helix $\rightarrow$ $\cos t\,\hat{i} + \sin t\,\hat{j} + \frac{t}{\sqrt{2}}\hat{k}$

tangent of helix at $t = T$

$$= -\sin T\,\hat{i} + \cos T\,\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$$

at $t = 0$

$$-\sin 0\,\hat{i} + \cos 0\,\hat{j} + \frac{1}{\sqrt{2}}\hat{k} = \hat{j} + \frac{\hat{k}}{\sqrt{2}}$$

Since given $t = T$ is orthogonal to at $t = 0$

$$\Rightarrow \left(-\sin T\,\hat{i} + \cos T\,\hat{j} + \frac{\hat{k}}{\sqrt{2}}\right) \cdot \left(\hat{j} + \frac{\hat{k}}{\sqrt{2}}\right) = 0$$

$$\Rightarrow \cos T + \frac{1}{2} = 0 \Rightarrow \cos T = -\frac{1}{2}$$

$$T = \left(\pi - \frac{\pi}{3}\right) = \boxed{\frac{2\pi}{3}}$$

Now $\int_C F \cdot dr = \int_C -y\,dx + x\,dy$

put $x = \cos t \Rightarrow \frac{dx}{dt} = -\sin t$

$y = \sin t \Rightarrow \frac{dy}{dt} = \cos t$

$$\Rightarrow \int_{t=0}^{\frac{2\pi}{3}} -\sin t \times -\sin t\, dt + \cos^2 t\, dt$$

$$\Rightarrow \boxed{\frac{2\pi}{3}} \text{ Ans}$$