題號： 423
科目： 應用電子學
節次： 7

國立臺灣大學 109 學年度碩士班招生考試試題

題號：423
共 2 頁之第 1 頁

※ 注意：請標明題號依序作答。

1. (25%) For $t < 0$, the circuit shown in Figure 1 is at DC steady state. Assume $V_{S1} = 27$ V, $V_{S2} = 12$ V, $R = 200$ Ω, $L = 20$ mH, and $C = 0.1$ μF. If the switch is thrown at $t = 0$,
   (a) (6%) Determine if the circuit is underdamped or overdamped for $t > 0$.
   (b) (5%) Find the capacitor voltage v_C at $t = 0$ and at $t \to \infty$, respectively.
   (c) (8%) Find the capacitor voltage $v_C(t)$ at $t > 0$.
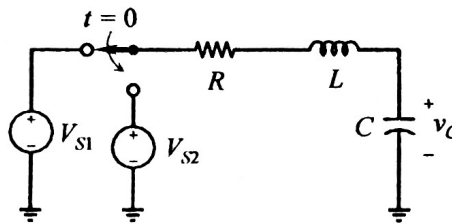   (d) (6%) What is the minimum capacitor voltage $v_{C,min}$ at $t > 0$?

Figure 1

2. (15%) For the filter circuit shown in Figure 2:
   Assume $R_1 = 4.7$ kΩ, $R_2 = 7.5$ kΩ, $L = 4$ mH, and $C = 0.33$ nF.
   (a) (5%) Determine if this circuit is a low-pass, high-pass, bandpass, or handstop filter.
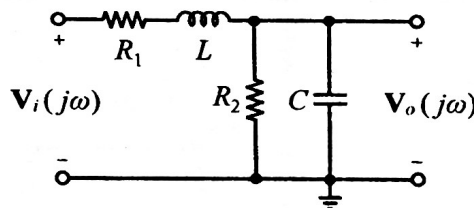   (b) (10%) Compute the frequency response function and determine $|V_o / V_i|$ at $\omega = 10^6$ rad/s.

Figure 2

3. (20%) A wave rectifier is shown in the circuit of Figure 3. Assume that a step-down transformer supplies 15 V rms to the rectifier.
   (a) (6%) If the diodes have an offset voltage of 0.7 V, sketch the input source voltage $v_S(t)$ and the output voltage $v_o(t)$, and state which diodes are on and which are off in the appropriate cycles of $v_S(t)$. The frequency of the source is 60 Hz.
   (b) (7%) If $R_L = 2.2$ kΩ and a filtering capacitor has a value of 2.5 μF, sketch the output voltage $v_o(t)$.
   (c) (7%) Repeat (b), with the capacitance equal to 100 μF.

Figure 3

見背面

題號： 423
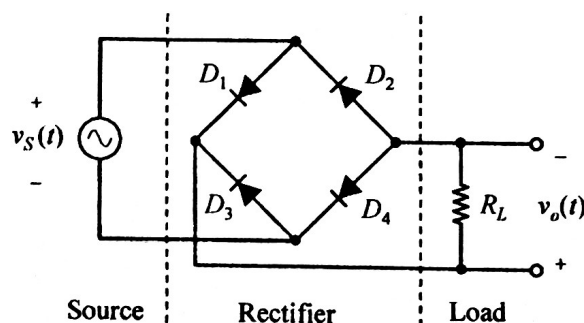科目： 應用電子學
節次： 7

國立臺灣大學 109 學年度碩士班招生考試試題

題號：423
共 2 頁之第 2 頁

4. (20%) For the given source voltages v_{s1} and v_{s2} of the circuit shown in Figure 4, please determine the output voltage v_o as a function of time and plot it. Assume ideal operational amplifiers are used. $R_{S1} = R_{S2} = R_{F1} = R_{F2} = R_o = 4$ kΩ and $C = 250\,\mu$F.
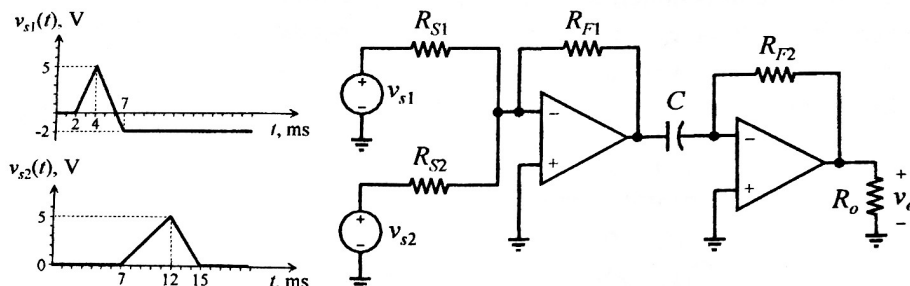

Figure 4

5. (20%) The circuit shown in Figure 5 is similar to a common collector implemented with an *npn* silicon transistor and a single DC supply $V_{CC} = 15$ V. v_S is a small sine wave signal with average value of V_{DC}. If $R_1 = 12$ kΩ, $R_2 = 8$ kΩ, $R_C = 50$ Ω, $R_E = 250$ Ω and $C_b = \infty$,

(a) (7%) Determine the voltage across the collector and emitter, V_{CE} at the operating point Q of the transistor.
(b) (7%) Find the voltage gain v_o/v_{in}.
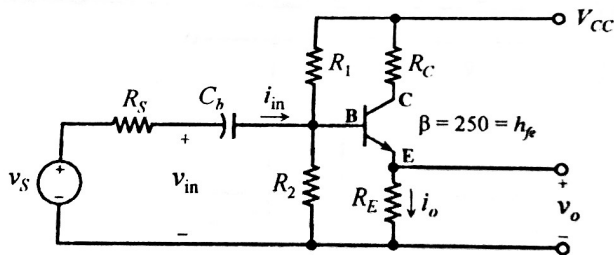(c) (6%) Find the current gain i_o/i_{in}

Figure 5

試題隨卷繳回