國立成功大學 106 學年度碩士班招生考試試題

系　　所：電機工程學系

考試科目：電儀表學

考試日期：0213，節次：2

※ 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%) A first-order RC high-pass filter is made by using a 1 MΩ resistor and a 2.2 μF capacitor. The value of the resistor may have 1% variation, and the value of the capacitor may have 5% variation. Please calculate its 3-dB frequency in Hz, and express its variation with the form of relative error.

2. (10%) Please describe the working principle of a thermocouple ac current meter , as shown in Fig. 1

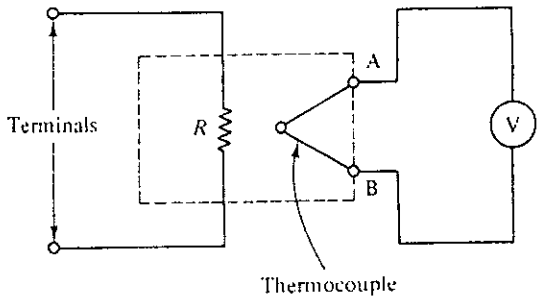

Fig. 1

3. (10%) Fig. 2 shows a half-wave average-reading ac meter by using a permanent magnet moving coil (PMMC), where Rm = 1 kΩ, I_{FSD} = 200 μA, and V_D (forward voltage of a diode) = 0.7V. Please find the value of R_S if the full-scale reading of this ac meter is 10 Vrms sin wave.

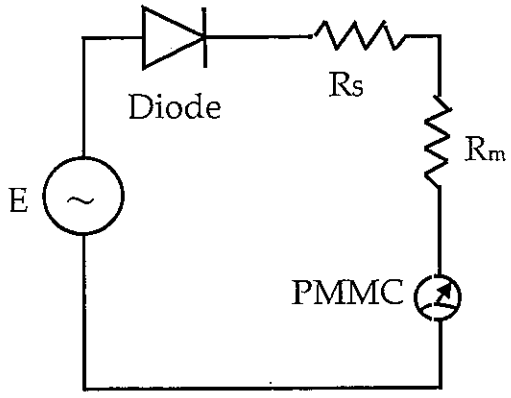

Fig. 2

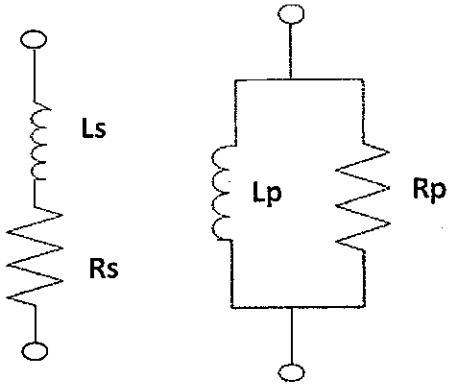

Fig. 3

4. (15%) The parasitic resistance of a real inductor can be modeled either by a parallel or series model, as shown in Fig. 3. Let Lp = 1 μH, Rp = 100 Ω, and the operating frequency is 1 MHz. (a) Please calculate its corresponding values of Ls and Rs. (9%) (b) Recalculate Rs and Ls when the operating frequency is lowered to 100 kHz. (6%)

5. (5%) For an eye-diagram, too much noise would reduce eye height, so noise is the main factor to determine the eye height. Then, what is the main factor to determine eye width (i.e., what is the main reason for a narrow eye width)?

6. (20%)
(a) Please describe and explain two sources of inherent errors in all frequency and period counters. (6%)
(b) If the frequency of a signal is 2.38 MHz and the five-digit DCA in a frequency counter reads 23800, please calculate the time base of this frequency counter. (6%)
(c)Please explain the operating principles of the frequency counter shown in Fig. 4, and draw the circuits in block A and block B. (8%)

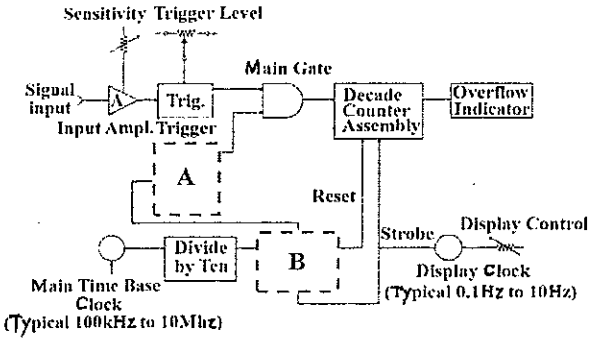

Fig. 4

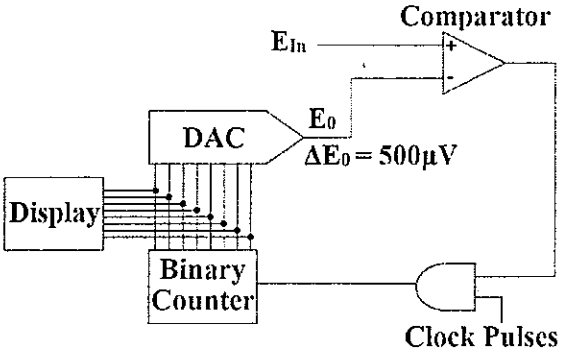

Fig. 5

7. (10%) Fig. 5 shows the block diagram of stepper-type digital voltmeter. Assume the frequency of the clock pulses is 10 MHz, and the output of the comparator changes from high to low at 2.5 μs after the beginning of the conversion cycle. Please calculate the input voltage E_{in}. (10%)

8. (20%)
(a) Please draw and explain the functional block diagram of a superheterodyne spectrum analyzer. (8%)
(b) If the constant of proportionality is 10, the resolution bandwidth (RBW) is 10 kHz and the sweep time is 50 ms in a spectrum analyzer, please calculate the span frequency. (6%)
(c) What are the differences between a spectrum analyzer and an oscilloscope? (6%)