Question # 1: For the sine function shown in the figure below, obtain the fourier transform, and plot the spectrum.
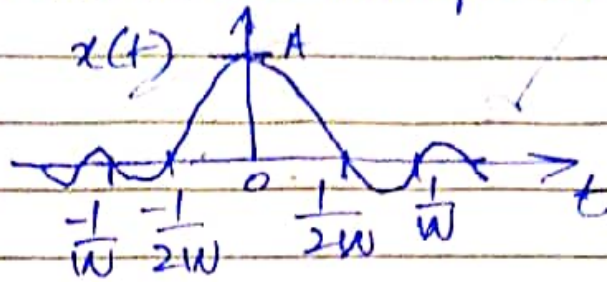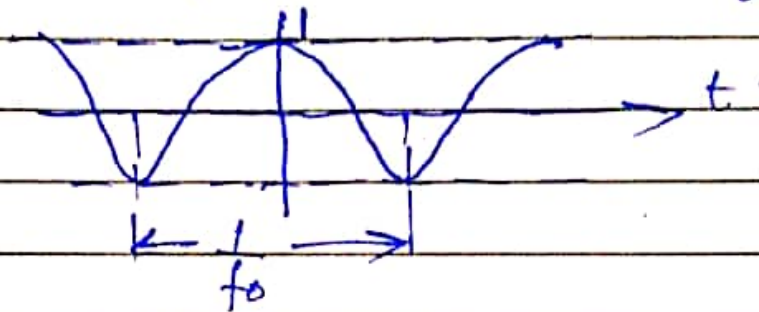

$x(t)$, with amplitude A, zeros at $-\frac{1}{W}, -\frac{1}{2W}, \frac{1}{2W}, \frac{1}{W}$

Question # 2: Obtain the Fourier transform of a cosine wave having a frequency f_0 and peak amplitude of unity and Plot its spectrum as shown in figure.

with spacing $\frac{1}{f_0}$

Question # 3: if $x(t) \xleftrightarrow{F} X(\omega)$, then, prove that
$$x(t)\cos\omega_c t \xleftrightarrow{F} \frac{1}{2}X(\omega-\omega_c) + \frac{1}{2}X(\omega+\omega_c)$$

Question # 4: For an AM DSB-WC envelope with $U_{max} = 20V$ and $U_{min} = 4V$, determine the following
i) Peak amplitude of the carrier
ii) Modulation coefficient and Percentage modulation
iii) Peak amplitude of the upper and lower side frequencies.

Question #5: Prove $P_t = P_c \left[1 + \dfrac{m_a^2}{2} \right]$.

$P_c = $ ~~mean Square value~~ Carrier Power

$P_t = $ ~~Sideband Power~~ Total Power

$m_a = $ modulation Index.