國 立 臺 北 科 技 大 學

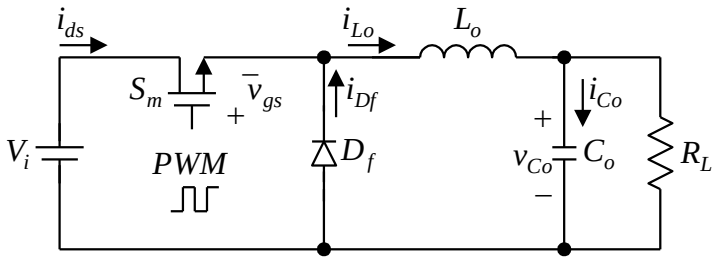
102 學年第一學期電機系博士班資格考試

電力電子學試題

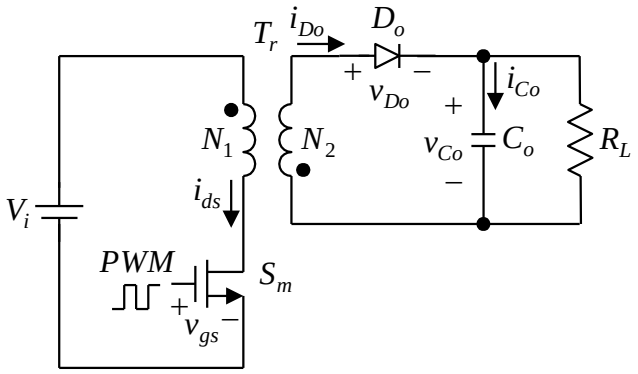
注意事項：

1. 本試題共十題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。
5. 可使用計算器。

1. (10%) If the following converter operates in CCM, please sketch in turn the waveforms of PWM$(=v_{gs})$, i_{ds}, i_{Df}, i_{Lo}, i_{Co}, v_{Co}.



2. (10%) If the following converter operates in CCM, please sketch in turn the waveforms of PWM$(=v_{gs})$, i_{ds}, i_{Do}, v_{Do}, i_{Co}, v_{Co}.



3. (10%) For a buck converter to be considered:

   a) Please plot $I_{LB} / I_{LB,\max}$ versus D under a fixed value of V_o, where $I_{LB,\max} = \frac{T_s V_o}{2L}$.

   b) Please plot $I_{LB} / I_{LB,\max}$ versus D under a fixed value of V_i, where $I_{LB,\max} = \frac{T_s V_i}{8L}$.

4. (10%) For a boost converter operating in DCM, please plot the corresponding operating area based on the curve of duty cycle versus load current with the BCM line used as a boundary.

5. (10%) A buck-boost converter operates in CCM. If $V_i = 8 \sim 40\text{V}$, $V_o = 15\text{V}$, $f_s = 20\text{kHz}$, $P_o \geq 2\text{W}$ and all the elements are ideal, then please find $L_{\min}$.

6. (10%) Under the condition of no power loss, please prove that for the AC-DC converter with the power factor equal to 1, the instantaneous output power has an AC component of double the line frequency.

7. (10%) Please find and prove the voltage conversion ratio of the current-fed push-pull converter operating in CCM.

8. (10%) Please give an illustration for the reason why the peak current mode control needs the slope compensation.

9. (10%) Please plot B-H curves for the following individual magnetic devices:
   1) for the output inductor of the buck converter operating in DCM.
   2) for the output inductor of the buck converter operating in CCM.
   3) for the transformer of the forward converter operating in CCM.
   4) for the transformer of the flyback converter operating in DCM.
   5) for the transformer of the flyback converter operating in CCM.

10. (10%) Please find the effect of the blanking time on the output voltage of the DC-AC inverter, if the load is inductive. Speaking lucidly, plot the relationship between the ideal output voltage and the actual output voltage, based on the output current.