Q. A series R-C combination is connected to an AC voltage of angular frequency $\omega = 500$□radian/s. If the impedance of the R-C circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is ?

3. In given R-C circuit,

$\omega = 500$ rad/s ; $Z = R\sqrt{1.25}$

$$\Rightarrow Z^2 = R^2(1.25)$$

$$\Rightarrow \frac{1}{(\omega C)^2} + R^2 = R^2(1.25)$$

$$\Rightarrow \frac{1}{(\omega C)^2} = (0.25)R^2$$

$$\Rightarrow \left(\frac{1}{\omega C}\right)^2 = (0.5R)^2$$

$$\Rightarrow \frac{1}{\omega C} = \left(\frac{1}{2}\right)R$$

$$\Rightarrow \frac{2}{\omega} = RC$$

$\Rightarrow \frac{2}{500} = \tau$ { $\because \tau = RC$ is the time constant of R-C circuit }

$\Rightarrow 4 \times 10^{-4} s. = \tau$

$\Rightarrow \boxed{\tau = 4 ms.}$