104. Solution: B

Let us first determine k:

$$1=\int_0^1\int_0^1 kxdxdy=\int_0^1\frac{1}{2}kx^2|_0^1\,dy=\int_0^1\frac{k}{2}dy=\frac{k}{2}$$

$$k=2$$

Then

$$E[X]=\int_0^1\int_0^1 2x^2dydx=\int_0^1 2x^2dx=\frac{2}{3}x^3|_0^1=\frac{2}{3}$$

$$E[Y]=\int_0^1\int_0^1 y\ 2x\ dxdy=\int_0^1 ydy=\frac{1}{2}y^2|_0^1=\frac{1}{2}$$

$$E[XY]=\int_0^1\int_0^1 2x^2ydxdy=\int_0^1\frac{2}{3}x^3y|_0^1\,dy=\int_0^1\frac{2}{3}ydy$$

$$=\frac{2}{6}y^2|_0^1=\frac{2}{6}=\frac{1}{3}$$

$$\text{Cov}[X,Y]=E[XY]-E[X]E[Y]=\frac{1}{3}-\left(\frac{2}{3}\right)\left(\frac{1}{2}\right)=\frac{1}{3}-\frac{1}{3}=0$$

(Alternative Solution)

Define $g(x)=kx$ and $h(y)=1$. Then

$$f(x,y)=g(x)h(x)$$

In other words, $f(x,y)$ can be written as the product of a function of x alone and a function of y alone. It follows that X and Y are independent. Therefore, $\text{Cov}[X,Y]=0$.