國立臺灣大學 115 學年度碩士班招生考試試題



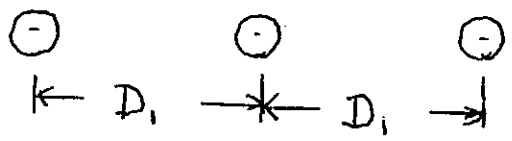
第1題至第6題，每題配分為11分。

※ 注意：請用2B鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. 一單相240V之交流電壓加於一阻抗為 $10\angle 60^\circ\ \Omega$ 之串聯電路，求此線路之功率因數。

(A) 0.95 (B) 0.9 (C) 0.8 (D) 0.5

2. 試計算下圖中的345 kV的三相輸電線之每相電感值。假設導体直徑為4.475 cm，$D_1 = 7.92$ m，同時假設此輸電線具有換位。




(A) $1.27 \times 10^{-6}$ H/m (B) $5 \times 10^{-6}$ H/m (C) 0.8 H/m (D) 3.3 H/m

3. 試求三相電流 $I_a = 10\angle 0^\circ$，$I_b = 10\angle 230^\circ$ 及 $I_c = 10\angle 130^\circ$ 安培之正序分量。

(A) $0.953\angle 180^\circ$ (B) $9.9\angle 0^\circ$ (C) $1.0\angle 0^\circ$ (D) $5\angle 120^\circ$

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4. 一台三相四極，60Hz之感應電動機，在1750 rpm操作時之轉矩為160 N-m，試求該機在1775 rpm時之轉矩。

(A) 10 N-m (B) 50 N-m (C) 80 N-m (D) 150 N-m

5. 一台12極，60Hz三相同步電動機，具同步電抗為6Ω，激磁電壓 $E_f = 3464$ V/相，端電壓 $V_a = 3810$ V/相，求功率角 $\delta = 30°$ 時之輸出功率。

(A) 1600 kW (B) 2250 kW (C) 3015 kW (D) 3299 kW

6. 將一額定為1000 kVA，12 kV/1.2 kV，60 Hz的雙繞組變壓器連接成13.2 kV/12 kV的降壓自耦變壓器時，試求此自耦變壓器之額定伏安值。

(A) 11 MVA (B) 1 MVA (C) 10 kVA (D) 12 MVA

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**Please select only one answer from the choices given.**

Note: CCM means discontinuous conduction mode, DCM means discontinuous conduction mode

7. (2pts) For any periodic voltage waveform, the RMS value is always greater than or equal to the average (mean) value.

   A. True B. False

8. (2pts) For which periodic waveforms does the RMS value equal the peak value divided by the square root of 2?

   A. Sinewave B. Fully rectified sinewave C. Square wave

   D. Triangle wave E. More than one of the above options

9. (2pts) A sinusoidal waveform (amplitude of 1 V) has a positive voltage offset of (2 V); its total harmonic distortion is:

   A. Less than zero B. Zero C. Greater than zero

10. (2pts) For sinusoidal AC power transfer, a power factor of 0.5 implies that equal amounts of real power in W and reactive power in VAR are transferred to the load.

    A. True B. False

11. In an ideal transformer, the magnetizing inductance is:

    A. Very large (approaches $\infty$) B. Equal to the leakage inductance

    C. Negative D. Dependent on load current E. Zero

12. (2pts) A full-wave diode rectifier fed by a 10 V-peak sinusoid and driving a purely resistive load, with each diode dropping 1 V, can achieve a power-conversion efficiency of 90 % or higher.

    A. True B. False

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13. (2pts) For an ideal buck converter operating in continuous conduction mode (CCM), the average input-to-output voltage ratio depends on:

A. Input capacitance B. Duty Ratio C. Output capacitance

D. Inductance value E. More than one of the above options

14. (2pts) For an ideal boost converter operating in discontinuous conduction mode (DCM), the average input-to-output voltage ratio depends on:

A. Input capacitance B. Duty Ratio C. Output capacitance

D. Inductance value E. More than one of the above options

15. (2 pts) Which statement about an ideal buck-boost converter operating in DCM is true?

A. Its voltage-gain depends only on the duty cycle, as in CCM

B. The voltage gain is independent of the load resistance

C. Increasing the inductance, with all other parameters fixed, changes the output voltage

D. The converter cannot operate in DCM; it must be in CCM

16. (2 pts) A six-phase full-wave diode rectifier (balanced, equal-amplitude phases) requires how many diodes in total? (minimum number of diodes to achieve full-wave rectification.

A. 6 B. 12 C. 18 D. 24 E. 30

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17. (2 pts) When selecting the PWM carrier frequency for a voltage-source inverter, what is the main reason to choose a carrier frequency much higher than the fundamental output frequency?

A. To increase the output voltage magnitude

B. To eliminate the need for deadtime between switches

C. To guarantee that the inverter operates in CCM

D. To make the inverter compatible with DC loads

E. To reduce the size of the output filter inductors

18. (2 pts) If the deadtime in a PWM-controlled inverter is too long, which of the following effects is most likely observed at the output?

A. The output voltage waveform becomes a perfect sinusoid

B. The fundamental output voltage magnitude is reduced, and harmonic distortion increases

C. The inverter operates in DCM

D. The switching losses of the MOSFETs increase dramatically

E. The input current becomes purely reactive

19. (2 pts) Which statement best describes the purpose of a gate-driver circuit for a MOSFET used in a power converter?

A. Supply fast, high-current pulses to charge/discharge the gate capacitance quickly

B. Provide a constant DC voltage to the MOSFET's drain terminal

C. Regulate the output voltage of the converter

D. Convert the MOSFET's source voltage to a higher level

E. Eliminate the need for a bootstrap capacitor in high-side drivers

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20. (2 pts) Compared with CCM operation, a converter running in DCM generally exhibits which of the following advantages and disadvantages?

A. Lower switching losses and a fixed voltage-gain independent of duty cycle

B. Reduced output voltage ripple and increased electromagnetic interference

C. Simpler control loop design and inability to regulate the output voltage

D. Higher efficiency at light loads and a voltage-gain that depends on load resistance

E. Higher peak inductor current and lower overall efficiency at all load levels

21. (2 pts) The primary purpose of a snubber circuit across a switching MOSFET is to:

A. Increase switching frequency　　B. Reduce turn-on voltage overshoot

C. Eliminate deadtime　　D. Improve power-factor　　E. Provide gate-drive isolation

22. (2 pts) In switching power supplies, the body diode of a MOSFET:

A. Is not used during regular operation

B. Provides a path for the gate-drive signal

C. Can conduct current when the MOSFET is turned off, allowing current to 'free-wheel'

D. Limits the maximum voltage that can appear across the MOSFET

E. Acts as a protective fuse that blows under overload

23. (2 pts) Mitigating conducted electromagnetic interference (EMI) is accomplished by:

A. Adding input-line LC filters

B. Adding a metal shield

C. Increasing the switching frequency of the converter

D. Placing a series resistor in series with the output load

E. Increasing the output-filter capacitor only

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