Seat No.

King Mongkut's University of Technology Thonburi

Midterm Examination, Semester 1, Academic Year 2014

Electrical Engineering Mathematics

Subject: EIE 208 ~~Electrical and Electronic Engineering Mathematics~~

For: 2^{nd} yr. students, International Program, Dept. of Electronic and Telecommunication Engineering

Date: Wed., 24 September 2014 **Time** 1:00pm – 4:00pm

Instructions:-

1. This exam consists of **8 pages** (including this page) for **7 problems** with the total score of 90.
2. This exam is *closed books*. Textbooks and documents related to the subject are **not allowed**.
3. *Answer* each problem **on the exam** itself (use the back pages for extra spaces).
4. A *calculator* complying with the university rule is **allowed**.
5. A *dictionary* is **not allowed**.
6. **Do not** bring any exam papers and answer sheets outside the exam room.

Remarks:-

- **Raise your hand when you finish the exam to ask for a permission to leave the exam room.**
- **Students who fail to follow the exam instruction might eventually result in a failure of the class or may receive the highest punishment with university rules.**
- **Carefully read the entire exam before you start to solve problems. Before jumping into the mathematics, think about what the question is asking. Investing a few minutes of thought may allow you to avoid twenty minutes of needless calculation!**

Open Minds ... No Cheating! GOOD LUCK!!!

This exam is designed by Asst. Prof. Dr. Pinit Kumhom (Ext. 9075, 9070)

This examination has been approved by the committees of the ENE department.

R. Silapunt

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(Assoc. Prof. Rardchawadee Silapunt, Ph.D.)

Head of Electronic and Telecommunication Engineering Department

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Name-Surname: __________ **Student No.:** __________

Prob. No.	1	2	3	4	5	6	7	8	9	10	**Total**
Full Score	10	15	20	12	13	10	10				90
Recieved Score											

Problem 1 [Math. and Engineering] (10 points) Describe the importance of mathematics in engineering and how mathematics is applied to engineering.

Problem 2 [Signals] (15 points)

2.1 (5 points) Decide whether or not each of the following statements is true (T) or false (F). If it is false, make the correction. ***Answering true (T) for a false statement or answering fasle (F) without correcting the statement will result in a negative score of -0.5 point. If you do not sure, leave it blank.***

______1. A signal in engineering is a function of time variable, which is either continuous or discrete.

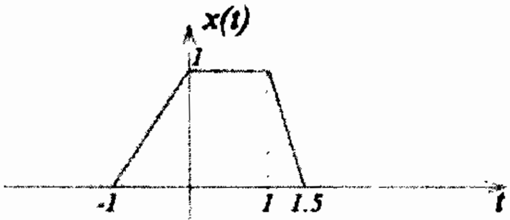
______2. A discrete-time signal is just another name of a digital signal, and we can generate a discrete signal by sampling a continuous signal.

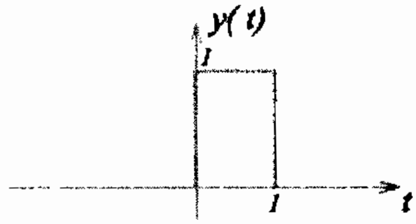
______3. A sinusoidal signal can be completely specified by its amplitude and frequency.

______4. If $x(t)$ is a periodic signal, then $x(t) = x(t+T)$, where T is a positive real number.

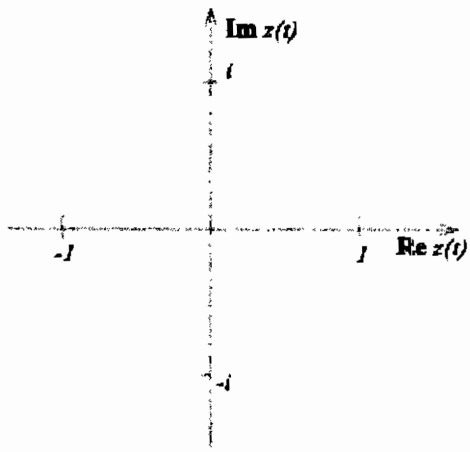
______5. A complex signal $x(t) = e^{j\omega_0 t}$ is a periodic signal whose period is ω_0.

