Question 5) A series R-C combination is connected to an AC voltage of angular frequency ω=500 radian/s. If the impedance of the R-C circuit is R√1.25 the time constant (in millisecond) of the circuit is?

(A) 1

(B) 2

(C) 3

(D) 4

Answer: (D) 4

Solution:

Given, ω=500 radian/s

The capacitance of the capacitor is C

$X_c = 1/\omega C = 1/500C$

Impedance of the circuit, $Z = R\sqrt{1.25}$

Using $Z^2 = R^2 + X_c^2$

$1.25R^2 = R^2 + 1/(500)^2C^2$

$0.25R^2 = 1/(0.25 \times 10^6)C^2$

$R^2C^2 = 10^{-6}/(0.25)^2$

$\Rightarrow RC = 10^{-3}/0.25$

= 0.004 s

= 4 ms