

# 淡江大學八十九學年度碩士班招生考試試題

系別：機械工程學系 科目：動態系統

本試題共 2 頁

本試題雙面印製

(各小題所佔分數在括號內，總分爲 100 分)

1. The mechanical system shown in Figure 1 has a rotating wheel of mass  $m$ . Springs and dampers are connected to the wheel using cable without slip on the wheel.
  - a. Write all of the modeling equations for each part of system in translational and rotational direction. (10 分)
  - b. Derive the differential equation of motion for the translational motion  $x$  as a function of the input motion  $u(t)$ . (15 分)
  - c. Determine the expressions for the natural frequency and damping ratio. (10 分)

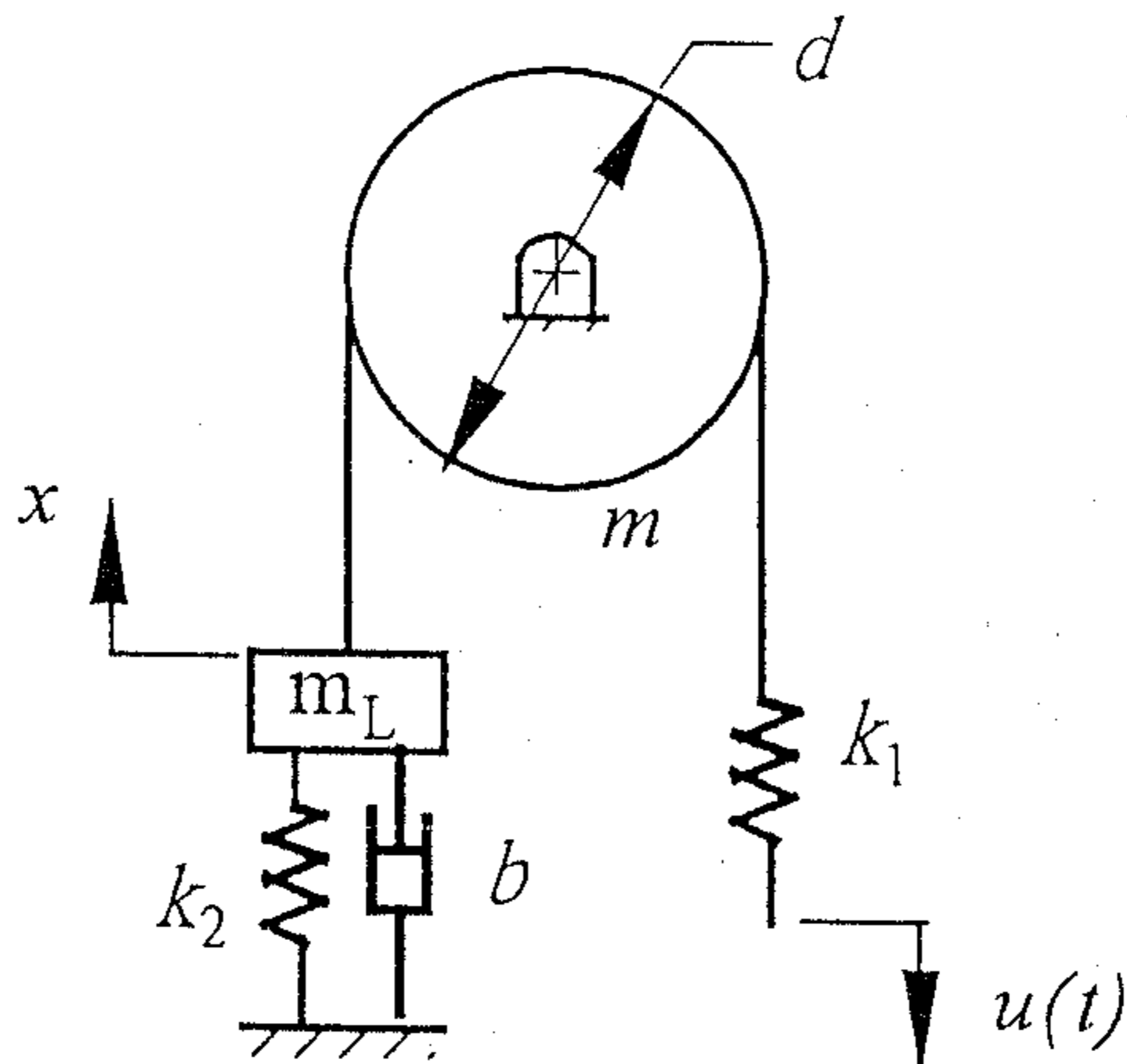


Figure 1 Mass-pulley system

2. A vehicle suspension system consisting of the tire, springs, and shock absorber is shown in Figure 2. Assume that the tire does not leave the