編號： 181

國立成功大學 107 學年度碩士班招生考試試題

系　　所：電機工程學系

考試科目：電力工程

考試日期：0205，節次：2

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) Design one CCM Buck converter with ideal components for the following specifications and list the parameters of the employed inductor and capacitor.
   (1) Input DC voltage: 20V,
   (2) Output DC voltage: 10V
   (3) Output power: 10W
   (4) Switching frequency: 100kHz
   (5) Inductor current ripple: 1%
   (6) Output voltage ripple ratio: 1%

2. (10%) Design one CCM Flyback converter with ideal components for the following specifications and list the parameters of the employed transformer and capacitor.
   (1) Input DC voltage: 200V,
   (2) Output DC voltage: 10V
   (3) Output power: 10W
   (4) Switching frequency: 100kHz
   (5) Inductor current ripple: 1%
   (6) Output voltage ripple ratio: 1%

3. (10%) Design and plot the P-I compensator using one ideal operational amplifier, one capacitor, and two resistors for the zero at ω=10 rad/s and the 10dB gain at ω=1 rad/s.

4. (10%) Plot the semiconductor structure and the equivalent circuit model of the power N-MOSFET, including three parasitic capacitors and one parasitic transistor.

5. (8%) Draw the physical structure and the equivalent circuit of a transformer with two isolated windings, including one leakage inductor, one magnetizing inductor, one copper-loss resistor, one core-loss resistor, one ideal transformer, and three parasitic capacitors.

6. (a) (4%) Draw the circuit diagram of a DC shunt generator with generated armature voltage E_A, armature resistor, shunt field resistor and shunt inductor L_F.
   (b) (4%) List two methods for the voltage control of a DC shunt generator.
   (c) (4%) Assume the field current is very small and ignorable at open circuit, write down voltage regulation (VR) when the generator is operating at full-load armature current I_A with the parameters shown in the circuit diagram of (a).

7. (20%) A three-phase transformer rated 20MVA, 22kV/11kV has per-phase series impedance of (0.04 + j0.08) per unit. The transformer is connected to a short distribution line which can be represented by a series impedance per phase of 0.5+j2 Ω. The line supplies a balanced three-phase load rated 10MVA, 11kV, with lagging power factor 0.8.

(a) (10%) Draw an **equivalent circuit** of the system indicating all impedances in per unit. Choose 10MVA, 11kV as the base.

(b) (5%) Find the **line current in real unit** at the 22kV side of the transformer.

(c) (5%) With the voltage at the primary side of the transformer held constant at 22 kV, the load at the receiving end of the line is disconnected. Find the **voltage regulation** at the load.

8. (20%) **Continue on problem 7** for using the same common base. Assume a 20MVA, 22kV synchronous generator has subtransient reactance of 20% is connected to the primary side of the transformer. The load side is connected with a 10MVA, 11kV synchronous motor with a 20% subtransient reactance. The motor is drawing 8MVA at a leading power factor of 0.8 when a symmetrical three phase fault occurs at the secondary side of the transformer. Find the **subtransient currents in per unit** from the generator, the motor, and at the fault point.