國立成功大學

112學年度碩士班招生考試試題

編　號：173

系　所：電機工程學系

科　目：電儀表學

日　期：0206

節　次：第 2 節

備　註：可使用計算機

※ 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%) If we operate a function generator with the process below, (A) Set a **sinewave** with **High level = 2V** and **Low level = 1V**, (B) Set V_{pp}=2V (C) Set **DC offset = 0.5V**. Please find the V_{rms} of the output signal (Please tell us how you calculate it).

2. (20%) A Half-wave rectifier is shown as Fig. 1. (a) Analysis the 'positive' cycle and indicate which diodes are **ON** and which are **OFF**. (b) Explain the **function of R_{SH} and D_2**. (c) Given a PMMC whose I_{FSD} = 50 μA and R_m=1.7 kΩ. When V=0.4 V_{FSD}, $I_{F(peak)}$ = 200 μA (All diodes: V_F=0.8 V) and V_{FSD}=50 V (ac). **Determine R_S and R_{SH}.**
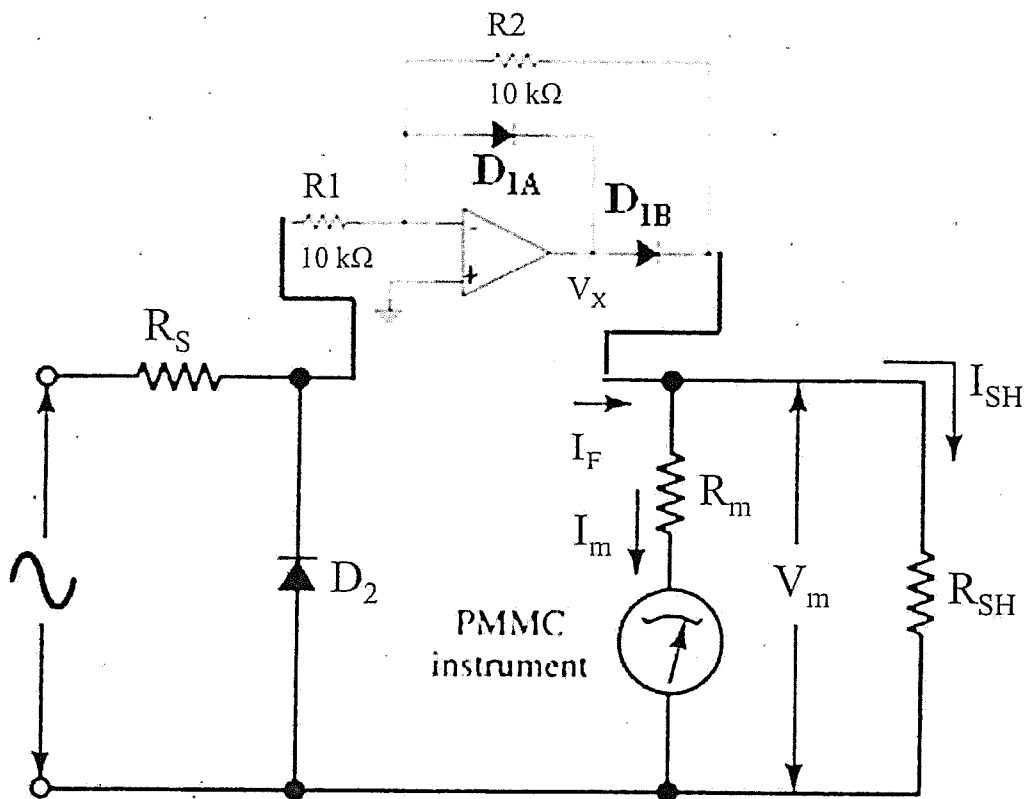

Fig. 1

3. (10%) Please draw a **detailed circuit** of **power supply** including **regulator** to generate around 12V DC from 120V, 60Hz AC input. Describe the functions of each circuit/device you used briefly.

4. (10%) Please explain how the **frequency counter** (see Fig. 2) working **as detail as possible**. The function of each **selected block (1 to 6)** should be mentioned.
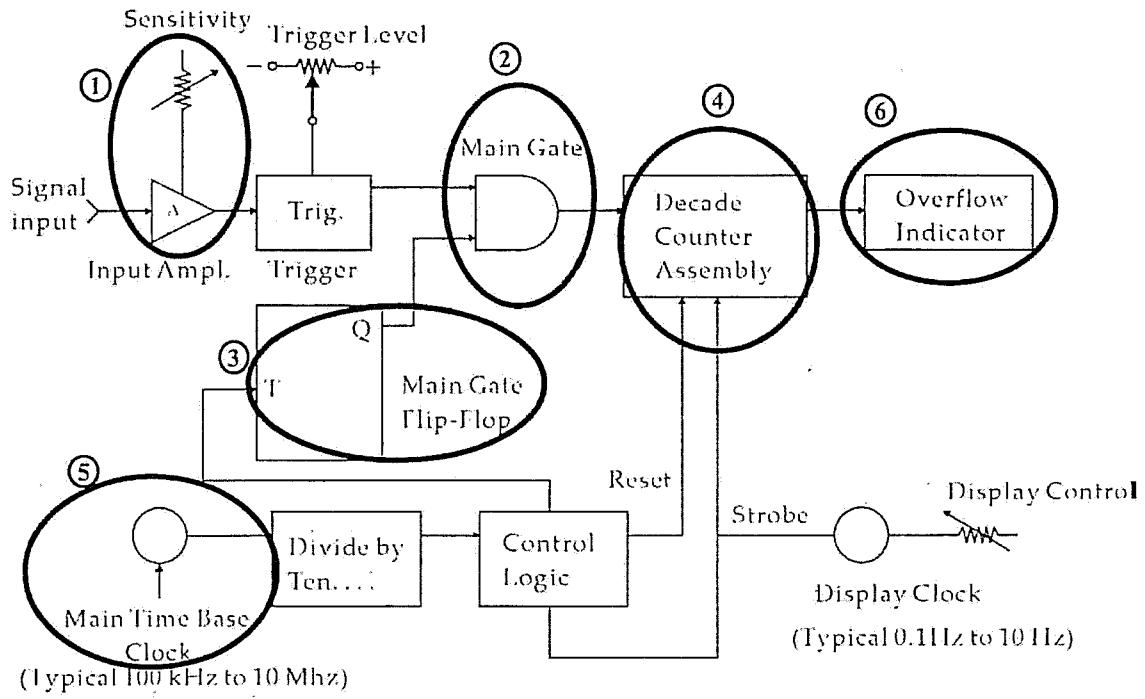