road and the inertia of the car is so large that the body can be considered as a fixed support. The tire weighs 100N, and the other constants are  $k=1200\text{N/m}$ ,  $k_1=500\text{N/m}$ , and  $c=350\text{N-sec/m}$ .
  - a. Derive the dynamic model equation of the system. Let the tire displacement  $x$  be measured from a suitable static equilibrium position. (10 分)
  - b. Write the transfer function between  $y$  as input and  $x$  as output. (8 分)
  - c. Find the roots and the corresponding time constants of the characteristic equation. (7 分)
  - d. Determine the frequency response of the tire displacement  $x$  to a road surface displacement  $y$ , and express in Bode diagrams. (10 分)

【注意背面尚有試題】

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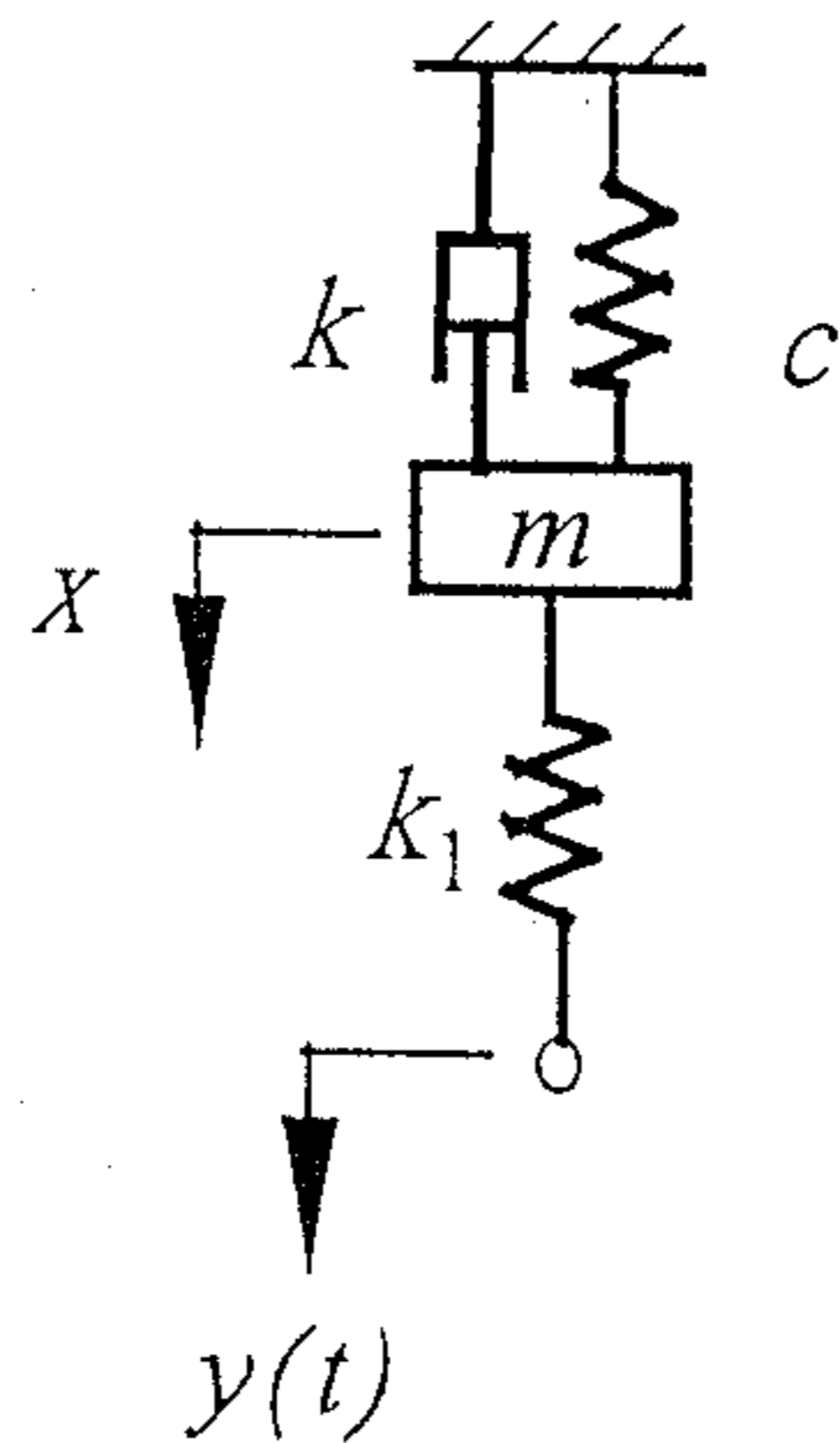


