Kafrelsheikh University
Faculty of Engineering
Department of electrical engineering
Subject: Signals Processing
Instructors: **Dr. Bedir B. Yousif** **2nd Year**

Date: 17 /6/2019
Time allowed: **3 hours**
Full mark: 90 Mark
Finalterm Exam: Two pages
Academic Number: ECE2204

*** This exam measures the Intended Learning Outcomes (ILOs)**

Field	National Academic Reference Standards (NARS)		
	Knowledge and Understanding	Intellectual Skills	Professional Skills
academic standards that the course contribute in achieving it	a4, a5, a12, a13 a16,a18	b1, b2, b3, b4, b7, b8, b11, b12, b13, and b18	c1, c2, c3, c4 and c5

Solve all the following questions and any missing data could be reasonably assumed and books

Question One:(30 Mark) (a4, a5, a12, b1, b2, b3, b4, b7, b8, c1, c2, c3)

a. Determine whether the following signals are energy signals, power signals, or neither.
$i.f(t)=\begin{cases} t & 0<t<\infty, \\ 0 & Otherwise \end{cases}$, $ii.f(t)=\begin{cases} A & -a<t<a, \\ 0 & Otherwise \end{cases}$, iii. $f(t)=e^{-|t|}$, $-\infty<t<\infty$ (6 M)

b. Consider the discrete-time signal in **Fig. 1**. Sketch the signal z[n]=x[n][u[n +1]- u[2-n]] and calculate its normalized energy E. (6 M)

c. Sketch and describe mathematically the time compressed by factor 3 and time expanded by factor 2 of the signal that shown in **Fig. 2**? (6 M)

d. Express $x(t)$ signal in **Fig. 3** in terms of the unit step function. and sketch the derivative of $x(t)$. (6 M)

e. Find the exponential Fourier series for x(t) = t, –1 < t < 1, and Plot the amplitude and phase spectra. (6 M)

Fig. 1

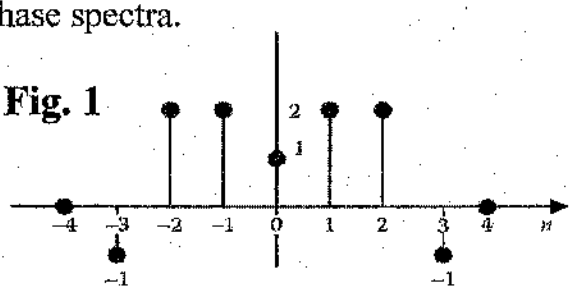
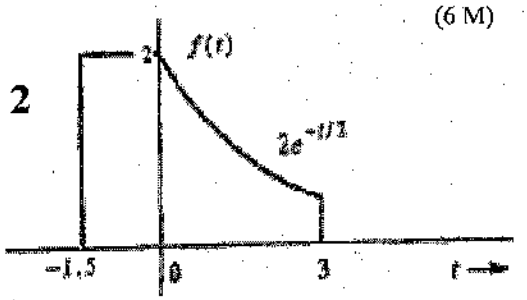


Fig. 2



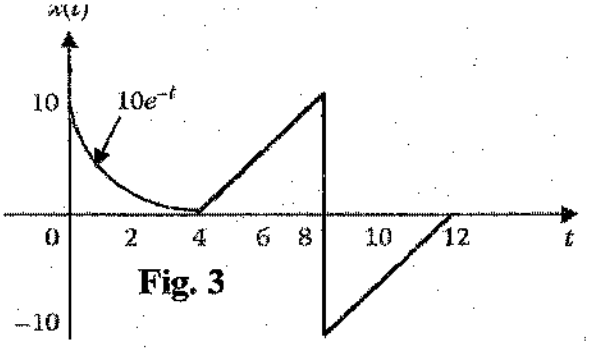


Fig. 3

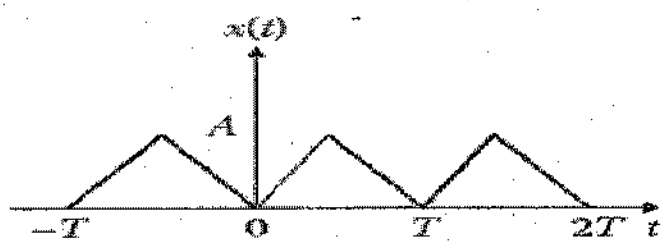


Fig. 4

Question Two:(30 Mark) (a13, a16, b11, b12,c4, c5)

a. Find the average power and the total harmonic distortion for the signal (6 M)

$$x(t) = 4 + 2\cos(2t - 30°) + \cos(4t - 15°).$$

b. Plot the amplitude and phase spectra for *x(t)* illustrated in Fig. 4, *If A=10 and T=2* (6 M)

c. Determine the Fourier transform of the signal in Figure 5. (6 M)

