HIGH PASS FILTERING

- Used for sharpening the image.
- It is done to attenuate low frequency components and high frequency component is preserved. • Different types of high pass filters are:-

Ideal High-Pass Filter

Trapezoidal High-Pass Filter

Butterworth High-Pass Filter

Gaussian High-Pass Filter

IDEAL HIGH-PASS FILTER (IHPF)

- The transfer function of an ideal high-pass filtering is given by

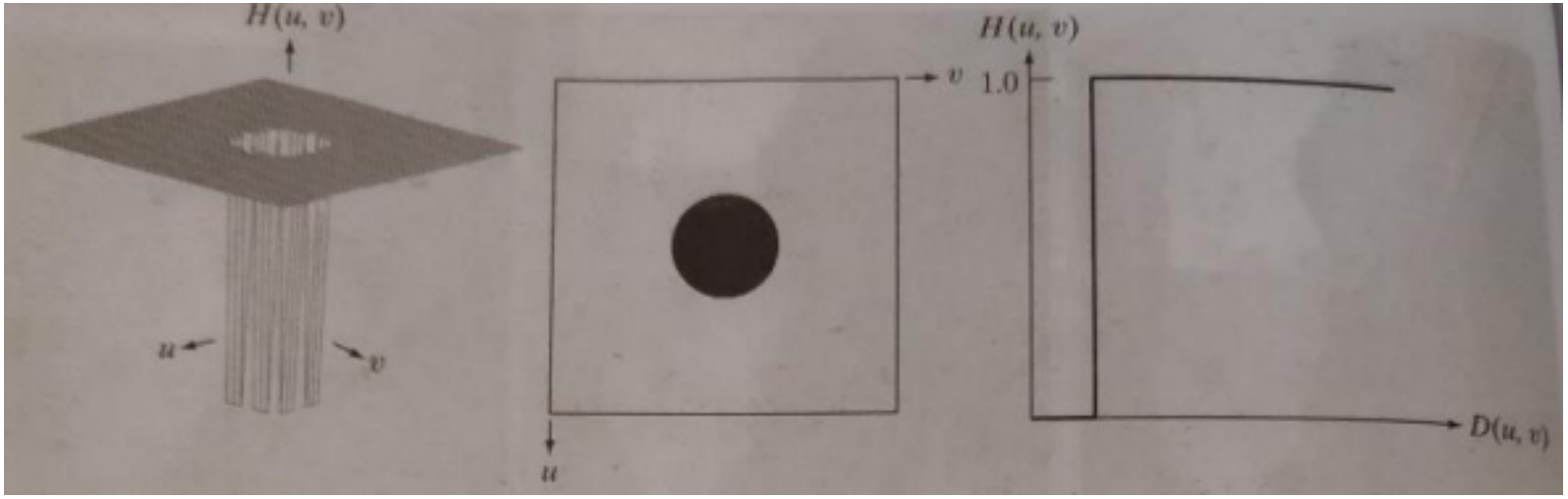
$$H(u,v)=\begin{cases}0, & D(u,v)\le D_0\\ 1, & D(u,v)>D_0\end{cases}$$

where D(u,v)-> is the distance between the point (u,v) and the origin of frequency domain

Distance is calculated as

$$D(u,v)=\sqrt{u^2+v^2}$$

$D_0$is the cut-off frequency.



a) Plot of ideal-High Pass Filter Transfer Function b) Filter displayed as an image c) Filter Cross Section

TRAPEZOIDAL HIGH-PASS FILTER (THPF)

- Its transfer function is given by

$$H(u,v)=\begin{cases}0, & D(u,v)\le D_1\\ \dfrac{D(u,v)-D_1}{D_0-D_1}, & D_1<D(u,v)<D_0\\ 1, & D(u,v)\ge D_0\end{cases}$$

where D(u,v)-> is the distance between the point (u,v) and the origin of the frequency domain.

$$D(u,v)=\sqrt{u^2+v^2}$$

D_0-> is positive constant(threshold) given in advance, called the cut-off frequency.

D_1->is a constant satisfying $D_1 < D_0$

BUTTERWORTH HIGH-PASS FILTER

(BHPF)

