

國立臺北科技大學一百零六學年第二學期

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

一百零六學年第二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【5】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. Please design a buck converter to produce an output voltage of 18 V across a 10-Ω load resistor. The output voltage ripple must not exceed 0.5 percent. The dc supply is 48 V. Let the switching frequency be 40 kHz and let the required inductance be 25 percent larger than the minimum to ensure that inductor current is continuous. Specify the duty ratio, the values of the inductor and capacitor, the peak voltage rating of each device, and the rms current in the inductor and capacitor. Determine the maximum equivalent series resistance (r_C) of the capacitor and the associated capacitance C with $C \times r_C = 72 \times 10^{-6}$. 20%
2. Design a forward converter such that the output is 5 V when the input is 170 V and the output current is 5 A. The switching frequency is 300 kHz and let the variation in inductor current be 40 percent of the average value. If the turns ratio $N_1/N_3=1$ that results in a maximum duty ratio of 0.5 for the switch, for margin, let $D=0.35$. The output voltage ripple must not exceed 1 percent. Choose the transformer turns ratio, duty ratio, and switching frequency. Choose L such that the current is continuous. Include the ESR when choosing a capacitor. For this problem, use $r_C=10^{-5}/C$. 20%

3. A push-pull converter has the following parameters : $V_d=30$ V, $N_p/N_s=2$ (primary turns over secondary turns), $D=0.3$, $L=0.5$ mH, $R=6$ Ω , $C=50$ μ F, and $f_s=10$ kHz. Determine V_o , the maximum and minimum values of i_L , and the output ripple voltage. Assume all components are ideal. 20%

4. Design a converter to produce an output voltage of 36 V from a 3.3 V source. The output current is 0.1 A and the switching frequency is 100 kHz. Design for an output ripple voltage of 2 percent and let the current variation in L_m be 40 percent of the average current. Include ESR when choosing a capacitor. Assume for this problem that the ESR is related to the capacitor value by $r_C=10^{-5}/C$. 20%

5. A resonant converter is shown as below, while the input voltage $V_d=12$ V, the resonant capacitor $C_r=0.1$ μ F, the resonant inductor $L_r=10$ μ H, the output current $I_o=1$ A and the switching frequency $f_s=100$ kHz. 20%
 - (a) Determine the output voltage.
 - (b) Determine the peak current in L_r and the peak voltage across C_r .
 - (c) What is the required switching frequency to produce an output voltage of 6V?
 - (d) Determine the maximum switching frequency.

