(7) Solⁿ :-

From IDFT, we know that

$$h(x,y) = \frac{1}{W_1 W_2} \sum_{u=0}^{W_1-1} \sum_{v=0}^{W_2-1} H(u,v)\, e^{2\pi i\left(\frac{ux}{W_1} + \frac{vy}{W_2}\right)}.$$

where $H(u,v)$ is the DFT of our filter.

In the spatial domain, the centre is at $(x,y) = (0,0)$
So, intensity at center is given by $h(0,0)$

$$h(0,0) = \frac{1}{W_1 W_2} \sum_{u=0}^{W_1-1} \sum_{v=0}^{W_2-1} H(u,v) \times e^{0}$$

$\left[\because \frac{ux}{W_1} + \frac{vy}{W_2} = 0\right]$
when $x=0, y=0$

Now, let $\Delta u = 1$, $\Delta v = 1$, then clearly

$$h(0,0) = \frac{1}{W_1 W_2} \sum_{u=0}^{W_1-1} \sum_{v=0}^{W_2-1} H(u,v)\, \Delta u \Delta v$$

If $W_1 W_2 >> 1$

$$\Rightarrow h(0,0) = \frac{1}{W_1 W_2} \int_0^{W_1-1} \int_0^{W_2-1} H(u,v)\, du\, dv$$

$$= \frac{1}{W_1 W_2} \int_{x \in D(u,v)} H(x)\, dx$$

where $D(u,v)$ is the Fourier domain through which $H(u,v)$ is defined. Clearly, area under $H(x)$ is positive according to input figure and hence $h(0,0) > 0$ and
$\therefore$ There is a strong spike at the origin