EN811100 LINEAR CIRCUIT ANALYSIS
RC/RL Exercise
Faculty of Engineering, Khon Kaen University

Academic Year 2563 Semester 2

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1. Given circuit diagrams below with an initial state that nodal voltage at node c, V_c, is 4 V, answer the following questions.
Note: numerical tolerance is 0.005.

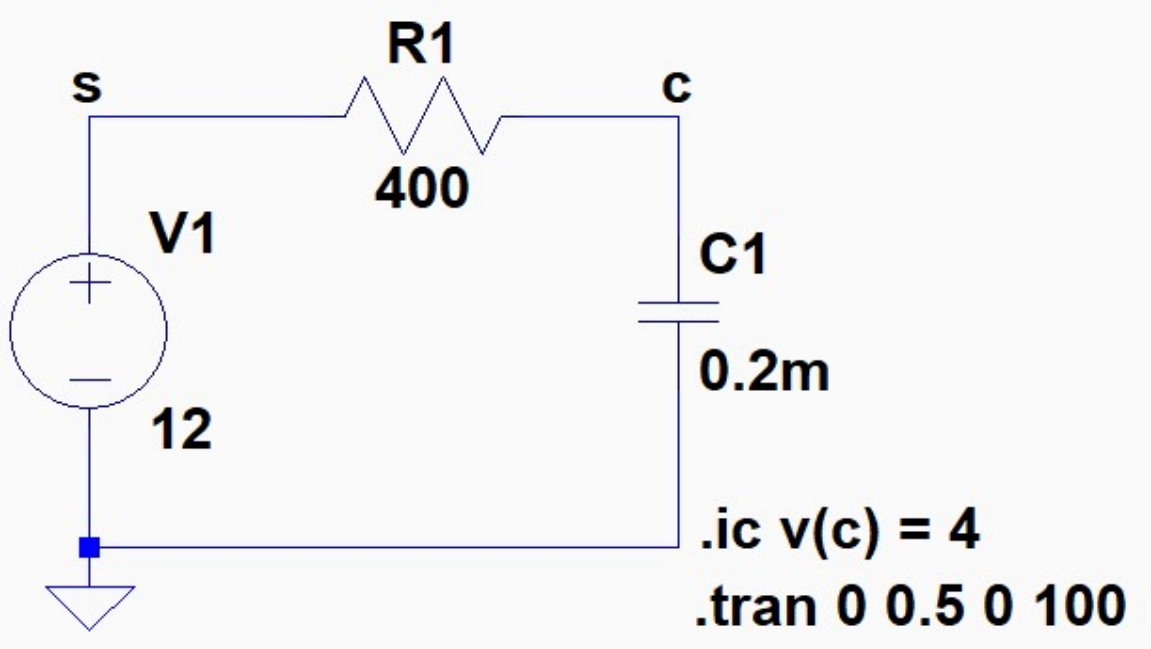

Figure 1. Circuit 1

1.1. What is the nodal voltage V_c at time t=0?
1.2. What is the nodal voltage V_c at steady state?
1.3. At steady state, what is the current i flowing through V1 (passing convention)?
1.4. What is the nodal voltage V_c as a function of time t?
1.5. What is the current i flowing through V1 (passing convention) as a function of time t?
1.6. What is the nodal voltage V_c at time t=80ms?
1.7. What is the nodal voltage V_c at time t=160ms?
1.8. What is the nodal voltage V_c at time t=240ms?
1.9. What is the nodal voltage V_c at time t=480ms?
1.10. What is the nodal voltage V_c at time t=5s?

Write the answers in the following format:

```
Q1.1: Vc = -12 V
Q1.2: Vc = -12 V
Q1.3: i = 0 A
Q1.4: Vc = 0.1 t + 12 sin(15 t - 1.57) + 5 V
Q1.5: i =  0.1 t + 12 sin(15 t - 1.57) + 5 A
Q1.6: Vc = -12 V
Q1.7: Vc = -12 V
Q1.8: Vc = -12 V
Q1.9: Vc = -12 V
Q1.10: Vc = -12 V
```

2. Given circuit diagrams below with an initial state that current flowing through L1 *i(L1)* flowing downward is 0 A, answer the following questions.
Note: numerical tolerance is 0.005.

