大同大學 九十一 學年度研究所碩士班入學考試試題

考試科目：電力系統　　所別：電機工程研究所　　第 1/2 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

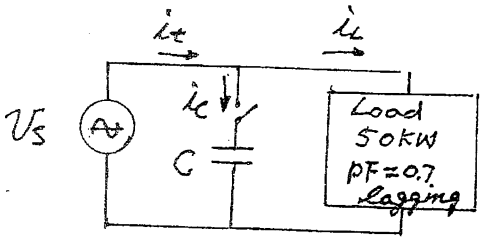
1. The series impedance matrix of a perfectly balanced 3φ line with one ground wire is: (16%)

$$Z_{abc-g} = \begin{array}{c} \\ a \\ b \\ c \\ g \end{array} \begin{array}{c} \begin{array}{cccc} a & b & c & g \end{array} \\ \begin{bmatrix} j3.5 & j2.5 & j2.5 & j1.0 \\ j2.5 & j3.5 & j2.5 & j1.0 \\ j2.5 & j2.5 & j3.5 & j1.0 \\ j1.0 & j1.0 & j1.0 & j2.0 \end{bmatrix} \end{array}$$

(a) Find $[Z_{abc}]$ for the line.

(b) Find $[Z_{012}]$ for the line.

2. A 1φ, 60 Hz, 120 V generator supplying a load that consumes 50 kw at a power factor of 0.7 lagging, as shown in figure. (12%)

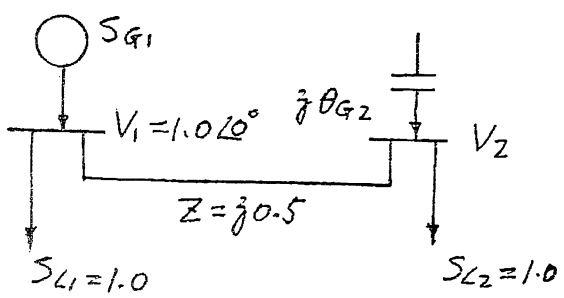


(a) Determine the value of the parallel capacitance needed to raise the power factor to 0.9 lagging.

(b) Determine the apparent power of the capacitor.

(C) If the generator has a 250 KVA rating, how many identical loads of the kind described can it safely supply when no capacitor is used to improve the pf ?

3. The one-line diagram of a power system is shown in the following figure, all quantities are per-unit values. (12%)

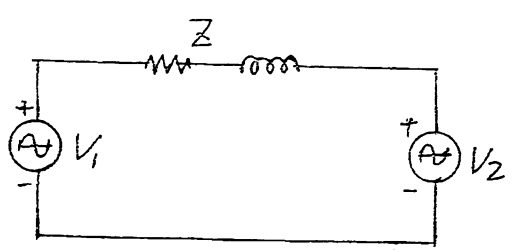


(a) Determine θ_{G2} so that $|V_2| = 1.0$.

(b) What is the angle of V_2 ?

(c) Calculate the system loss.

4. Two single-phase voltage sources are connected by a line of $Z = 0.7 + j2.4\ (\Omega)$ as shown in the following figure. $V_1 = 500\angle 16.26°$ V, and $V_2 = 585\angle 0°$ V. (12%)



(a) Find the complex power for each machine and determine whether they are delivering or receiving real and reactive power.

(b) Find the loss (real and reactive) in the line.

〈轉背面〉

大同大學 九十一 學年度研究所碩士班入學考試試題

考試科目：電力系統　　所別：電機工程研究所　　第2/2頁

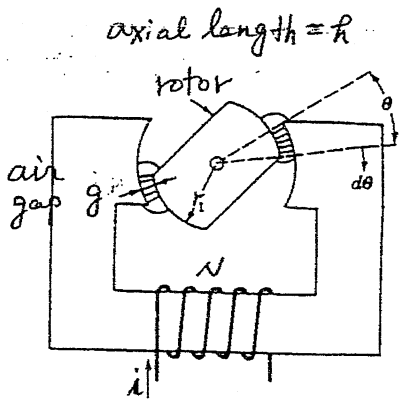
註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

5. (12%)
(a) List the advantages of using bundled-conductor for high-voltage transmission lines.
(b) Describe the purposes and restructure of the power industry deregulation.

6. (12%) A 1KVA, 220V/110V, 400 Hz transformer is desired to be used at a frequency of 60 Hz. Calculate (a) the maximum rms value of voltage output of the low voltage side, where the permissible flux density keeps the same.
(b) the KVA rating of the transformer under the condition of 60 Hz.

7. (12%) A 3φ, 3-wire, Y-connected induction motor is initially operating under balanced 3φ condition. when one of the phase windings becomes open-circuited. Under this condition, calculate the relative magnitudes of the resultant positive- and negative revolving mmf waves.

8. (12%) The magnetic-circuit (or the simplify reluctance motor) is made of cast-steel as shown in the figure. The rotor is free to turn about a vertical axis. The dimensions are shown in the figure.



(a) Derive an expression for the torque acting on the rotor. in terms of dimensions and magnetic field in the air-gaps.

(b) The maximum flux density in the overlapping portions of the air-gap is limited to 2T (Tesla), compute the maximum torque in newton-meter for $r_1 = 2$ cm. $h = 2$ cm. and $g = 0.2$ cm.