國 立 臺 北 科 技 大 學

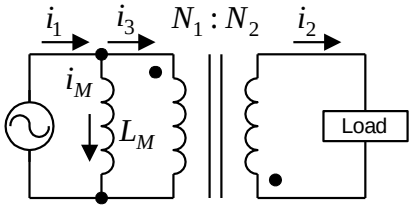
九十九學年第二學期電機系博士班資格考試

電力電子元件 試題

注意事項：

1. 本試題共【10】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。

1. As shown in the following figure, if the load is purely resistive, plot the relationship between i_1, i_3 and i_M based on the phasor diagram, along with a clear explanation. (5%)



2. Prove the power-transferring capability of the transformer in terms of the core area product, the maximum flux density and the switching frequency, under the condition that the input power is equal to the output power. (10%)
3. Find and prove the energy released for one cycle for the flyback converter operating in the boundary conduction mode (BCM), under the condition that the input power is equal to the output power. (10%)
4. (a) Plot the DC-AC inverter based on the push-pull converter topology, with MOSFETs used as switches. (5%)

   (b) If the load is purely resistive, how about the magnetizing current flow during the blocking time? Please explain it as clearly as possible. (5%)

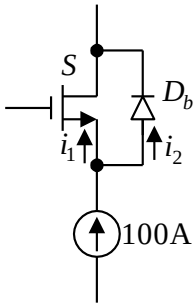
   (c) If the load is inductive, how about the magnetizing current flow during the blocking time? Please explain it as clearly as possible. (5%)
5. (a) Why is the current transformer (CT) not used to sense the continuous conduction current? (5%)

   (b) Why is the flux density in the CT not constant? (5%)

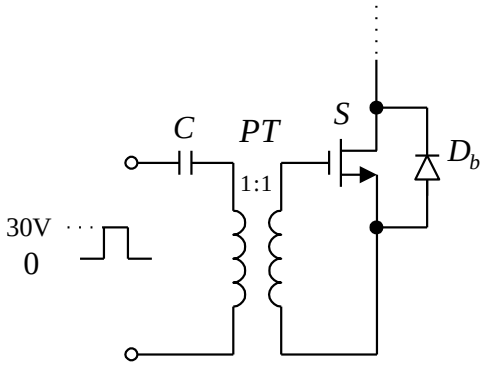
(c) Why does the magnetizing current for the CT always operate in DCM? (5%)

6. (a) Assuming that the MOSFET switch has a turn-on resistance of 2mΩ and the diode has a forward voltage of 0.7V, if the switch is turned on, how about i_1 and i_2 in the steady state? (5%)

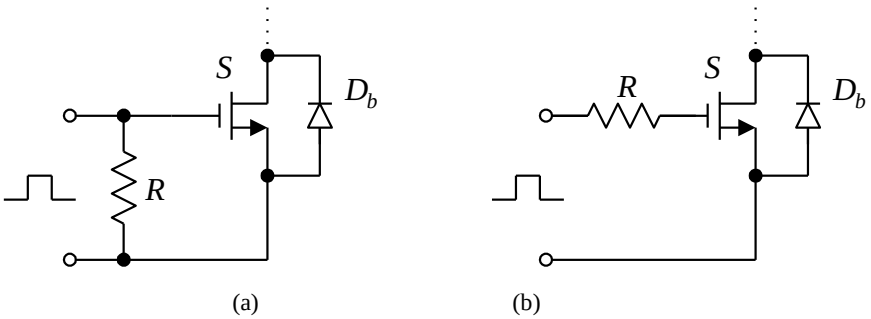
   (b) Under the same conditions in (a) except that the turn-on resistance is changed from 2mΩ to 20mΩ, how about i_1 and i_2 in the steady state? (5%)



7. In theory, if $|V_{GS}| \le 20\,\text{V}$, how about D_{min} and D_{max} accordingly? (10%)

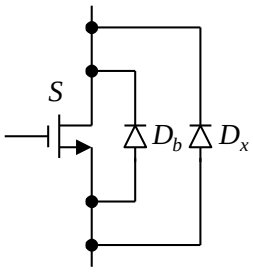


8. What is the purpose of *R* in each circuit? (10%)



(a) (b)

9. If the anti-diode D_b is disabled using one diode D_x by this way, what problem will occur? (5%)



10. If S_2 is turned on but S_1 is turned off, then C is charged to 15V. After this, if S_2 is turned off but S_1 is turned on, please plot the current flow and also find the voltage stress on D. (10%)