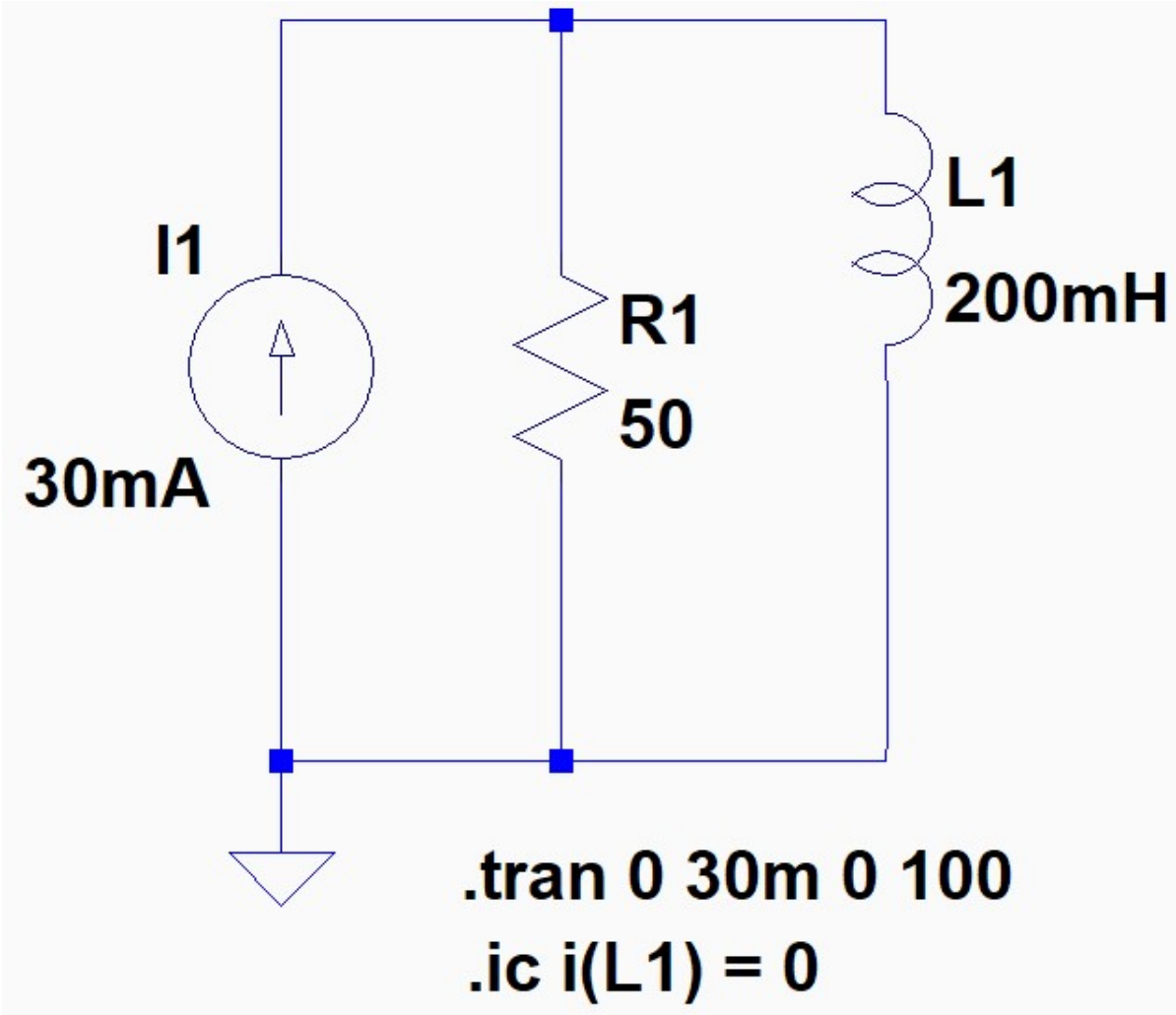

Figure 2. Circuit 2

2.1. What is the current *i(L1)* at time *t*=0?
2.2. What is the current *i(L1)* at steady state?
2.3. At steady state, what is the voltage across the inductor L1 (polarity: + is up and – is down)?
2.4. What is the current *i(L1)* as a function of time *t*?
2.5. What is the voltage across the inductor L1 (polarity: + is up and – is down) as a function of time *t*?
2.6. What is the current *i(L1)* at time *t*=4ms?
2.7. What is the current *i(L1)* at time *t*=8ms?
2.8. What is the current *i(L1)* at time *t*=16ms?
2.9. What is the current *i(L1)* at time *t*=24ms?
2.10. What is the current *i(L1)* at time *t*=240ms?

