THE INTERNATINONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY – HCMC

Mid-term Examination

Date: November , 2020

Duration: 90 minutes.

SUBJECT: PRINCIPLES OF EE 2	
Dean of School of Electrical Engineering Signature: Full name: Mai Linh	 Lecturer: Mai Linh Signature:

INSTRUCTIONS: This is an opened-book examination.
Laptop, tablets, & cell phones are not allowed during the exam

A. Select the correct answer: (30 points)

"Step Response of an R-C Circuit with a DC voltage V_S".

1. The current in the R-C circuit at a time $t = 0^+$ is?

a) V_S/R b) R/V_S c) V_S d) R

2. In an R-C circuit, when the switch is closed, the response _____

a) do not vary with time b) decays with time
c) rises with time
d) first increases and then decreases

3. A series R-C circuit consists of resistor of 10 Ω and capacitor of 0.1 F as shown in the Fig. 1. A DC voltage V_S = 20 V is applied to the circuit at t = 0. What is the current in the circuit at t = 0? Assume at t = 0, switch S is closed.

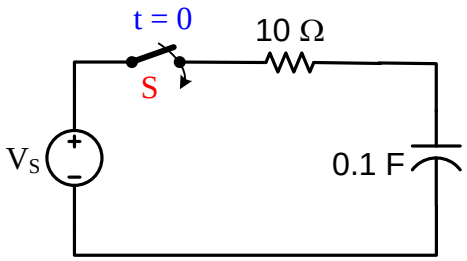

Fig. 1

a) 1A b) 2A c) 3A d) 4A

4. The current equation in the circuit shown in the question 3 is?

a) $i = 2(e^{-t})$ A b) $i = 2(e^{t})$ A
c) $i = 2(-e^{-t})$ A d) $i = 2(-e^{t})$ A.

5. Determine the voltage across the capacitor in the circuit shown in the question 3 is?

a) $V_C = 20(1 - e^{-t})$ V b) $V_C = 20(1 + e^{t})$ V
c) $V_C = 20(1 - e^{t})$ V d) $V_C = 20(1 + e^{-t})$ V.

"Step Response of an R-L Circuit with a DC voltage V_S"

6. The value of the time constant in the R-L circuit is?

a) L/R b) R/L c) R d) L

7. After how many time constants, the transient part reaches more than 99 percent of its final value?

a) 2 b) 3 c) 4 d) 5

8. A series R-L circuit with R = 30 Ω & L = 15 H has a constant voltage V_S = 60V applied at t = 0 as shown in the Fig. 2. Determine the current (A) in the circuit at $t = 0^+$?

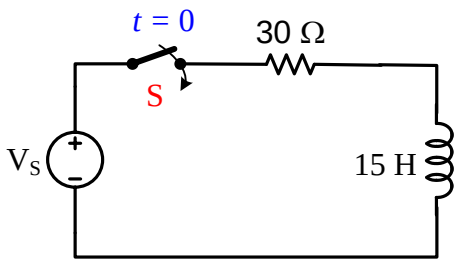

Fig. 2

a) 1A b) 2A c) 3A d) 0A

Name: **Student ID:**

9. The expression of current obtained from the circuit in terms of differentiation from the circuit shown in the question 8?

a) $\frac{di}{dt}+i=4$ b) $\frac{di}{dt}+2i=0$

c) $\frac{di}{dt}+2i=4$ d) $\frac{di}{dt}-2i=4$

10. Determine the voltage across the inductor in the circuit shown in the question 8 is?

a) $V_L = 60(-e^{-2t})$ V b) $V_L = 60(e^{2t})$ V

c) $V_L = 60(e^{-2t})$ V d) $V_L = 60(-e^{2t})$ V

"Step Response of an R-L-C Circuit"

11. For an R-L-C circuit, if the roots of an equation are real and unequal, then the response will be?

a) critically damped b) under damped

c) over damped d) damped

12. If the roots of an equation are complex conjugate, then the response will be?

a) over damped b) critically damped

c) damped d) under damped

13. If the roots of an equation are real and equal, then the response will be?

a) over damped b) damped

c) critically damped d) under damped

14. The circuit shown in the Fig. 3 consists of resistance, capacitance and inductance in series with a source V_S = 100 V when the switch S is closed at t = 0. Find the equation obtained from the circuit in terms of current i?

