**Numericals on Sensors**

Q.1: Calculate the length of an iron rod which can be used to produce ultrasonic waves of 20 KHz. Given, Y= 11.6x1010 N/m2 and ρ=7.23x103 kg/m3.

Q.2: Calculate the natural frequency of a pure iron rod of 40 mm length. The density of pure iron is 7.25x103 kg/m3 and its Young modulus is 115x109 N/m2. Can the magnetostriction oscillator produce ultrasonic waves with this rod? Comment on the result.

Q.3: Find the natural frequency of vibrations of a quartz plate of thickness 1.8 mm. Given, Y= 8x1010 N/m2 and density =2650 kg/m3. Also calculate the change in the thickness required if the same plate is to be used to produce ultrasonic waves of frequency 2 MHz.

Q.4: Certain piezoelectric crystal of thickness 4 mm produces ultrasonic waves of frequency 400 KHz. Calculate the thickness of this crystal to produce ultrasonic frequency of 500 KHz.

Q.5: For Fe-Cu thermocouple, the neutral temperature is 285 °C when the cold junction temperature is 0 °C. Calculate the temperature of inversion if the cold junction temperature is -30 °.

Q.6: Calculate thermos emf of Sb-Au thermocouple whose junctions are at 0 °C and 100 °C. Given the Seebeck coefficients *a* and *b* for Sb and Au as, aSb-Pb=35.58 µV/°C; bSb-Pb=0.146 µV/°C2; aAu-Pb=2.90 µV/°C; bAu-Pb=0.009 µV/°C2.

Q.7: The thermo emf of a Cu-Fe thermocouple of 2160 µV when the cold junction is at 0 °C and the hot junction at 250 °C. Calculate the constants *a* and *b* if the neutral temperature is 330 °C.

Q.8: The thermo- electric power of iron is 17.5 micro Volt/ degree C at 0 C and 5 micro Volt/ degree at 125 C. The thermo electric power of cadmium is 3 micro Volt/ degree C at 0 C and 15 micro Volt/ degree C at 150 C. Calculate the neutral temperature of Iron Cadmium junction.

-----------------------------------------------------END-----------------------------------------------------