20. From Eq. 28-11, we have $i = (\varepsilon / R)\, e^{-t/\tau}$ since we are ignoring the self-inductance of the capacitor. Eq. 32-16 gives

$$B = \frac{\mu_o i_d\, r}{2\pi R^2}\ .$$

Furthermore, Eq. 25-9 yields the capacitance

$$C = \frac{\varepsilon_o \pi (0.05\ \text{m})^2}{0.003\ \text{m}} = 2.318 \times 10^{-11}\ \text{F},$$

so that the capacitive time constant is $\tau = (20.0 \times 10^6\ \Omega)(2.318 \times 10^{-11}\ \text{F}) = 4.636 \times 10^{-4}$ s.

At $t = 250 \times 10^{-6}$ s, the current is

$$i = \frac{12.0\ \text{V}}{20.0 \times 10^6\ \Omega}\, e^{-t/\tau} = 3.50 \times 10^{-7}\ \text{A}\ .$$

Since $i = i_d$ (see Eq. 32-15) and $r = 0.0300$ m, then (with plate radius $R = 0.0500$ m) we find

$$B = \frac{\mu_o i_d\, r}{2\pi R^2} = \frac{\mu_o (3.50 \times 10^{-7})(0.03)}{2\pi (0.05)^2} = 8.40 \times 10^{-13}\ \text{T}\ .$$