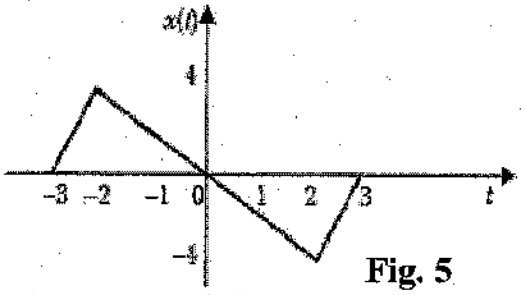


Fig. 5

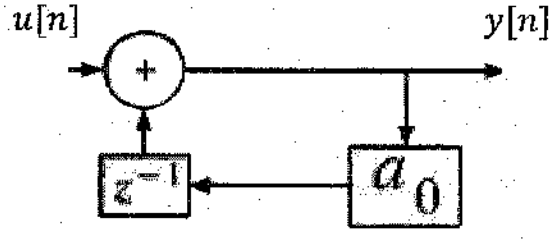


Fig. 6

d. Sketch $Y(\omega)$ *and* $y(t)$*for* (6 M)

$$(i)Y(\omega) = \frac{\delta(\omega)}{(j\omega+1)(j\omega+2)}$$

$$(ii)Y(\omega) = \frac{1}{2}[X(\omega-\omega_0) + X(\omega-\omega_0)], if\ x(t) = rect(\frac{t}{4})$$

e. A band-pass filter has its lower and upper cutoff frequencies as 10 and 20 Hz respectively. If the input signal is $V_i = 4e^{-t}u(t)$, calculate the $1-\Omega$ energy of the input and the percentage that appears at the output. (6 M)

Question Three:(30 Mark) (a13, a18, b13, b18,c4, c5)

a. Evaluate the Fourier transform of the following signals: (4 M)

$(i_0)\ x(t) = \delta(t-2) + \delta(t-1) + \delta(t+1) + \delta(t+2)$ (i1) $y(t) = 4te^{-t}u(t)$

b. For a given signal $f(t) = 0.504[1 + \sum_{n=1}^{\infty} \frac{2}{1+16n^2}(\cos 2nt + 4n\sin 2nt)]$. (4 M)

Evaluate: i. periodic time ii. DC and AC power and Sketch the phase spectra

c. If $x(t) = 2 + \delta(t-2) - 3\delta(t-4)$. sketch $y(t) = \int_0^t x(\tau)d\tau$ (4 M)

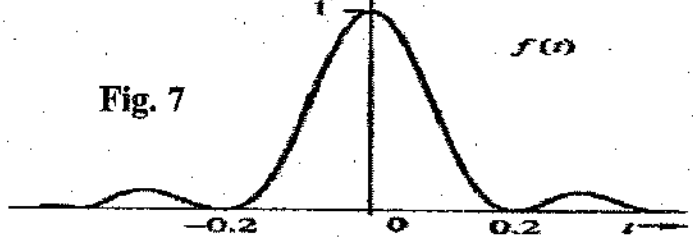
d. Find the z-transform of the following composite signal and determine its region of convergence. (6 M)

$$x[n] = (\frac{1}{2})^n u[n] + \cos(5n)u[n]$$

e. For a given low pass digital filter in **Fig.6**. Find $Y[Z]for\ y[n] = u[n] + a_0 y[n-1]$

f. The sampling of signal $f(t) = sinc^2(5\pi t)$ is sampled using train of pulses as in Fig.7 Sketch the time sampled signal and the spectrum of sampling and sampled signal. (6M)

Fig. 7



Best wishes of success
Dr. Bedir yousif