

4B13 Electronic Sensors – Numerical Answers 2009

1. (a)  $0.09\text{ }^{\circ}\text{C}$ ,  $1.07 \times 10^{-4}\text{ V}$   
(b)  $0.57\text{ }^{\circ}\text{C}$   
(c)  $0.16\ \Omega$
2. (d)  $2.12\text{ pF}$ ,  $217\text{ mV}$
3. (c) X: 990.0, 1007.2, 1024.4, 1041.6, 1058.8;  $0.344 \pm 0.008\text{ }^{\circ}\text{C}$   
Y: 1020.0, 1036.7, 1054.0, 1072.1, 1090.8; non-linear  
Expanded uncertainty approx.  $\pm 0.06\%$
4. (a)  $24.7\ \mu\text{s}$  across diameter,  $9.95\ \mu\text{s}$  around wall  
(b) (i)  $110\text{ mV}$  into matched load or  $220\text{ mV}$  open circuit  
(ii)  $85\text{ mV}$  into matched load or  $170\text{ mV}$  open circuit  
(c)  $2174\text{ Hz}/(\text{litre}/\text{sec})$
5. (b)  $\mu_{\text{eff}} = 291$ , eg. with 400 turns,  $G = 3000$   
(c)  $9.2\ \mu\text{V}$   
(d)  $R = 4500\ \Omega$ ,  $V_n = 85\text{ nVrms}$ ,  $0.42\text{ nT}$  with core or  $120\text{ nT}$  without