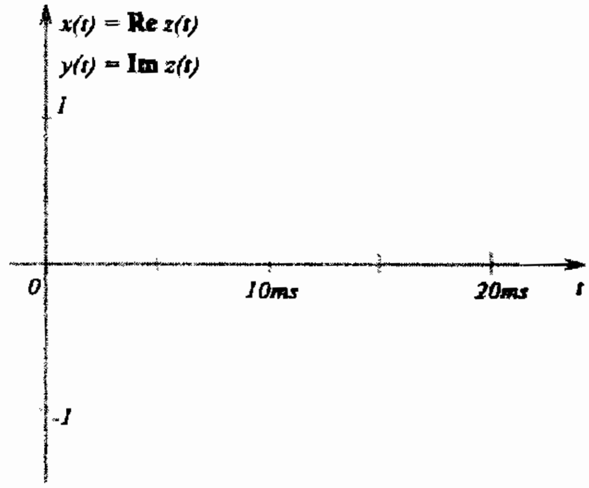
2.2 (10 points) Given a signal $x(t)$ and $y(t)$ shown below, plot $x(0.5t-1)$, $y(-2t+1)$ and $x(t)y(-t-1.5)$



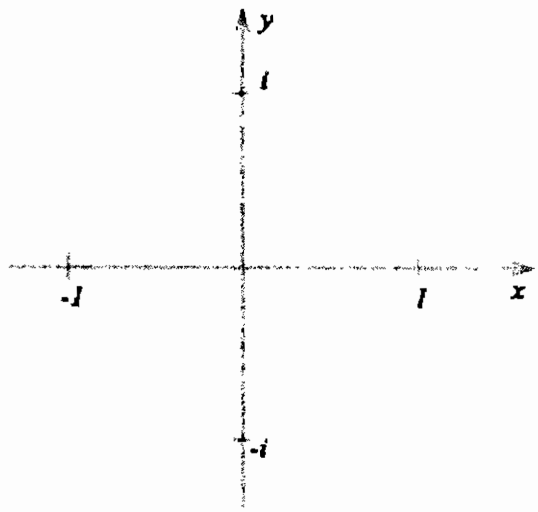


Problem 3 [Signals] (10 points) Plot the trajectory of the complex function $z(t) = 2e^{i\pi/6}e^{i100\pi t}$ for $0 \le t < 20ms$, and plot its real and imaginary part.





Problem 3.2 [Signals] (10 points) Write complex exponential functions $s(t)$, $m(t)$, and $h(t)$ to describe the trajectories of the heads of a clock's pointers for second, minute, and hour, respectively, starting from 00:00:00 ($t = 0$), where all pointers are set at the number 12 ($\theta = \pi/2$). The radiuses for the second, minute, and hour pointers are 1, 0.8, and 0.5 respectively. What is the degree of each pointer at the time 1:02:32am ($t = 1 \cdot 3600 + 2 \cdot 60 + 32$ s)?



Problem 4 [Complex numbers] (12 points) Manipulate the following complex numbers so that they can be expressed in (1) rectangular form, $z = x + iy$, and (2) polar form using exponential function, $z = re^{i\theta}$, where θ is the argument of z in the principal branch. Show how your results are obtained.

4.1

$$z = \frac{e^2 e^{i\pi/4}}{1-i}$$

4.2 $z = (1-\pi)(-1-\sqrt{3}i)^2$

4.3

$$z = \frac{2\sqrt{3}\pi e^{i\pi}}{1-\sqrt{3}i} + \sqrt{3}\pi + \pi i$$

4.4

$$z = \frac{e^{-2}\sin\pi/6}{-1-i} - \frac{e^{-2}e^{i\pi/2}\cos\pi/6}{1+i}$$

Problem 5 [Complex Roots] (13 points) Find all the solutions of the following equation and plot them on the complex plane.

$$(z^6+64)(z^2+2iz-4)=0$$

Problem 6 [Analytic Functions] (10 points) Find the domain that make the following complex function analytic. (Hint: Use the Cauchy-Riemann Equations, $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$)

6.1 $f(z) = 3x^2 + 2x - 3y^2 - 1 + i(6xy + 2y)$

6.2 $f(z) = e^{x^2-y^2}[\cos(2xy) + i\sin(2xy)]$

Problem 7 [System Analysis] (10 points) Describe linear system analysis concept based on the Laplace transform using a simple RC circuit as an example.