KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-241 – Data and Computer Communication

Assignment #2 – Due Tuesday Feb 23rd – in class

Student Name:

Student Number:

Problem #	Maximum Mark	Mark
1	10+10	
2	30	
3	20+10	
Total	60 + 20	

Problem 1 (10 points +10 bonus)

Consider the following signal $s(t) = (1 + 0.1\cos(5t))\cos(100t)$.

a) (10 points) Decompose $s(t)$ into a linear combination of sinusoidal functions and find the amplitude, frequency, and phase of each component.

b) (bonus 5 points) Find the period (or frequency) of $s(t)$

c) (bonus 5 points) Find the total power for $s(t)$.

Hint: Use the identity $\cos(a)\cos(b) = \frac{1}{2}[\cos(a-b) + \cos(a+b)]$

Problem 2 (30 points):

Consider the two periodic signal $s(t)$ and $g(t)$ shown in Figure. Both signals have amplitude of A volts and period T seconds.

From class notes we know that the Fourier Series Expansion (FSE) for $s(t)$ is given by

$$s(t) = \frac{A}{\pi} + \frac{A}{2}\cos\left(\frac{2\pi}{T}t\right) + \frac{2A}{\pi}\sum_{n=2,4,6}^{\infty}\frac{(-1)^{1+n/2}}{n^2-1}\cos\left(\frac{2\pi}{T}\times n\times t\right)$$

a) (5 points) If power for signal $s(t)$ is equal to $\frac{A^2}{4}$ (refer to class notes), what would be the power for the signal $g(t)$? Why? Use intuition and do not calculate using $P_g = \frac{1}{T}\int_0^T |g(t)|^2 dt$.

d) (15 points) Derivation for the FSE for signal $g(t)$ WITHOUT using the definition for F.S.E.

Hint: write $g(t)$ as a shifted and/or scaled version of $s(t)$ and substitute in the given FSE for $s(t)$. You may need the trigonometric identity $\cos(a \pm b) = \cos(a)\cos(b) \mp \sin(a)\sin(b)$

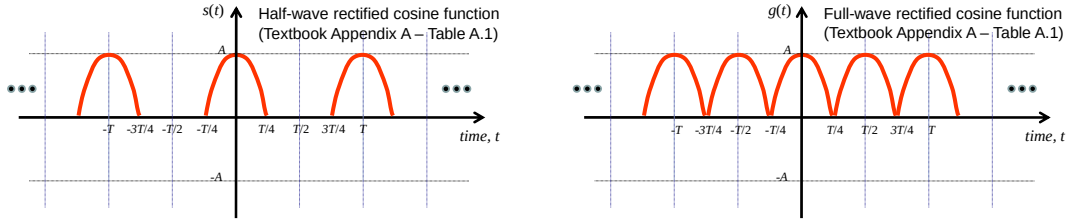

Figure: Signals $s(t)$ and $g(t)$ for problem 2.

Problem 3 (20 point + 10 bonus) On the subject of Z-transform

a) (5 points) Compute the Z-transform for the sampled signal $x(n) = 5 \times 0.8^n$ for $n = 0, 1, 2, \ldots$.

b) (5 points) Compute the Z-transform for the sampled signal $x(n) = 5 \times 0.8^n u(n)$.

c) (5 points) Compute the Z-transform for the sampled signal $x(n) = 5 \times 0.8^n u(n-3)$.

d) (5 points) Compute the inverse Z-transform for $X(z) = \frac{2z}{z-0.5}$.

e) (10 points - bonus) Compute the inverse Z-transform for $X(z) = \frac{6}{(z-0.8)(z-0.2)}$.

Student must show their work and required steps.