

ME 343 MECHANICAL LAB – 1

MID TERM EXAMINATION #1

Prof. Trivikrama Pala. Fall2021:

ONE PAGE FORMULA SHEET & CALCULATOR ALLOWED

1. Two resistors are connected in parallel. They are labeled R1 and R2.

Resistor	Resistance in Ω
R ₁	720.0 \pm 0.4 Ω
R ₂	1.58 \pm 0.03 Ω

$$R = \frac{R_1 R_2}{R_1 + R_2}$$

Evaluate the uncertainty in the combined resistance [20]

2. A simple RC circuit is to be used as a lowpass filter. It is desired that the output voltage be attenuated 3 dB at 100 Hz. Calculate the required value of time Constant T. [10]

3. A simple RC Filter is used to filter out the High Frequency components from the input. Values of $R = 2.5 \pm 0.05 \times 10^6 \Omega$ and $C = (250 \pm 10) \times 10^{-12} \text{ F}$. [20]

- Find the output signal, i.e. find its amplitude and phase difference, if the input signal is $4.0 \sin(1885t)$.
- Sketch the input and output signals on the same graph. Show at least two cycles of each signal.
- Evaluate the gain in dB

4. Following data pertains to a Thermistor. [20]

Temp in °C	Resistance in Ω
30.0	3551
50.0	1568

For a thermistor,

$$R = R_0 e^{\left[\beta \left(\frac{1}{T} - \frac{1}{T_0} \right) \right]}$$

- Evaluate the parameter β .
- Evaluate the sensitivity at $T=20^\circ\text{C}$.

5. For a certain thermistor $\beta=3420\text{K}$. The resistance at 200°F is known to be $1010 \pm 3 \Omega$. The thermistor is used for a temperature measurement, and the resistance is measured as $2315 \pm 4 \Omega$. Calculate the temperature and the uncertainty. [20]

For a thermistor,

$$R = R_0 e^{\left[\beta \left(\frac{1}{T} - \frac{1}{T_0} \right) \right]}$$

$$T = \frac{\beta}{\left[\ln \left(\frac{R}{R_0} \right) + \frac{\beta}{T_0} \right]}$$

$$U_T = \sqrt{\left(\frac{\partial T}{\partial R} U_R \right)^2 + \left(\frac{\partial T}{\partial R_0} U_{R_0} \right)^2}$$

6. What do you know about. (Explain in not more than ten sentences, use sketches liberally. Very long answers will NOT be considered for grading) [10]

- What do you understand by the term 'six sigma'? Explain.
- what is more important: Mean or Standard deviation in analyzing a set of data, explain.
- Explain about band pass filter.
- Discuss (15 lines max) Tolerance, Error and Uncertainty
- Name some industrial applications of the Thermistors.

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- Sketch the input and output signals on the same graph. Show at least two cycles of each signal.
- Evaluate the gain in dB

4. Following data pertains to a Thermistor. [20]

Temp in °C	Resistance in Ω
30.0	3551
50.0	1568

For a thermistor,

$$R = R_0 e^{\left[\beta \left(\frac{1}{T} - \frac{1}{T_0} \right) \right]}$$

- Evaluate the parameter β .
- Evaluate the sensitivity at $T=20^\circ\text{C}$.

5. For a certain thermistor $\beta=3420\text{K}$. The resistance at 200°F is known to be $1010 \pm 3 \Omega$. The thermistor is used for a temperature measurement, and the resistance is measured as $2315 \pm 4 \Omega$. Calculate the temperature and the uncertainty. [20]

For a thermistor,

$$R = R_0 e^{\left[\beta \left(\frac{1}{T} - \frac{1}{T_0} \right) \right]}$$

$$T = \frac{\beta}{\left[\ln \left(\frac{R}{R_0} \right) + \frac{\beta}{T_0} \right]}$$

$$U_T = \sqrt{\left(\frac{\partial T}{\partial R} U_R \right)^2 + \left(\frac{\partial T}{\partial R_0} U_{R_0} \right)^2}$$

6. What do you know about. (Explain in not more than ten sentences, use sketches liberally. Very long answers will NOT be considered for grading) [10]

- What do you understand by the term 'six sigma'? Explain.
- what is more important: Mean or Standard deviation in analyzing a set of data, explain.
- Explain about band pass filter.
- Discuss (15 lines max) Tolerance, Error and Uncertainty
- Name some industrial applications of the Thermistors.

-END-

ME 343 MECHANICAL LAB – 1

MID TERM EXAMINATION #1

Prof. Trivikrama Pala. Fall2021:

ONE PAGE FORMULA SHEET & CALCULATOR ALLOWED

1. Two resistors are connected in parallel. They are labeled R1 and R2.

Resistor	Resistance in Ω
R ₁	720.0 \pm 0.4 Ω
R ₂	1.58 \pm 0.03 Ω

$$R = \frac{R_1 R_2}{R_1 + R_2}$$

Evaluate the uncertainty in the combined resistance [20]

2. A simple RC circuit is to be used as a lowpass filter. It is desired that the output voltage be attenuated 3 dB at 100 Hz. Calculate the required value of time Constant T. [10]

3. A simple RC Filter is used to filter out the High Frequency components from the input. Values of $R = 2.5 \pm 0.05 \times 10^6 \Omega$ and $C = (250 \pm 10) \times 10^{-12} \text{ F}$. [20]

- Find the output signal, i.e. find its amplitude and phase difference, if the input signal is $4.0 \sin(1885t)$.
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6. What do you know about. (Explain in not more than ten sentences, use sketches liberally. Very long answers will NOT be considered for grading) [10]

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-END-