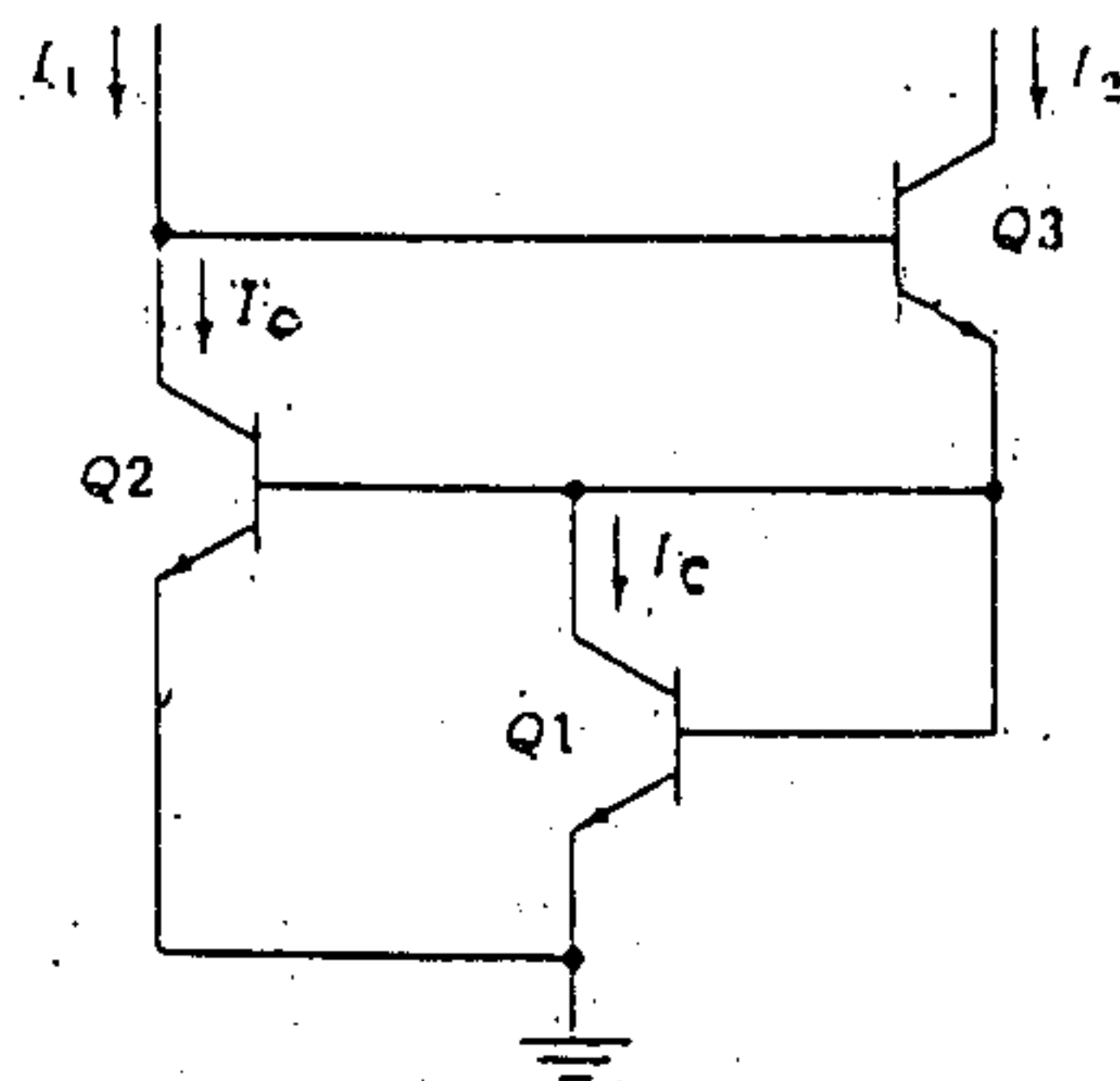
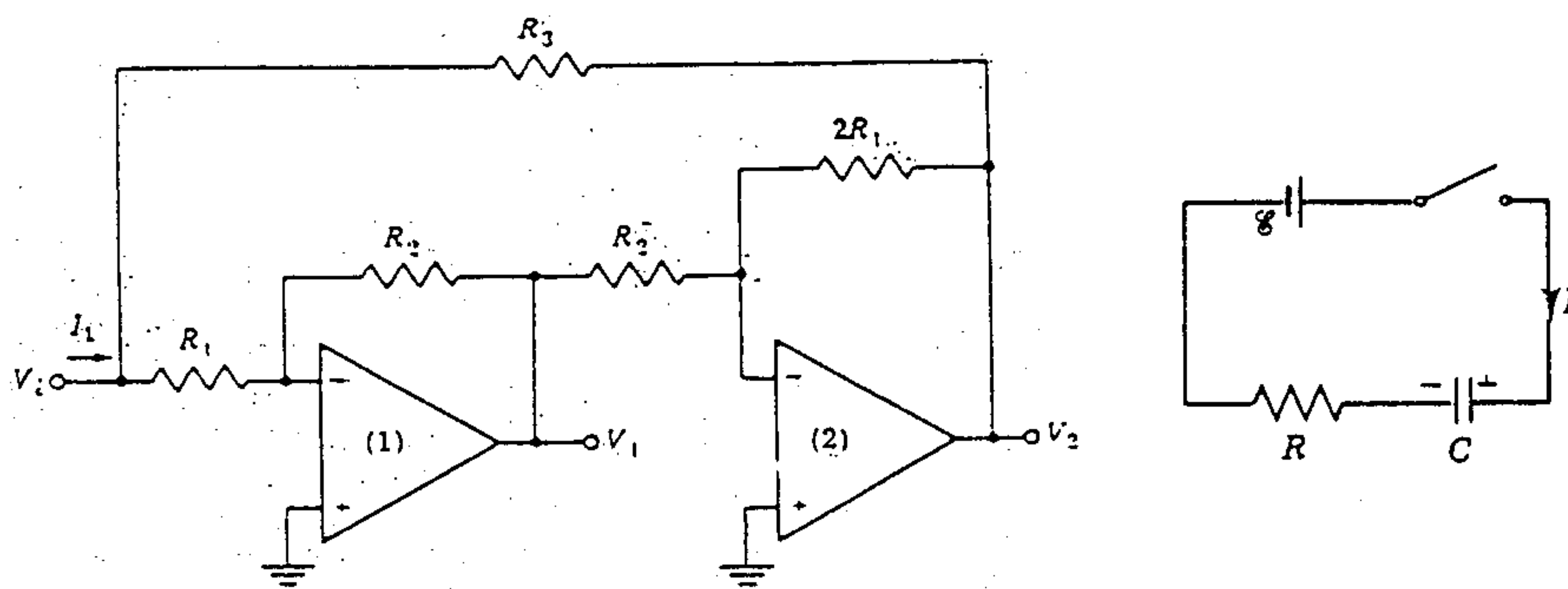


