Islamic University Faculty of Engineering Department of Electrical Engineering		الجامعة الإسلامية كلية الهندسة قسم الهندسة الكهربائية

EE 202 – CIRCUIT THEORY II

Fall Semester 2017-2018

Midterm Exam 1

Exam Date: Novemeber 06, 2017; Exam Duration: 90 minutes

Student's Full Name: [redacted]

Student ID #: [redacted] **Section #: 1053 Signature:**_____

Instructions:

- **Write your student ID number on the top of each page**
- **Write the solution in the space provided under each question**
- **Show all the details of your analysis and calculations**

Question No.	Points Assigned	Points Awarded
1. [CO_6, PI_11_14, SO_11]	34	31
2. [CO_2, PI_1_27, SO_1]	33	19
3. [CO_5, PI_11_14, SO_11]	33	13
Total	**100**	53

Question 3 – (solution Continued)

unit step: it's internal when we closed the circut the unit step mean it's very smal drop internal when we close the circuit to get the same value for (sources voltag or current) like

impulse functions : this function it's get the same value when we close the circuit (so no unit step)

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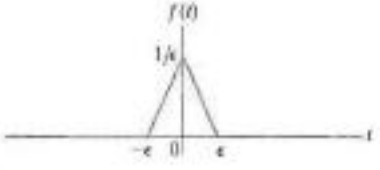
Question 3

Find the Laplace transform of (show steps)

a) The derivative of unit step function **(9 points)**
b) cosωt **(9 points)**
c) What is the magnitude of f(0) when c=0 ? **(7 points)**
d) What is unit step and impulse functions? **(8 points)**



$\frac{d}{ds}F(s) = 1$

Solution

$\int F(s)\,ds$

$\frac{d}{ds}F(s) = 1$

$\frac{d}{ds}F(0) = 0$

$\Rightarrow 1 - 0 = 1$

b) $\cos \omega t = \frac{1}{(s+a)^2 + \omega^2}$

c) $F(0) = \frac{1}{0} = \infty$

b) $P = |S| \cos\theta$

$Q = |S| \sin\theta$

$P = iV = (149.906 + 3.747i) \times (3)$

$= 449.718 + 11.241i$

c) $R_L = \sqrt{R_{Th}^2 + (X_L + X_{Th})^2}$

d) $P = \frac{1}{n} \frac{V}{R}$

Question 2

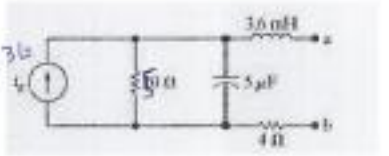
The source current in the circuit shown is 3 cos 100t A as shown in figure, when value of resistor is taken 50 ohm instead of 20 ohm.

a) What impedance should be connected across terminals a, b for maximum average power transfer? **(8 points)**

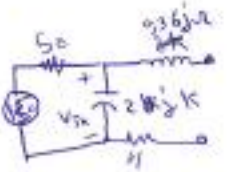
b) What is the average power transferred to the impedance in (a)? **(9 points)**

c) Assume that the load is restricted to pure resistance. What size resistor connected across a,b will result in the maximum average power transferred? **(9 points)**

d) What is the average power transferred to the resistor in (c)? **(7 points)**



Solution



$Z_L = Z_{Th}^*$

$V = 3 \times 50 = 150\ V$

$w = 100 \Rightarrow X_L = wL = 0,36\ \Omega \quad \left| X_C = \frac{1}{wC} = 2000\ \Omega \right.$

Phasor Eq?

$V_{Th} = \frac{2000j}{2000j+50} \cdot 150 = 149,906 + 3,747\,i$

Thevenin's Eq.

$So\ Z_{Th} = \frac{V_{Th}}{I} = \frac{149,906 + 3,747i}{3} = 49,968 + 1,24\,j$

$\Rightarrow Z_L = 49,968 - 1,24\,j$

So $k_3 = k_1^* \Rightarrow k_3 = -15$

And $k_4 = k_2^* \Rightarrow k_4 = -15i$

29

$$\Rightarrow \frac{60}{(s^2+4s+5)^2} = \frac{-15}{(s+2+i)^2} + \frac{15i}{(s+2+i)} + \frac{-15}{(s+2-i)^2} + \frac{-15i}{(s+2-i)^2}$$

So Laplase invers

$$\mathcal{L}^{-1}(F(s)) = -15t\,e^{-(2+i)t} + 15i\,e^{-(1+i)t} - 15t\,e^{-(2-i)t} - 15i\,e^{-(2-i)t}$$

poles: it's limit of $F(s)$ when $s \to \infty$

$\lim_{s\to\infty} F(s)$

2

Zeroes: it's limit of $F(s)$ whe $s \to 0$

$\lim_{s\to 0} F(s)$