

10. (a) A thermistor has a resistance of $9.0 \text{ k}\Omega$ in ice-water and $0.5 \text{ k}\Omega$ in boiling water. The thermistor obeys the law

$$R(T) = K \exp\left(\frac{B}{T}\right)$$

where $R(T)$ is the resistance at an absolute temperature T .

Determine the values of k and B and hence the numerical equation that shows how the resistance of the thermistor varies with temperature.

- (b) The thermistor in (a) is to be used as the transducer in a Wheatstone bridge circuit, FIGURE 4. The bridge circuit is to give an output voltage in the range 0 to 1.0 volts and approximately proportional to temperature over the range 0 to 50°C . Explain briefly how the bridge circuit can be designed to meet this specification and calculate suitable values for the resistors and V_S .

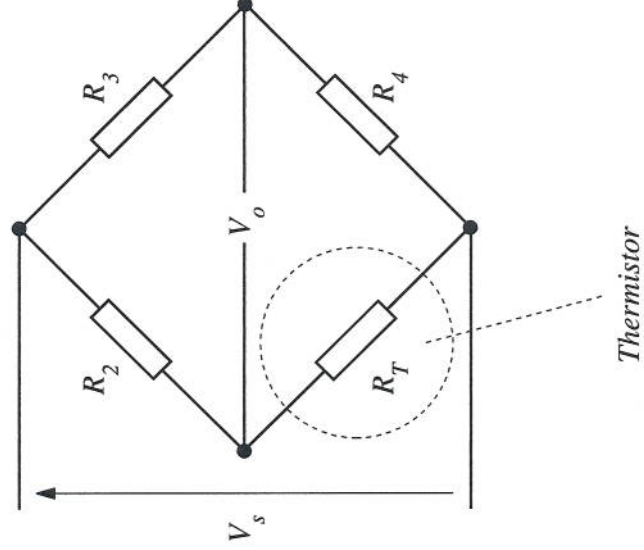


FIG. 4

- (c) The output voltage V_o of the bridge circuit of FIGURE 4 is fed to the input of a 12-bit ADC. If the full range input of the ADC is 1 volt, determine the maximum temperature change required to give a one bit change in output of the ADC.

- (d) The 12-bit ADC is a successive approximation type. If the input signal is the binary equivalent of 3328 determine how many approximations must be made to complete the conversion and give the final binary result of the conversion process.