1) $F = \frac{\varepsilon_0 \varepsilon_r A V^2}{2d^2} = \frac{(8.854\times10^{-12})(1)(500\times10^{-6})^2(100)^2}{2(10\times10^{-6})^2} = 110.675\,\mu N$

2) $\bar{V} = 100V$

$V_{rms} = \frac{100}{\sqrt{2}}$

$F = \frac{\varepsilon_0 \varepsilon_r A V_{rms}^2}{2d^2} = \frac{(8.854\times10^{-12})(1)(500\times10^{-6})^2(100)^2}{4(10\times10^{-6})^2} = 55.34\,\mu N$

3) $V_{PI} = \sqrt{\frac{8kd^3}{27A\varepsilon_r\varepsilon_0}} = \sqrt{\frac{8(50)(10\times10^{-6})^3}{27(500\times10^{-6})^2(1)(8.854\times10^{-12})}} = 81.81\,V$

4) $F = Kx$

$\frac{\varepsilon_0 \varepsilon_r A V^2}{2(d-x)^2} = Kx$

$V = \sqrt{\frac{2(d-x)^2 Kx}{\varepsilon_0 \varepsilon_r A}} = \sqrt{\frac{2(10\times10^{-6} - 1\times10^{-6})^2(50)(1\times10^{-6})}{(8.854\times10^{-12})(1)(500\times10^{-6})^2}} = 60.49\,V$

5) $f_{d1} = \frac{f_s}{1+\frac{x}{c}} = \frac{20{,}000}{1+\frac{10}{331}} = 19.413\,KHz$ at moving object

$f_d = \frac{f_{d1}}{1+\frac{x}{c}} = \frac{19{,}413}{1+\frac{10}{331}} = 18{,}844\,KHz$ back at source

6) $f_{d1} = \frac{f_s}{1+\frac{x}{c}} = \frac{20{,}000}{1-\frac{10}{331}} = 20.623\,KHz$ at moving object

$f_d = \frac{f_{d1}}{1+\frac{x}{c}} = \frac{20{,}623}{1-\frac{10}{331}} = 21{,}265\,KHz$ back at source