The potential difference $V$ and the current $i$ flowing through an instrument in an ac circuit of frequency $f$ are given by $V=5 \cos \omega t$ volts and $I=2 \sin \omega t$ amperes (where $\omega=2 \pi f$ ). The power dissipated in the instrument is (1)Zero (2) $10 \mathrm{~W}(3) 5 \mathrm{~W}(4) 2.5 \mathrm{~W}$

## Solution

The potential difference V can be expressed as

$$
V=5 \cos \omega t=5 \sin \left(\omega t+\frac{\pi}{2}\right)
$$

because $\cos a=\sin \left(a+\frac{\pi}{2}\right)$ for any $a$.
The power dissipated in the instrument is

$$
P=V_{r m s} I_{r m s} \cos \varphi
$$

where rms means the root mean square, $\cos \varphi$ - the power factor, where $\varphi$ is the phase angle between the voltage and current.

Since

$$
\varphi=\frac{\pi}{2}
$$

therefore

$$
\cos \varphi=\cos \frac{\pi}{2}=0
$$

The power dissipated in the instrument is

$$
P=V_{r m s} I_{r m s} \cdot 0=0
$$

Answer: (1) Zero.

