※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) The current flowing through a 1 kΩ, ± 5% resistor was measured as 2.5 mA. The measuring error is 3%. Please calculate the possible range of the voltage across the resistor.

2. (10%) Please explain the meanings and definitions of the following two terms: (a) Accuracy (b) Precision.

3. (15%) Please list and explain the three main forces that influence the movement of the pointer in a Permanent Magnet Moving Coil (PMMC) deflection meter.

4. (15%) When calculating the sensitivity/resolution of a Wheatstone bridge using a PMMC, most of the bridge circuit can be replaced by its Thévenin equivalent circuit, as shown in the figure below. For the case that E=5V, R_1=10 kΩ, R_3=16 kΩ, R_4=8 kΩ, and the PMMC points at zero (i.e., the null condition is reached), please calculate R_{in} and V_{in}.
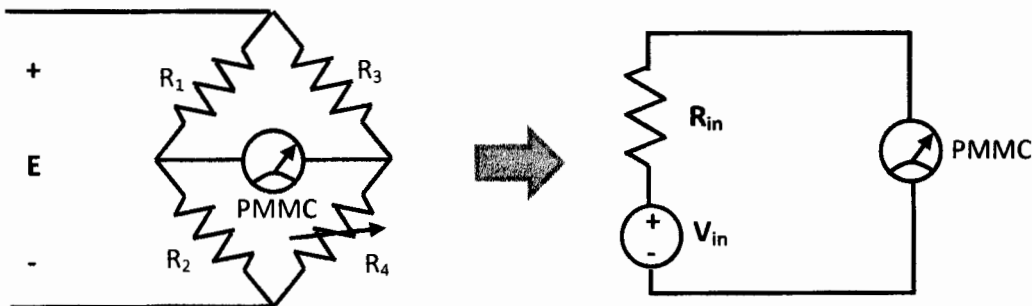

5. (a) (5%) In a frequency counter, find the frequency of a signal in Hertz if the Decimal Counting Assembly (DCA) reads 4236 and the time base is set to 5 ms.

   (b) (8%) List all factors that affect time base inaccuracy and explain them briefly.

6. (a) (6%)Please define resolution bandwidth (RBW) selectivity in a spectrum analyzer.

   (b)(6%)If the settings of a spectrum analyzer are k = 3, RBW = 1000 Hz, and span = 30 kHz, please calculate the sweep time (ST).

7. The figure below is a rectifier, where R_1=2kΩ, R_2=2kΩ, R_3=3kΩ, R_4=R_5=6kΩ.

   (a)(6%)Explain the operation of the circuit when a sine wave is applied to Vin.

   (b)(6%)Plot the related waveforms of V1 and Vout when Vin is a 5Vp-p sine wave with 0.2s period.
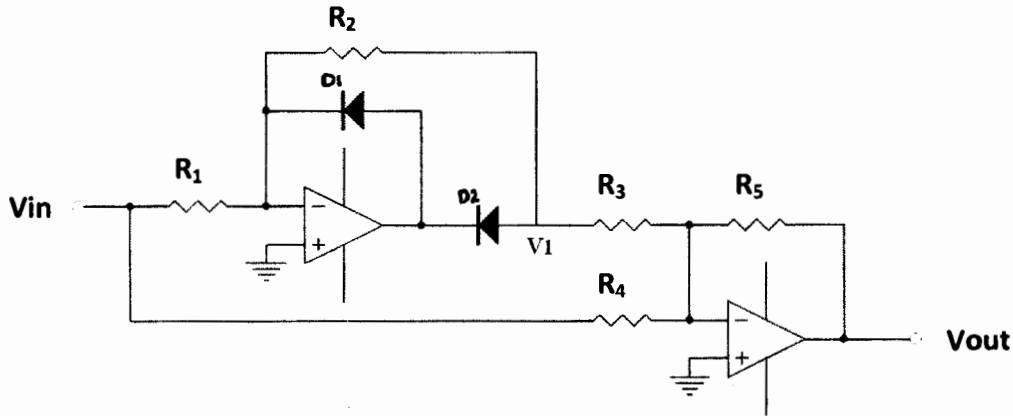
8. The figure below is an operational amplifier voltage regulator, given that R_2 = 4 kΩ and V_z = 6 V.

   (a)(5%) If the range of V_o is 8 V-40 V, choose the proper R_3 and R_4.

   (b)(8%) To avoid short circuit, the current-limiting circuits are absolutely necessary in this system. Please add a current-limiting circuit for this system and explain its operation.