KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

SECOND SEMESTER 2006/2007

EE 207 MAJOR EXAM I

LOCATION: 14-108

DATE: SATURDAY 31-3-2007

TIME: 6:00-7:30 PM

Student's Name:…….

Student's I.D. Number:…….

	Maximum Score	**Score**
Problem 1	**20**	
Problem 2	**20**	
Problem 3	**10**	
Problem 4	**10**	
Total	**60**	

Problem 1 [20 points]

a) For the signal $x(t) = 3\sin(2\pi t)\Pi(t)$, which of the following statements is correct? (Circle the correct answer):

i) $x(t)$ is an energy signal.
ii) $x(t)$ is a power signal.
iii) $x(t)$ is neither an energy nor a power signal.

b) Evaluate the following integral: $\int_{-\infty}^{+\infty} (3t^2 - 2t)\,\dot{\delta}(t-2)dt$

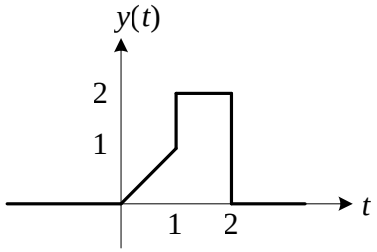
c) Find the fundamental period the periodic signal

$s(t) = 5\cos(40\pi t + \frac{\pi}{8}) + 7\sin(60\pi t - \frac{\pi}{3})$.

d) Sketch the double-sided amplitude spectrum of the signal $s(t)$ given in part (c).

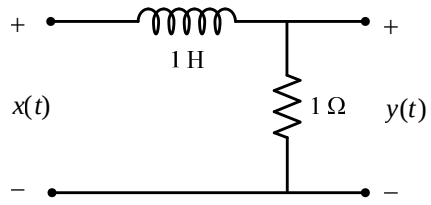
e) Sketch the signal $g(t) = \Pi(0.5t + 1.5)$.

f) Express the signal $y(t)$ (shown in the diagram below) in terms of singularity functions.



Problem 2 [20 points]

The circuit shown has an input voltage $x(t)$, output voltage $y(t)$, and zero initial conditions:



a) Show that the input $x(t)$ and the output $y(t)$ are related by a differential equation of the form:

$$\tau_o \frac{dy(t)}{dt} + y(t) = x(t)$$

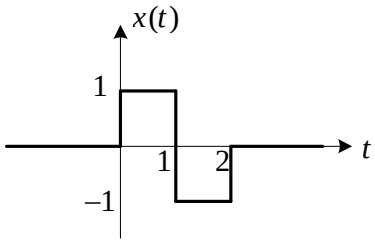
And evaluate the constant τ_o.

b) Use the above differential equation to show that this circuit can be considered as a linear time-invariant (LTI) system.

c) Assuming that this circuit has the following impulse response: $h(t) = (\frac{1}{\tau_o})e^{-t/\tau_o}u(t)$

Find the step response $a(t)$ [i.e. the response due to a unit step input $x(t) = u(t)$].
[Express your final result using a single expression, which valid for all t].

d) Now consider the following input signal $x(t)$:

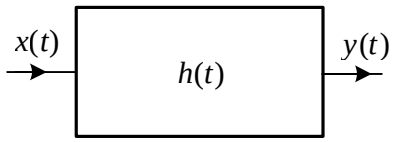


Express $x(t)$ in terms of a combination of step functions.

e) Find the output voltage of the circuit when the input is $x(t)$ shown in part (d).
[Hint: It is useful to consider the answer to part (c)].

Problem 3 [10 points]

Consider the linear time invariant system shown:

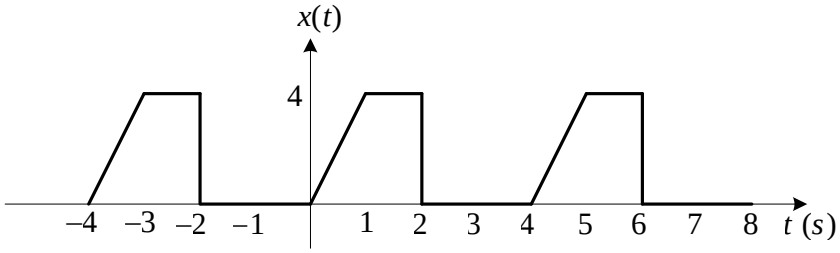


The impulse response of the system is given by $h(t) = 4e^{-3t}u(t)$.

Find the output $y(t)$ due to the input signal $x(t) = 5e^{-2t}u(t)$.

Problem 4 [10 points]

Consider the periodic signal $x(t)$:



a) Find the period of $x(t)$.

b) Calculate the average value (D.C. value) of $x(t)$.

c) Calculate the Trigonometric Fourier Series coefficient a_1 [i.e. the cosine coefficient associated with the fundamental frequency].

[Hint for part (c): $\int x\cos(bx)\,dx = \frac{x\sin(bx)}{b} + \frac{\cos(bx)}{b^2}$]