Fig. 2

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5. (15%) A government places 3 radar gun and records the timing in front / in the middle / at the end of a tunnel to test speeding. A driver David drives the first half at speed of (constant velocity) 55 km/hr before the middle speeding gun. After that he drives the second half at 90 km/hr. The rule of max speed is 70 km/hr based on "**average speed during the whole tunnel.**"[i.e., counting based on the timing in front and at the end of tunnel] (a) Will David get a speeding ticket (i.e., he should pay a fine due to speeding); (b) if the first and middle radar guns detect the speed with errors, 70 km/hr $\pm$ 10% and 90 km/hr $\pm$ 10%. Please calculate the average speed "with relative errors".

6. (20%) Fill the blank: (a) X (dBm) = the average of -30 dBm and 0 dBm, X=_____ dBm (roughly estimate). (b) Use the following rectifier circuit (Figure P6) to measure 120 V_{rms} (let V_D = 0.7 V), PIV (peak inverse voltage) of the diode = _____. (c) A series-typed ohmmeter using a PMMC meter with an accuracy to $\pm$1% (uncertainty), an unknown resistor R_x is measured when the ohmmeter indicates 0.5 FSD, R_x has an uncertainty of _____ %. (d) Consider a dual-slope integration converter with E_{ref}= 20 V and a 3-digital counter. This converter operates in two stages: First stage (t_0-t_1) for charging and second stage (t_1-t_2) for discharging. Please indicate the 3-digital counter shall show ___ (3 digits) at t_1 and ___ (3 digits) at t_2, so the input voltage can be measured to 2.5 V.
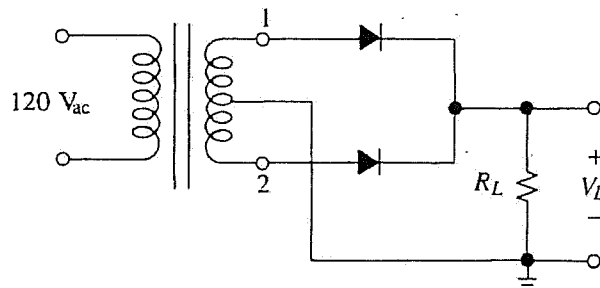

Figure P6

7. (15%) A PMMC instrument has a three-resistor Ayrton shunt connected across it to make an ammeter, as shown in Figure P7. The resistance values are R_1=0.05Ω, R_2=0.45 Ω, R_3=4.5 Ω. The PMMC meter has I_{FSD}= 100 μA and R_m =1 kΩ. Calculate the three ranges of the ammeter. And explain advantages of Ayrton meters.
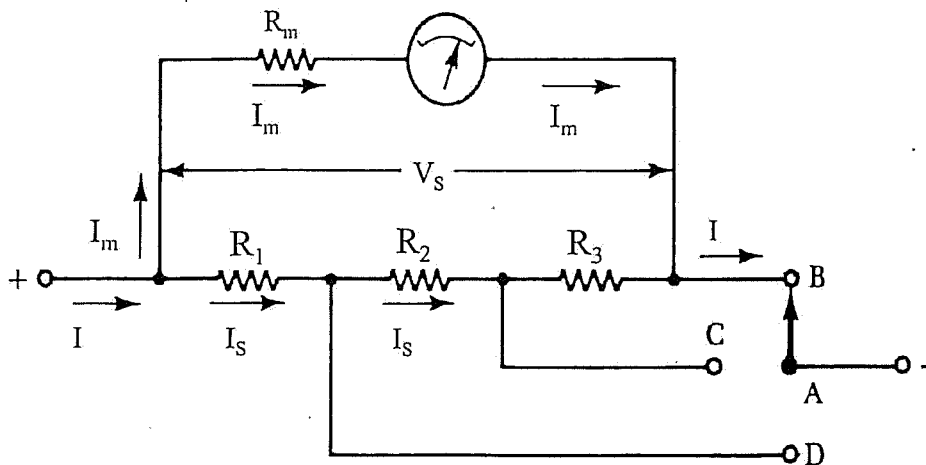

Figure P7