國立臺灣科技大學
九十學年度碩士班招生考試試題

系所組別：電子工程系丙組
科目：電子學

- (1) (15%) For the circuit diagram shown in Fig. 1, please calculate the R_i value (in terms of R_1, R_2, R_3). ($R_i = \frac{V_i}{I_i}$)
- (2) (10%) For a RC charging circuit shown in Fig. 2, please calculate the current I (in terms of ξ, R, C , and t (time)). Assume the switch is "ON" at $t=0$.
- (3) For the current repeater shown in Fig. 3, using identical transistors.
- (a) (5%) Please explain why is the collector current I_c of Q_1 is identical to that of Q_2 .
- (b) (15%) Please calculate the I_2/I_1 value (in terms of β (transistor current gain)).



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(4) (15%) Please schematically plot ρ (electrical resistivity) as a function of temperature (in Kelvin scale), with respect to (a) metal, (b) semiconductor, and (c) superconductor, respectively; and also simply explain why?

(5) (10%) Please derive that the capacitance of a parallel-plate capacitance, if the plate separation is very small, is given by

$$C = \epsilon_0 \times (A/d)$$

Where ϵ_0 : vacuum dielectric constant, A: plate area, d: plate separation

(6) (10%) Please state and compare the characters of Boson and Fermion particles, respectively.

(7) According to Planck's theory, the energy per cm^3 in the frequency interval ν to $\nu+d\nu$ of the black body spectrum of a cavity at temperature T is given by

$$\rho_T(\nu)d\nu = (8\pi\nu^2/c^3) \times [h\nu/(\exp(h\nu/kT)-1)] d\nu$$

where c is the speed of light, h is Planck's constant.

(a) (10%) Please explain the physical meanings of the term $(8\pi\nu^2/c^3)$ and the term $[h\nu/(\exp(h\nu/kT)-1)]$, respectively.

(b) (10%) Please derive the term $[h\nu/(\exp(h\nu/kT)-1)]$ from quantum theory and Boltzmann distribution.



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