題號： 358　　國立臺灣大學 111 學年度碩士班招生考試試題

科目：電力工程

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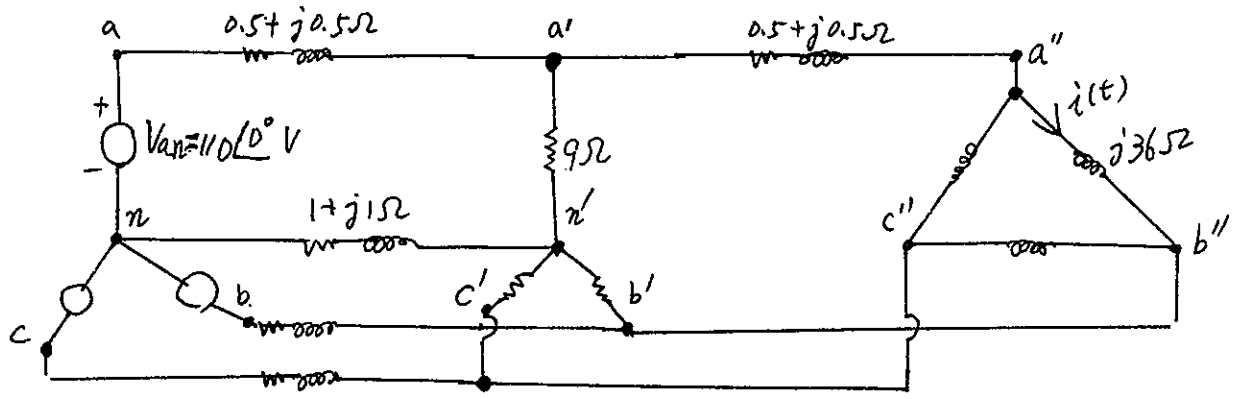
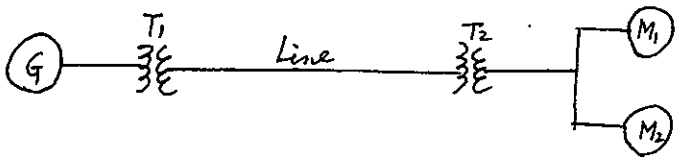
1. Given a salient-pole synchronous generator with terminal voltage Va = 1.0 $\angle 0^\circ$, Xd = 1.0, Xq = 0.6 (d- and q- axis synchronous reactance), r (armature resistance) = 0.005. Find the open-circuit voltage when the armature current is Ia = 0.8 $\angle -60^\circ$. (15%)
2. Given the 60 Hz, balanced three-phase system shown below, find i(t). (15%)



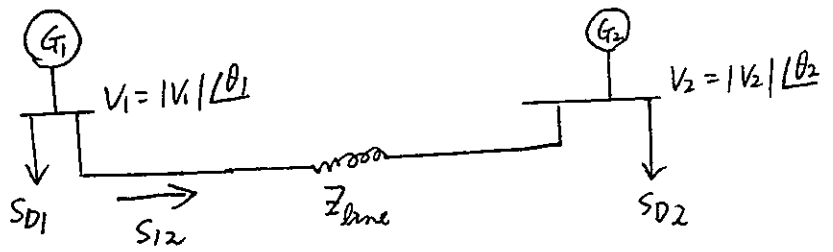
3. A three-phase, 10 HP, four-pole Y-connected three-phase induction motor is supplied power from a balanced three- phase 60 Hz source of 220 V line-to-line. Determine the frequency of the rotor current when it is rotating at a speed of 1000r/min. (12%)
4. Draw an impedance diagram and compute the per-unit impedances for the system whose one-line diagram is shown below. The three phase and line-line ratings are as follows:

   Generator G : 20 MVA, 13.8 KV, X = 0.1 p.u.
   Motor M1 : 5MVA, 14.4 KV, X = 0.15 p.u.
   Motor M2 : 10 MVA, 14.4 KV, X = 0.15 p.u.
   Transformer T1: 30 MVA, 13.2-161 KV, X = 0.1 p.u.
   Transformer T2: 20 MVA, 161-13.8 KV, X = 0.1 p.u.
   Line : 20+j120 ohm (actual)

   Select a base of 30 MVA and 161 KV in the transmission line. (12%)



5. Let $|V1| = 1.05$, $|V2| = 1$, $Z_{line} = 0.6\angle 80^\circ$, $\theta_{12} = \theta_1 - \theta_2$. For what nonzero θ_{12} is S_{12} purely reactive? ($0 < \theta_{12} < 2\pi$) (12%)



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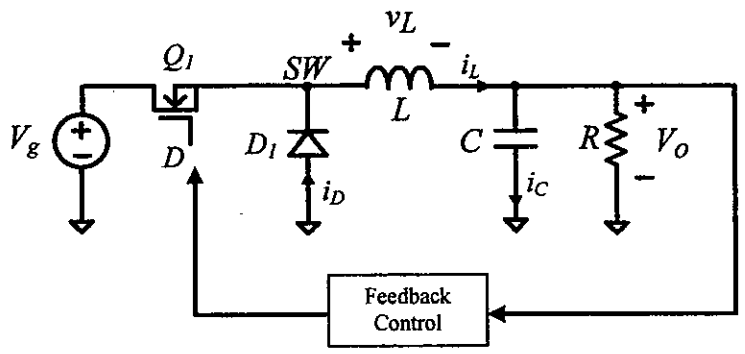
6、A buck converter below operates at steady-state and discontinuous conduction mode (DCM). Assume the converter is ideal.

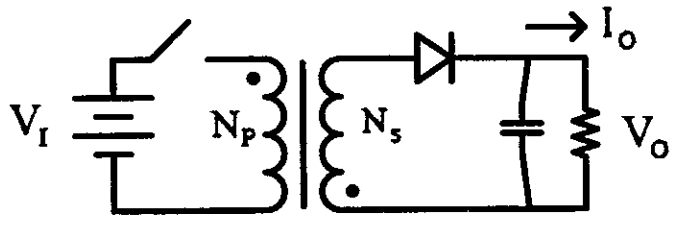


(a) How many modes do the converter operates in DCM? Draw the equivalent circuit of each mode. (3%)
(b) Derive the input to output dc gain (V_g/V_o) as a function of circuit variables such as L, C, R and duty cycle D. (5%)
(c) Derive the criteria for the converter operates at DCM. (3%)
(d) Sketch the time waveforms of D, SW voltage, i_L, i_C. Mark peak and valley values (7%)

7、Answer below questions. Explanation or mathematic derivations are required.

(a) What is the value of integration of capacitor current across a switching period at steady-state? (3%)?

(b) Why the diode D in the flyback converter below will turn-on after switch turn-off? (4%) (hint: Draw the equivalent circuit of Flyback converter)



(c) A buck-boost converter in CCM operation as below. Assume there is a small parasitic inductance in series with the switch. Draw the voltage waveform across this inductor and duty waveform for two switching periods. (5%)

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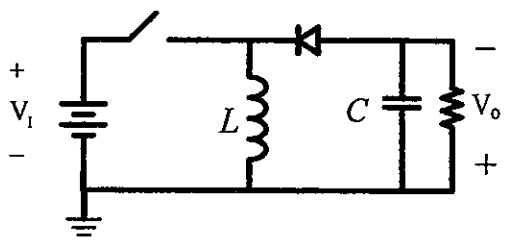

(d) Draw the Bode plot (gain and phase plots) of the transfer function $T = \frac{10}{s(s+10)}$ (4%)

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