

國立臺北科技大學一百零三學年第一學期

電機系博士班資格考試試題範本說明

- 一. 本系博士班資格考試試題為 A4 格式之版面。
- 二. 提供之試題範本自第 1 頁起提供 A4 格式之版面共 4 頁，若有不足請自行加頁。
- 三. 本範本以 Office 之 Word 文書應用軟體製作，命題委員至少須輸入之資料共四項，各項簡要說明如下：(前三項請依範本上之原字型與字型大小輸入，**前二項已代為執行合併列印套稿，請確認組別名稱與考試科目**。謝謝您！)

(一) **【考試科目名稱】** ⇒ [依所附檔案內**考試科目名稱**完整輸入取代]

(二) ⇒ [請依試題**題數**輸入取代並增加**必要之配分**與**各項特殊規定**]

注意事項：

1. 本試題共 **【1】** 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。

(三)

試題本文 ⇒ [請輸入**題號**與**試題內容**並完成排版與列印]

範本版面說明

試題本文之外方格線，係以單格表格並以隱藏格線方式設計，請在格線內命題，不要超出格線外；若有圖片，亦請於列印後黏貼於規劃版面內。謝謝！

- 四. 命題版面達 A4 共 2 頁(含)以上時，請修改範本第 1 頁之 **第一頁 共一頁** 為 **第一頁 共二頁**；若頁數更多，請類推修改增加之。
- 五. 本範本檔案及考試科目名稱檔案，將由本系以隨身碟提供命題委員，請命題委員在規劃版面內命題，**並以 A4 紙張列印出試題繳交，隨身碟亦請交給本系**。本系將直接列印後隨即製版，不再作其他處理，若有圖片請自行黏貼於妥當之版面位置。

國立臺北科技大學

一百零三學年第一學期電機系博士班資格考試

切換式電源設計 試題

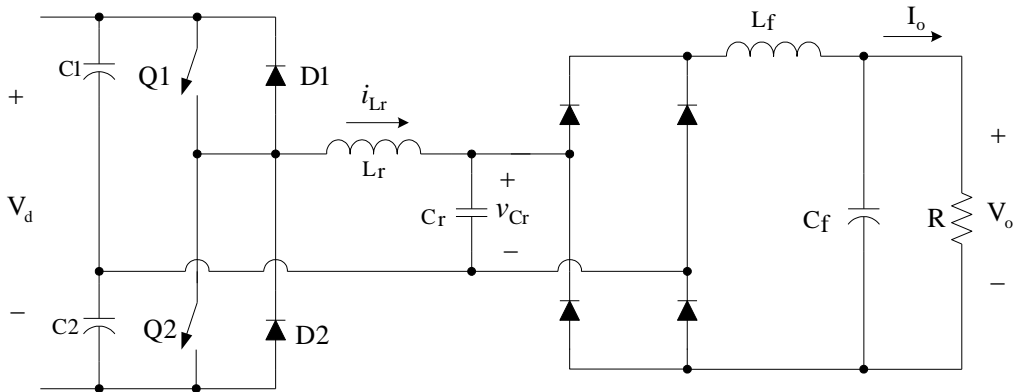
第一頁 共 2 頁

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注意事項：

1. 本試題共【4】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. A parallel resonant converter is shown as below. Please illustrate the operations for each time-duration in case of $f_s < (1/2)f_0$, where f_s is the switching frequency and f_0 is the resonant frequency, the operation analysis should include the equivalent circuits, the resonant equations depicting each equivalent circuit state, the waveforms on C_r and L_r and the derivation of output voltage formula. In your analysis, should specify which switches can be switched with ZCS or ZVS and the associated time points. While the input voltage $V_d=100V$, the resonant capacitor $C_r=0.32\mu F$, the resonant inductor $L_r=8\mu H$, the output current $R=10\Omega$ and the switching frequency $f_s=120kHz$ depending on the above analysis, please determine the output voltage. 40%



2. A Cuk converter has an input of 12 V and is to have an output of -18 V supplying a 40 W load under the switching frequency $f_s=50$ kHz. Please calculate the duty ratio, the inductor sizes L_1 and L_2 such that the change in inductor currents is no more than 10 percent of the average inductor current, the output capacitor value C such that the output ripple voltage is no more than 1 percent, and the output capacitor value C_1 such that the ripple voltage across C_1 is no more than 5 percent. 20%

3. If a forward converter has the following parameters : $V_d=48$ V, $R=10$ Ω , $L=0.4$ mH, $L_m=5$ mH, $C=100$ μ F, $f_s=35$ kHz, $N_1/N_2=1.5$, $N_1/N_3=1$, and $D=0.4$. (a) Determine the output voltage, the maximum and minimum currents in L , and the output voltage ripple. (b) Determine the peak current in the transformer primary winding. Verify that the magnetizing current is reset to zero during each switching period. Assume all components are ideal. 20%

4. Power supplies for telecommunications applications may require high currents at low voltages, wherein the switching frequency 500 kHz is required. Design a buck converter that has an input voltage of 3.3 V and an output voltage of 1.2 V. The output current varies between 4 and 6 A. The output voltage ripple must not exceed 2 percent. Specify the inductor value such that the peak-to-peak variation in inductor current does not exceed 40 percent of the average value. Determine the required rms current rating of the inductor and of the capacitor. Determine the maximum equivalent series resistance of the capacitor. 20%