1. Number of turns in two coils, made of same material, are 100 and 500 respectively. Calculate the ratio of their self-inductances if geometric form factor of first coil is three times the second coil.                    2

2. What is null position in LVDT displacement sensor? How does its o/p voltage vary with upward and downward displacement of the core, explain using necessary diagram?                    4

3. a. Illustrate the o/p behaviour of an optical potentiometer ($V_o/V_{ref}$ vs. x/L) at $R_C/R_P$ value of 0.1.                    3
   b. Calculate the % error in the rate of flow in a pipe with diameter 100mm ±1% and velocity 1m/s ±3%.                    2

4. Graphically highlight the o/p behaviour of Thermocouple, RTD & Thermistor with change in temperature.3

5. Derive the relation between the output voltage and change in the resistance when strain gage is fixed in one of the arms of the Wheatstone bridge. [Make standard assumptions].                    4

6. Calculate the change in the temperature of an electric oven if its thermistor has a resistance of 1800Ω at $70^0$C and the rheostat need to be set at 1500 Ω to obtain the balanced condition. [Resistance–temperature coefficient of thermistor is -0.05/$^0$C]                    4

7. a. Calculate the thermocouple sensitivity of a device that uses alloy1 and 2 with sensitivities -72μV/$^0$C and 500 μV/$^0$C.                    2
   b. A thermocouple circuit gives an emf 33.3 mV at 800 $^0$C with reference temperature 0$^0$C. The resistance of the meter coil is 50 Ω and a current of 0.1 mA gives full scale deflection. Resistance of junctions and leads is 12 Ω. Assuming full scale deflection at 800$^0$C, calculate the value of the series resistance and approximate error in temperature due to rise of 1 Ω in $R_e$.                    4
   c. A platinum thermometer has a resistance of 100Ω at 25$^0$C. Find its resistance at 65$^0$C if the resistance temperature coefficient of platinum is 0.00392/$^0$C.                    3

8. a. Explain the working principle of MEMS based accelerometer using suitable diagram.                    4
   b. How does its output voltage vary with the proof mass displacement and driving voltage $V_0$.                    2
   c. The below circuit measures the acceleration a through capacitor changes. Variation of $V_y$ for a=0, a>0 and a<0, respectively, are shown below. Draw the corresponding o/p voltages $V_{out}$                    3
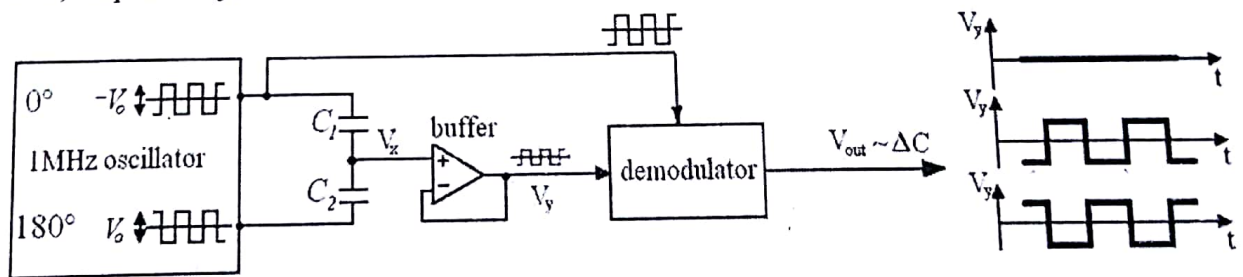


9. a. Explain the working principle of Fiber Bragg Grating (FBG) as strain measurement sensor with the help of suitable diagram.                    4
   b. How does the wavelength of the FBG changes with strain and temperature?                    2
   c. If the fiber is fixed at a single point sufficiently apart from the Bragg grating, how does it behave?                    2

10. Explain the operating principle of RVDT for angular displacement measurement. Write down the relationship between the induced voltages of the secondary windings and angle of the rotor.                    6

11. Explain the working principle of piezo-electric and piezo-resistive accelerometers. Also write down two limitations for each of them.                    6