- Its transfer function is given by

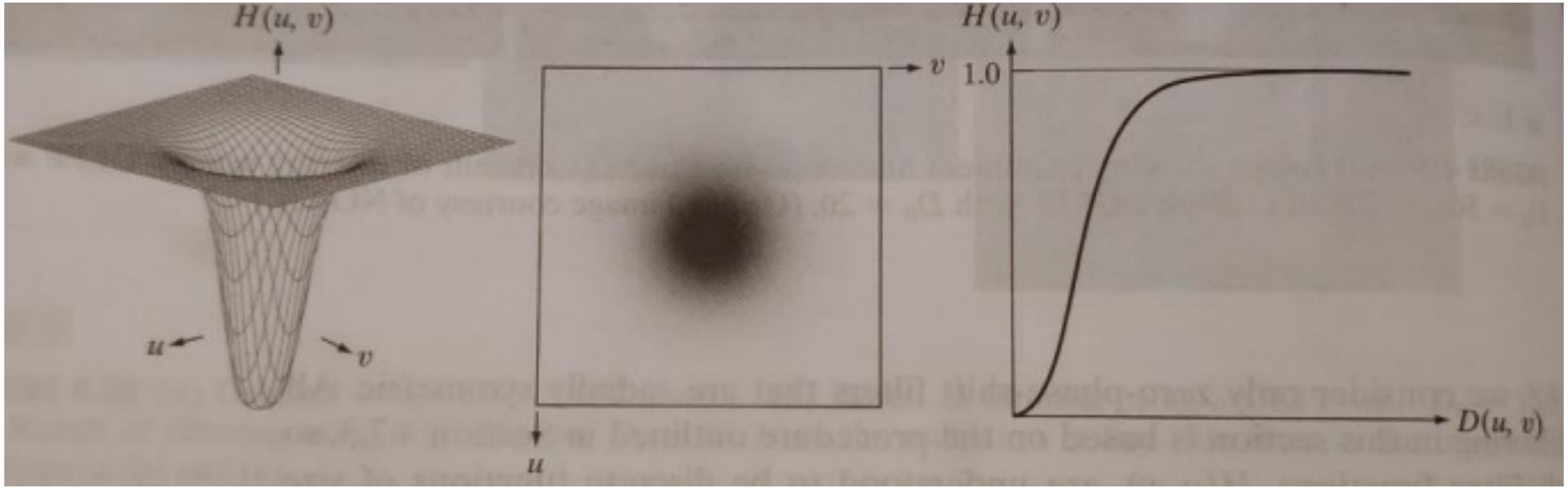
$$H(u,v)=\frac{1}{1+\left[\frac{D_0}{D(u,v)}\right]^{2n}}$$

where n ->is the order of filtering

D_0-> is cut-off frequency

$D(u,v)$-> is the distance between the point (u,v) and the origin of the frequency domain.

$$D(u,v)=\sqrt{u^2+v^2}$$



a) Plot of Butterworth-High Pass Filter Transfer Function b) Filter displayed as an image c) Filter Cross Section

GAUSSIAN HIGH-PASS FILTER (GHPF)

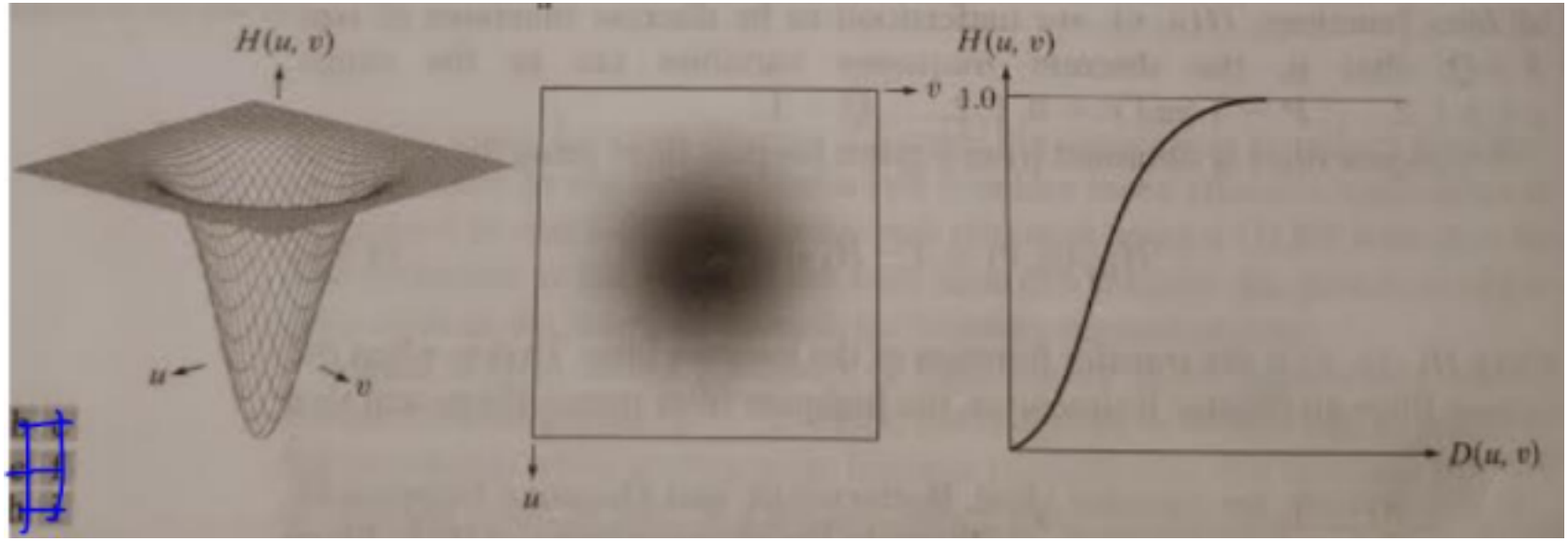
- Its transfer function is given by

$$H(u,v) = 1 - e^{-D^2(u,v)/2D_0^2}$$

- where D(u,v)-> is the distance between the point (u,v) and the origin of the frequency domain.

$$D(u,v) = \sqrt{u^2 + v^2}$$

- D_0-> cutoff frequency



a) Plot of Gaussian-High Pass Filter Transfer Function b) Filter displayed as an image c) Filter Cross Section