Q1: Find the autocorrelation of the following signal :

$$g(t) = e^{-at}\, u(t)\ ,\ a > 0\ .$$

Then , use the Wiener-Khintchine theorem to determine the energy spectral density of the signal .

(20%)

Q2 : Determine and sketch the output $y(t)$ of a LTI system with the impulse response $h(t)$ and the input signal $x(t)$ are given in Fig.(1) .

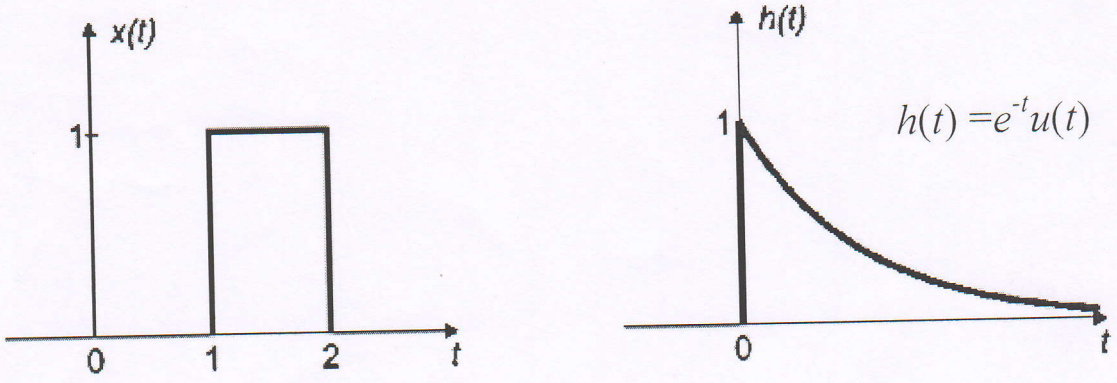

Fig.(1)

(20%)

Q3: Consider an ideal low-pass filter with frequency response :

$$H(\omega) = \begin{cases} 1\ , & |\omega| \le 11\pi \\ 0\ , & |\omega\ | > 11\pi \end{cases}$$

The input to this filter is the periodic signal f(t) shown in Fig.(2). Find

(i) The trigonometric Fourier series of the input f(t) and draw its amplitude spectrum .

(ii) The output response of the filter y(t) .

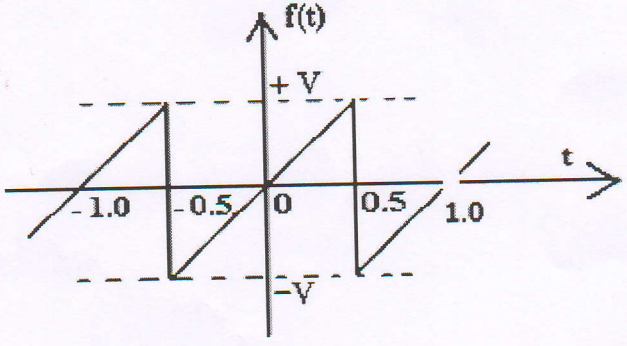

Fig.(2)

(20%)

Q4 : The continuous-time system shown in Fig.(3) consists of two integrators and two scalar multipliers. Write a differential equation that relates the output y(t) and the input x(t).

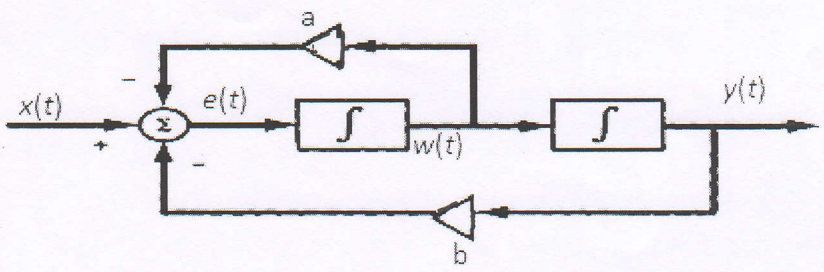

Fig.(3)

(20%)

Q5 : For the simple continuous-time RC frequency-selective filter shown in Fig.(4) , obtain the frequency response $H(j\omega)$. Sketch the magnitude and phase responses for $-\infty < \omega < \infty$.

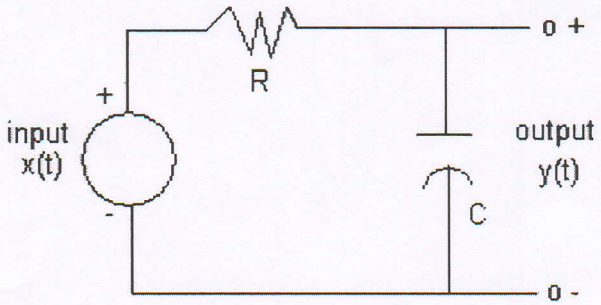

Fig.(4)

(20%)

Q6 : A continuous-time signal $x(t)$ is shown in Fig. (5) . Sketch and label each of the following signals :

$(a)\ x(t)\,u(1-t)$ $(b)\ x(t)\left[u(t)-u(t-1)\right]$ $(c)\ x(t)\,\delta\left(t-\frac{3}{2}\right)$

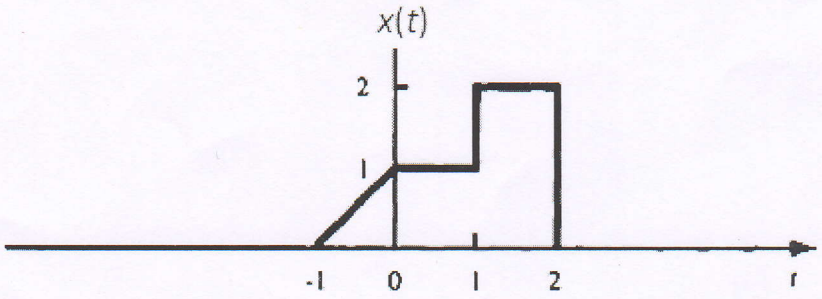

Fig. (5)

(20%)