a) I'd use the 7290A-10 sensor, it has a range of ±10g which meets the specs and introducing error

$$10g\left(1 - \underbrace{0.2\%}_{\text{non-linear hysteresis}} - \underbrace{2\%}_{\text{transverse}} - \underbrace{1\%}_{\text{thermal shift}} - \underbrace{\frac{0.0025}{2}}_{\text{resolution}} - \underbrace{0.1\%}_{\text{zero shift}}\right) = 9.6575g > 9.5g$$

So it still meets the specs.

It has a frequency response of 0Hz to 500Hz why means the Nyquist requirement is met.

b)

Table 1: Static Specifications of the Sensor

	Characteristic	Value
	Range	-10g to 10g
	Sensitivity	200 ±10 mV/g
	Resolution	0.0025 g
	Operating Temperature	-55°C to 121°C
Interfering	Zero measured output	± 50 mV
Interfering	Thermal Zero Shift	± 2%
Interfering	Risidual Noise	500 μV_{rms}
Interfering	Zero shift	0.1 %
Modifying	Non-linearity and Hysteresis	± 0.5%
Modifying	Transverse Sensitivity	2%
Modifying	Thermal Sensitivity Shift	±3 %

c) We know max input = 9.5g

Ideally:

$$V_o = 200\ mV/g\ a$$

$$V_o(9.5g) = 200\ mV/g\ (9.5g)$$
$$= 1.9V$$

Introducing errors:

$$V_o(a) = \left(200\ mV/g\,(1 + \underbrace{0.02}_{\text{transverse}} + \underbrace{0.03}_{\text{thermal sensitivity}})\,a\right) + \underbrace{50\ mV}_{\text{zero output}} + 1.9V\underbrace{(0.02)}_{\text{thermal}}$$
$$+ \underbrace{12 \times 500\ \mu V}_{\text{noise (not rms)}} + 1.9V\underbrace{(0.001)}_{\text{zero shift}} + \underbrace{1.9V(0.005)}_{\text{non-linear + hysteresis}}$$

$$V_o(9.5g) = 2.055107\ldots V$$

$$\text{error} = \frac{2.055\ldots - 1.9}{1.9} \times 100\% = 8.164\%\ FS$$

d) ~~Butterworth~~ Butterworth Filter specified in datasheet

$$|H| = \frac{1}{\sqrt{1+\left(\frac{\omega}{\omega_c}\right)^{2n}}} \qquad n=4 \text{ (order)}$$

$$\omega_c = 2\pi(500\text{Hz}) = 1000\pi$$

I need $|H| = 0.0001$

$$0.0001 = \frac{1}{\sqrt{1+\left(\frac{\omega}{1000\pi}\right)^4}}$$

$\omega = 314159.2646\ldots$ rad/s

$f = 49999.9788\ldots$ Hz

$f = 50$ KHz

∴ We need $f_s = 100$ KHz (due to Nyquist Theorem)

Table 2: 4430A settings

Setting	Value
Gain (±0.1%)	2.35
LPF order	4
LPF cutoff frequency	500 Hz
INPUT SEL	AC
GAIN	2.35
FILTER	LPRG
LOW PASS	500 Hz

e)