ECE-205 Quiz 1

1) For a first order RC circuit, the time constant is of the form
   a) $\tau = C / R_{th}$  b) $\tau = R_{th} / C$  c) $\tau = R_{th}C$  d) none of these

2) For a first order RL circuit, the time constant is of the form
   a) $\tau = R_{th}L$  b) $\tau = L / R_{th}$  c) $\tau = R_{th} / L$  d) none of these

3) The differential equation that relates the current through a capacitor to the voltage across a capacitor is
   a) $v_c(t) = C \frac{di_c(t)}{dt}$  b) $i_c(t) = \frac{1}{C} \frac{dv_c(t)}{dt}$  c) $i_c(t) = C \frac{dv_c(t)}{dt}$  d) $v_c(t) = \frac{1}{C} \frac{di_c(t)}{dt}$

4) The differential equation that relates the current through an inductor to the voltage across an inductor is
   a) $i_L(t) = L \frac{dv_L(t)}{dt}$  b) $v_L(t) = \frac{1}{L} \frac{di_L(t)}{dt}$  c) $i_L(t) = \frac{1}{L} \frac{dv_L(t)}{dt}$  d) $v_L(t) = L \frac{di_L(t)}{dt}$

5) The standard form for an RC or RL first order circuit, with input $x(t)$ and output $y(t)$, is
   a) $\frac{dy(t)}{dt} + \tau y(t) = Kx(t)$  b) $\frac{dy(t)}{dt} + \tau y(t) = Kx(t)$  c) $\frac{1}{\tau} \frac{dy(t)}{dt} + y(t) = Kx(t)$
   d) $\frac{dy(t)}{dt} + \tau y(t) = \frac{1}{K} x(t)$  e) $\tau \frac{dy(t)}{dt} + y(t) = \frac{1}{K} x(t)$  f) $\tau \frac{dy(t)}{dt} + y(t) = Kx(t)$

6) A capacitor is a/an  a) short circuit  b) open circuit  to DC signals.

7) An inductor is a/an  a) short circuit  b) open circuit  to DC signals.
Problems 8 and 9 refer to the following circuit:

![Circuit Diagram](image)

8) The Thevenin resistance seen from the ports of the capacitor is
a) \( R_{th} = R_c + R_a \parallel R_b \)  
b) \( R_{th} = R_c \)  
c) \( R_{th} = R_c \parallel (R_a + R_b) \)  
d) \( R_{th} = R_a + R_b + R_c \)  
e) none of these

9) The static gain for the system is
a) \( K = 1 \)  
b) \( K = \frac{R_c}{R_a + R_b + R_c} \)  
c) \( K = \frac{R_b}{R_a + R_b} \)  
d) \( K = \frac{R_a}{R_a + R_b} \)  
e) none of these

Problems 10 and 11 refer to the following circuit

![Circuit Diagram](image)

10) The Thevenin resistance seen from the ports of the capacitor is
a) \( R_{th} = R_a + R_b \)  
b) \( R_{th} = R_c \)  
c) \( R_{th} = R_c \parallel (R_a + R_b) \)  
d) \( R_{th} = R_a + R_b + R_c \)  
e) none of these

11) The static gain for the system is
a) \( K = 1 \)  
b) \( K = R_c \)  
c) \( K = R_a + R_b \)  
d) \( K = R_c \parallel (R_a + R_b) \)  
e) none of these
Problems 12 and 13 refer to the following circuit

12) The Thevenin resistance seen from the ports of the inductor is
   a) \( R_{th} = R_a + R_b \parallel R_c \)  b) \( R_{th} = R_c + R_a \parallel R_b \)  c) \( R_{th} = R_a + R_b \)  d) \( R_{th} = R_a + R_c \)  e) none of these

13) The static gain for the system is
   a) \( K = 1 \)  b) \( K = \frac{R_a}{R_a + R_b} \)  c) \( K = \frac{R_a}{R_a + R_b} \)  d) \( K = \frac{R_b}{R_c + R_b} \)  e) none of these

Problems 14 and 15 refer to the following circuit

14) The Thevenin resistance seen from the ports of the inductor is
   a) \( R_{th} = R_c \parallel (R_a + R_b) \)  b) \( R_{th} = R_c \)  c) \( R_{th} = R_a + R_b \)  d) \( R_{th} = R_a + R_b + R_c \)  e) none of these

15) The static gain for the system is
   a) \( K = 1 \)  b) \( K = \frac{R_a + R_b}{R_a + R_b + R_c} \)  c) \( K = \frac{R_c}{R_a + R_b + R_c} \)  d) \( K = \frac{R_c}{R_a + R_b} \)  e) none of these
16) If $z = \frac{1+j}{1-j}$, then

a) $\angle z = 0^{\circ}$  b) $\angle z = 90^{\circ}$  c) $\angle z = -90^{\circ}$  d) $\angle z = -45^{\circ}$  e) $\angle z = 45^{\circ}$

17) If $z = \frac{1+j}{3+j}$, then

a) $|z| = 0$  b) $|z| = \frac{2}{8}$  c) $|z| = \frac{2}{\sqrt{8}}$  d) $|z| = \frac{2}{\sqrt{10}}$

18) The following graph shows the step response of a first order system

The best estimate of the static gain of this system is  a) 1.0  b) 2.0  c) 3.0  d) 6.0