

F2018 MTE220 Assignment 6

userid: _____

Opamps are available with the following data sheet values:

V_{OS}	I_B	I_{OS}	R_D	R_C	R_O	f_t	A_o	I_{sc}	L_+	L_-
1 mV	1 μ A	1 nA	1 M Ω	1 G Ω	75 Ω	1 MHz	200 k	10 mA	+ 14 V	- 14 V

where I_{sc} is the maximum current the opamp's output can supply.

5% PVNS (Preferred Value Numbering Systems) list: 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91.

1% PVNS (Preferred Value Numbering Systems) list: 100, 102, 105, 107, 110, 113, 115, 118, 121, 124, 127, 130, 133, 137, 140, 143, 147, 150, 154, 158, 162, 165, 169, 174, 178, 182, 187, 191, 196, 200, 205, 210, 215, 221, 226, 232, 237, 243, 249, 255, 261, 267, 274, 280, 287, 294, 301, 309, 316, 324, 332, 340, 348, 357, 365, 374, 383, 392, 402, 412, 422, 432, 442, 453, 464, 475, 487, 499, 511, 523, 536, 549, 562, 576, 590, 604, 619, 634, 649, 665, 681, 698, 715, 732, 750, 768, 787, 806, 825, 845, 866, 887, 909, 931, 953, 976.

- (1) Design a thermal-sensor instrument with a 1 s response time whose output linearly varies from - 12.0 V for - 100 °C to + 12.0 V for + 100 °C given a thermocouple with 2 μ V/°C (0 °C reference) and a 1.00 mV/°C 3-terminal solid-state temperature-sensor. In addition, you have available general purpose opamps, 1% PVNS resistors, and ± 15 V power supply. Keep the sensor power dissipation low to avoid any additional compensation.
- (2) Design a two active strain gauge and two temperature compensation strain gauge measurement device with a 3.00 ms response time whose output varies from - 12.0 V to + 12.0 V as the strain on a cantilever beam varies from compression strain of 2.00 μ m/m to tensile strain of 2.00 μ m/m using 120 Ω strain gauges with a GF=2.50. Use 1% PVNS resistors, general purpose opamps, ± 15 V power supply, and a + 1.00 V reference. Next discuss how you would modify your design so its voltage gain varies with a control signal input voltage.
- (3) Design a light tracking signal circuit with a 1.00 ms response time which uses the short circuit current of two matched photodiodes as the input control signal such that a 5% difference in their maximum expected short circuit current of 1.00 μ A results in a ± 10.0 V signal. Besides the match photodiode pair, you have available 5% PVNS resistors, general purpose opamps, ± 15 V power supply.