Figure 2 Vehicle suspension system

3. Consider the RC circuit of Figure 3, which consists of the series connection of a voltage source,  $e_s(t)$ , a resistor,  $R=8\Omega$ , and a capacitor.
- Derive the dynamic system equation of the circuit. (15 分)
  - For a step input voltage source, find the capacitance necessary to give a settling time of 2.5 milliseconds. We define the settling time to be four times of the time constant. (15 分)

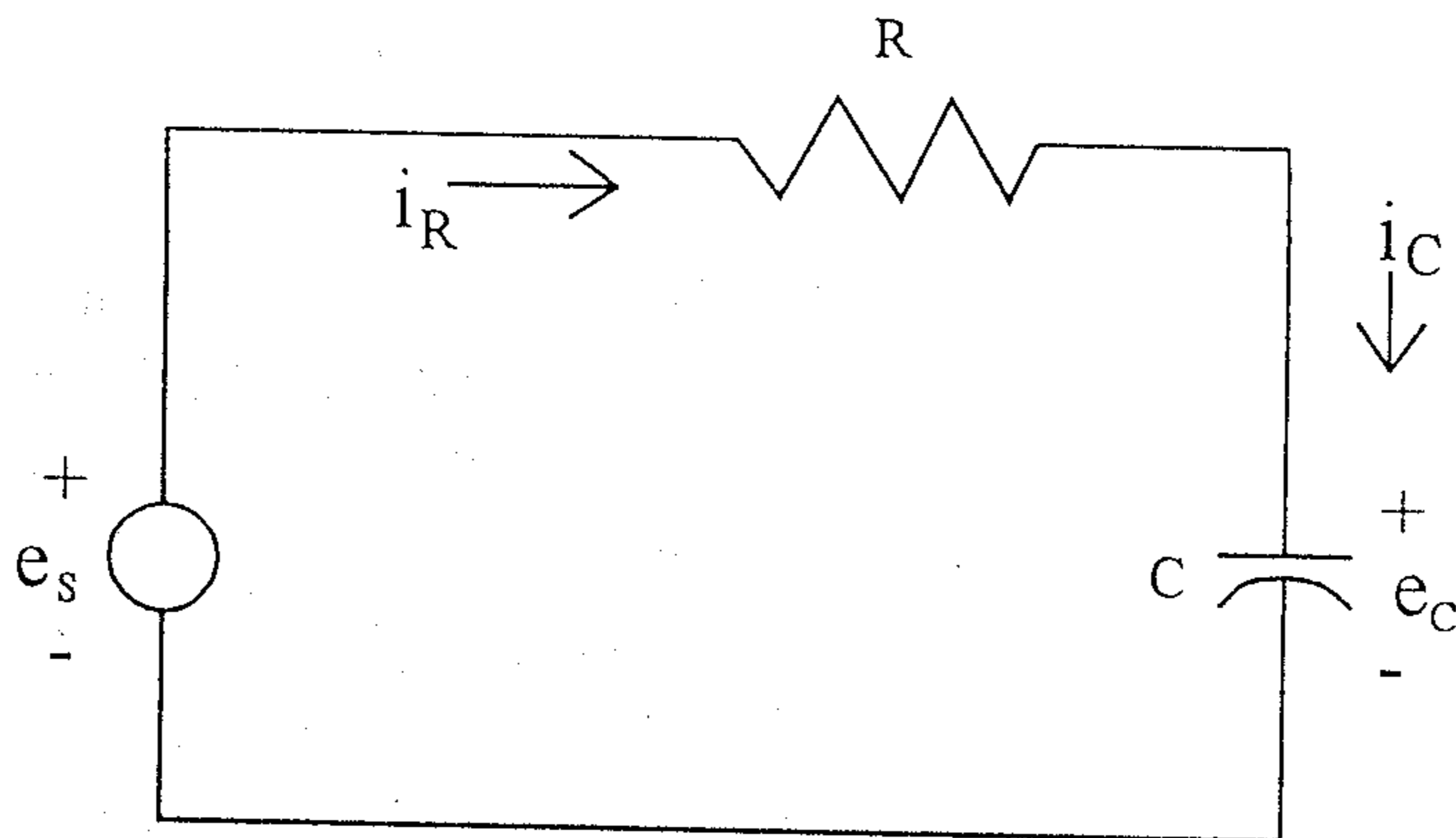


Figure 3 RC circuit

◀ 注意背面尚有試題 ▶