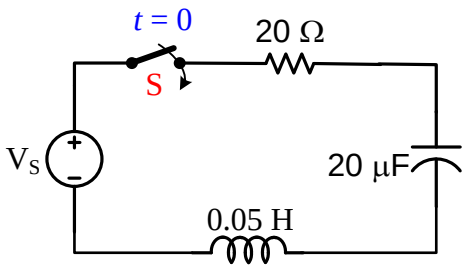

Fig. 3

a) $100 = 20i + 0.05\frac{di}{dt} + \frac{1}{20\times10^{-6}}\int idt$

b) $100 = 20i - 0.05\frac{di}{dt} + \frac{1}{20\times10^{-6}}\int idt$

c) $100 = 20i + 0.05\frac{di}{dt} - \frac{1}{20\times10^{-6}}\int idt$

d) $100 = 20i - 0.05\frac{di}{dt} - \frac{1}{20\times10^{-6}}\int idt$

15. At time t = 0, the value of current in the circuit shown in the question 14 is?

a) 1A b) 2A c) 3A d) 0A

B. Problems

Problem 1: *(25 marks)* Given the circuit in Fig. 4.

a) Construct the s – domain circuit from the given circuit?

b) Find the expression of voltage $v_0(t)$ from the circuit by means of Laplace transform?

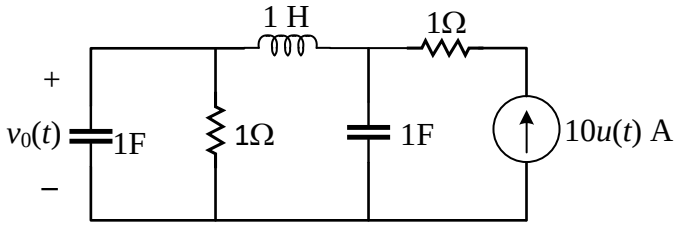

Fig. 4: Figure for Problem 1

Problem 2: *(25 marks)* The switch in the circuit (shown in Fig. 5) has been in position **a** for a long time. At $t = 0$ it moves instantaneously to position **b**. Knowing that V = 24 V; $R_1 = 3\ \Omega$; $R_2 = 5\ \Omega$; $R_3 = 20\ \Omega$; C = 0.1 F; L = 5.625 H.

a) Find $V_0(s)$?

b) Find $v_0(t)$?

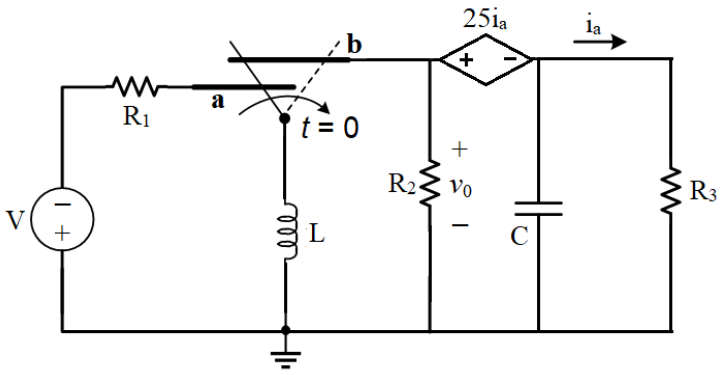

Fig. 5: Figure for Problem 2

Problem 3: *(20 marks)* For the following Laplace function $F(s)$, find the inverse Laplace transform $\mathcal{L}^{-1}\{F(s)\}$?

$$F(s) = \frac{10s^3 + 40s^2 + 40s + 6}{s^4 + 6s^3 + 11s^2 + 6s}$$

.

Name: **Student ID:**