Mathematics of Discrete Cosine Transform (DCT)[1]

DCT_I:

$$y(k) = \sqrt{\frac{2}{N}} \sum_{n=1}^{N} x(n) \frac{1}{\sqrt{1+\delta_{n1}+\delta_{nN}}} \frac{1}{\sqrt{1+\delta_{k1}+\delta_{kN}}} cos(\frac{\pi(n-1)(k-1)}{N-1}) \tag{1}$$

DCT_II:

$$y(k) = \sqrt{\frac{2}{N}} \sum_{n=1}^{N} x(n) \frac{1}{\sqrt{1+\delta_{k1}}} cos(\frac{\pi(2n-1)(k-1)}{2N}) \tag{2}$$

DCT_III:

$$y(k) = \sqrt{\frac{2}{N}} \sum_{n=1}^{N} x(n) \frac{1}{\sqrt{1+\delta_{n1}}} cos(\frac{\pi(n-1)(2k-1)}{2N}) \tag{3}$$

DCT_IV:

$$y(k) = \sqrt{\frac{2}{N}} \sum_{n=1}^{N} x(n) cos(\frac{\pi(2n-1)(2k-1)}{4N}) \tag{4}$$

References:
https://uk.mathworks.com/help/signal/ref/dct.html

The general equation for a 2D DCT

$$F(u,v) = \sqrt{\frac{2}{N}} \sqrt{\frac{2}{M}} \sum_{i=0}^{N-1} \sum_{j=0}^{M-1} \Lambda(i)\Lambda(j) cos(\frac{\pi(2i+1)(u)}{2N}) cos(\frac{\pi(2j+1)(v)}{2M}) f(i,j) \tag{5}$$

[1] Implemented Mathematics
The series are indexed from n = 1 and k = 1 instead of the usual n = 0 and k = 0, because MATLAB® vectors run from 1 to N instead of from 0 to N – 1.
All variants of the DCT are unitary (or, equivalently, orthogonal): To find their inverses, switch k and n in each definition. In particular, DCT-1 and DCT-4 are their own inverses, and DCT-2 and DCT-3 are inverses of each other.

and the corresponding inverse 2D DCT transform is $F(u,v)^{-1}$
where

$$\Lambda(\kappa) := \begin{cases} \frac{1}{\sqrt{2}} & for\ \kappa = 0 \\ 1 & otherwise \end{cases}$$

References:
https://users.cs.cf.ac.uk/Dave.Marshall/Multimedia/node231.html