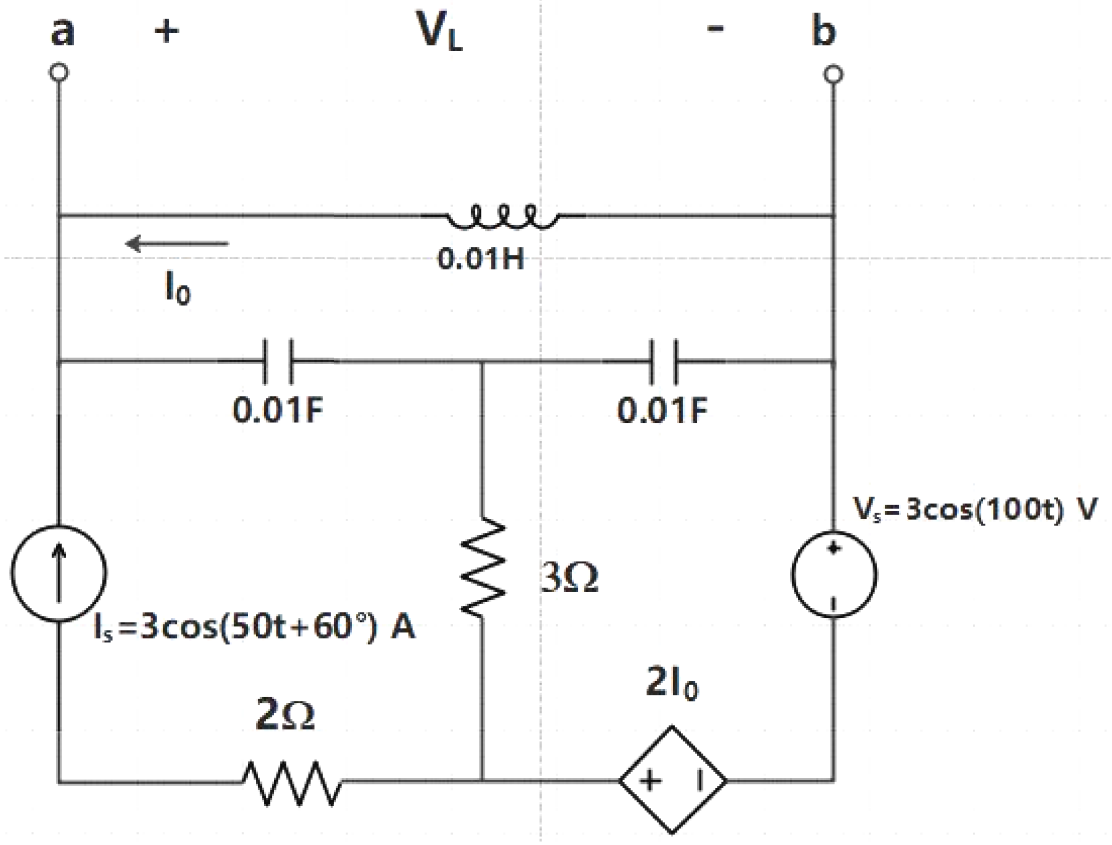


This schematic shows an oscillator which can convert DC voltage to AC voltage.

(1) Please derive the oscillation frequency.

(2) Please determine $\mathbf{R_1/R_2}$ to let the oscillation occur.

Problem #2



Please find the Thevenin equivalent of the circuit above. Your result should be a schematic with all necessary values marked.

Hint: Please utilize Super-position Principle to deal with AC sources with multiple frequencies.

Mathematics Formula Sheet:

- **Phasor and Complex number**

$$j^2 = -1$$

$$\frac{a + jb}{c + jd} = \frac{(a + jb)(c - jd)}{(c + jd)(c - jd)} = \frac{(ac + bd) + j\,(bc - ad)}{c^2 + d^2}$$

$$A + jB = \sqrt{A^2 + B^2}\angle\left[\arctan\frac{B}{A}\right] = \sqrt{A^2 + B^2}\, e^{j\arctan\frac{B}{A}}$$

$$\frac{A\angle\theta_1}{B\angle\theta_2} = \frac{A}{B}\angle(\theta_1 - \theta_2), \text{we say A leading B for } \angle(\theta_1 - \theta_2)$$

$$e^{j\theta} = \cos\theta + j\sin\theta$$

For phasors and complex number calculations, You'd better use a scientific calculator (recommended: CASIO 991).

Introduction to CASIO fx-991 calculator:

Complex Number Calculation: *You may press "MENU" button and select the "complex number" to do the complex number calculation.*

For the unit imaginary "j", the button "ENG" stands for that.

For the phasor angle "∠", please press "SHIFT", and then press "ENG" button.

Mention: It's invalid to input ∠θ, like ∠60! You must input a number before that, such as "1∠60" or "2∠60"

Complex Number and Phasor Transformation: *Please press "SHIFT" and then press "MENU", you can select the "Complex" and then choose its form (" a+bi " or "r∠θ")*

Angle Unit Transformation: *Please press "SHIFT" and then press "MENU", you can select the "angle unit" and then choose its unit ("degrees" or "rad")*