Write the answers in the following format:

```
Q2.1: i = -12 mA
Q2.2: i = -0.28 A
Q2.3: V = 12 V
```

```
Q2.4: i = 0.1 t + 12 sin(15 t - 1.57) + 5 A
Q2.5: V =  0.1 t + 12 sin(15 t - 1.57) + 5 V
Q2.6: i = -12 mA
Q2.7: i = -12 mA
Q2.8: i = -12 mA
Q2.9: i = -12 mA
Q2.10: i = -12 mA
```

3. Given circuit diagrams below with an initial state that nodal voltage at node c, V_c, is 12 V, answer the following questions.
Note: numerical tolerance is 0.005.

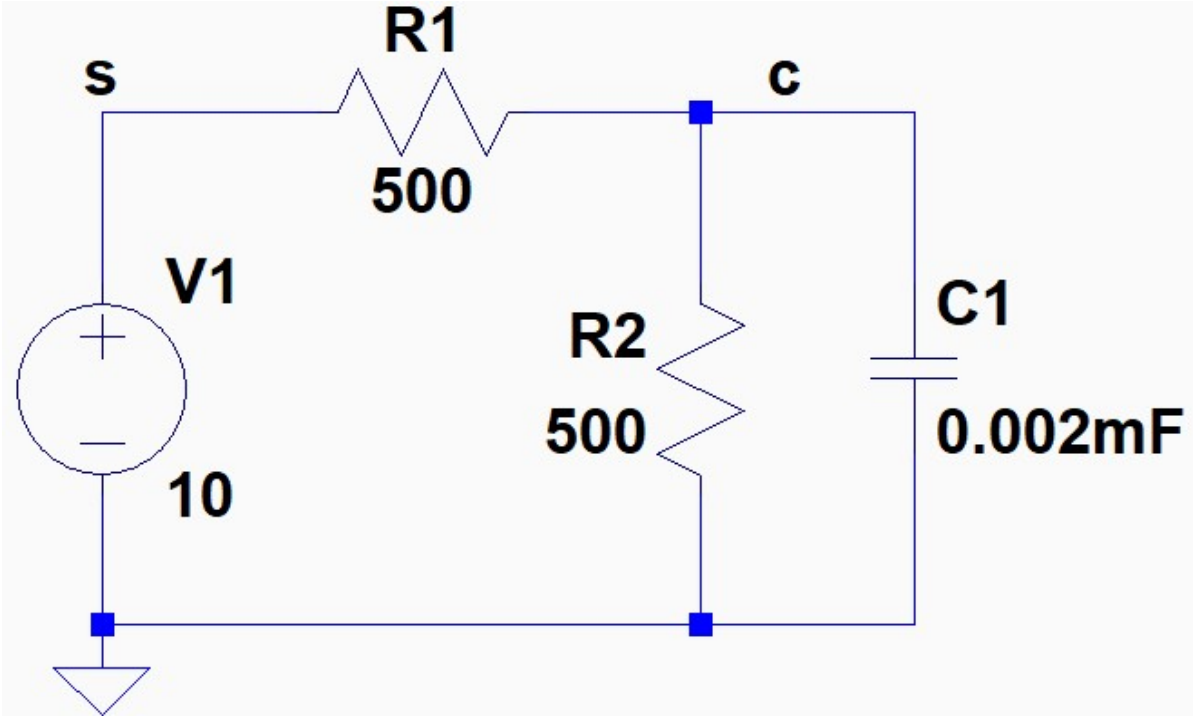

Figure 3. Circuit 3

1.1. What is the nodal voltage V_c at steady state?
1.2. What is the nodal voltage V_c as a function of time t?
1.3. What is the nodal voltage V_c at time t=1.5ms?
1.4. What is the nodal voltage V_c at time t=15ms?
1.5. What is the nodal voltage V_c at time t=150ms?

Write the answers in the following format:

```
Q3.1: Vc = -12 V
Q3.2: Vc = 0.1 t + 12 sin(15 t - 1.57) + 5 V
Q3.3: Vc = -12 V
Q3.4: Vc = -12 V
Q3.5: Vc = -12 V
```