

※ 考生請注意：本試題 可 不可 使用計算機

- 1 A simplified circuit model for a particular op amp is shown in Fig. 1 Derive its open-loop gain. (10%)

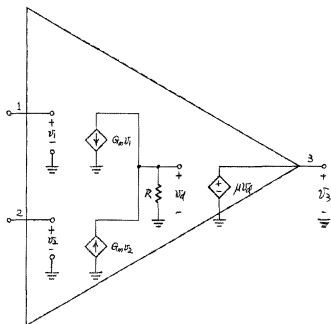


Fig. 1

2. A Miller integrator having a resistor R and a capacitor C is useful for signal integration. A large resistance R_f may be connected in parallel with C for providing the negative feedback. Derive its transfer function and discuss the function of R_f . (10%)
3. Real op amps respond to both the differential and common-mode components of their input signals. The CMRR is used to represent the effectiveness of op amp in rejecting common-mode signals. If an op amp as shown in Fig. 1 having a mismatch ΔG_m between the transconductances of the two channels. Find the expressions for A_d , A_{cm} , and CMRR. (15%)
4. Describe the Schottky-barrier diode, and its differences from the pn -junction diode. (15%)

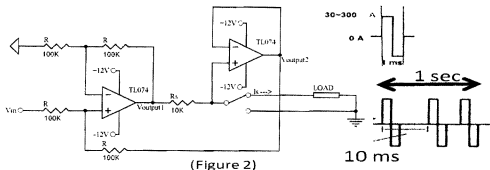
(背面仍有題目,請繼續作答)

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5. (10 %) Explain the following terms generally used in electronics (each for 2 %)

- (a) Isolation amplifier
- (b) Lock-in amplifier
- (c) Wheatstone bridge
- (d) Parallel analogue-to-digital converter (also called flash ADC)
- (e) VHDL (very-High-Speed integrated circuit hardware description language)

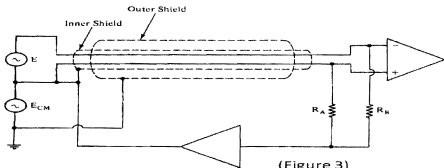
6. (10 %) Please describe Field Programmable Gate Array (FPGA) and Complex Programmable Logic Device (CPLD) and their differences.



(Figure 2)

7. (20 %) Figure 2 is a modified Howland amplifier which has been designed to be a voltage to current converter.

- (a) Please show that the relationship between V_{in} and I_s in terms of the resistance of $LOAD$. (10 %)
- (b) In our experiment, we wish to design a stimulator which can generate biphasic pulse of $300\mu s$ pulse width at 100 Hz for 1 sec, as shown in above Figure. The current output range would be $30-300\mu A$. You can use microprocessor to generate this stimulation sequence or use logical circuits such as monostable, astable, and other circuits. Please draw your design in block diagram with necessary specifications. You can make any assumptions and use components that you are familiar with. (10 %)



(Figure 3)

8. (10%) The ground connection is very important in the design of electronic medical device.

- (a) Could you explain the so-called single-point grounding and its advantages? (5 %)
- (b) Figure 3 is a guard shield circuit with common mode amplifier. Please explain its working principles to overcome common mode interference (E_{CM}). (5%)