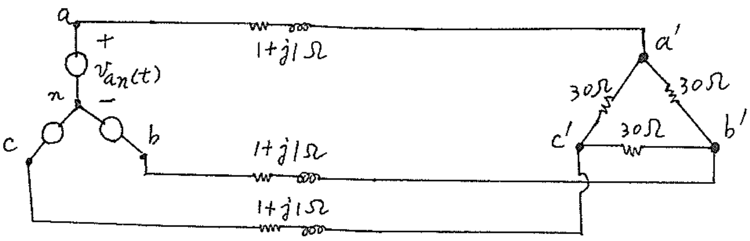
題號：393

1. A 380 V, 20HP, 60 Hz four-pole Y-connected three phase induction motor has the following impedances in ohms per phase referred to the stator circuit:
   R_1 =0.6 ohm, X_1 = 1 ohm, R_2= 0.3 ohm, X_2 = 0.45 ohm, X_m (magnetizing reactance) =25 ohm.
   The total rotational losses are 1000W and are assumed to be constant.
   The core loss is neglected. For a rotor slip of 2 percent at the rated voltage and rated frequency, find the motor's stator current. (10%)

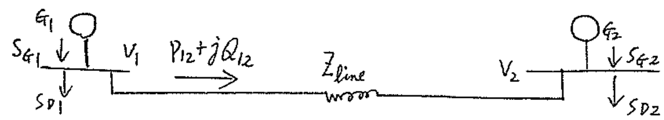
2. The synchronous reactance for a round rotor synchronous generator is 1.0 and the armature resistance is negligible. Find the real power delivered by the generator when the terminal voltage is $1\angle 0^\circ$ and the open-circuit voltage is $1.2\angle 30^\circ$.(10%)

3. The resistance and leakage reactance for the high voltage winding of a 25 KVA, 2000: 200V, 60 Hz, single phase transformer are R_1 = 0.6 ohm and $X_{\ell 1}$ = 1.8 ohm, respectively . On the other hand, the resistance and leakage reactance for the low voltage winding are R_2 = 0.006 ohm and $X_{\ell 2}$= 0.018 ohm, respectively. Neglect the exciting current of the transformer. Select a base of 25 KVA and 2000 V for the high voltage winding.
   (a) Compute the per unit values for the resistances and leakage reactance for the two windings. (10%)
   (b) When the low voltage winding delivers power to a load of 20KW, 0.9 power factor lagging at 200V, find the per unit voltage at the high voltage side. (6%)

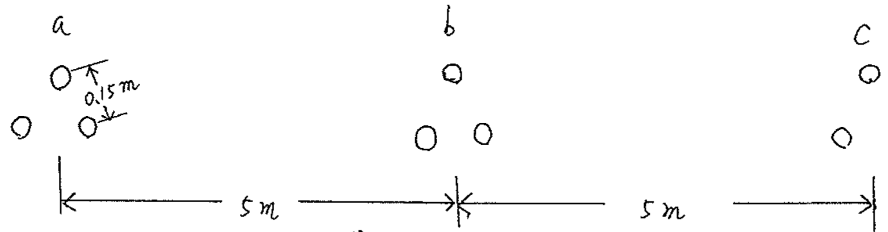
4. Given the 60 Hz, balanced three-phase system shown below, find v_{an}(t) when $v_{a'b'}$ (t) = 173 $\sqrt{2}$cos 377t. (10%)



5. Assume that $|V_1|$ = 1.03, $|V_2|$ =1.0, Z_{line} =$0.8\angle 80^\circ$. Find the maximum value for Q_{12}. (10%)



6. The radius of each sub-conductor is 1 cm for the following 345 KV, 60 Hz, completely transposed balanced three phase lines. Find the per phase inductance In H/m and per phase capacitance to neutral in F/m. (10%)



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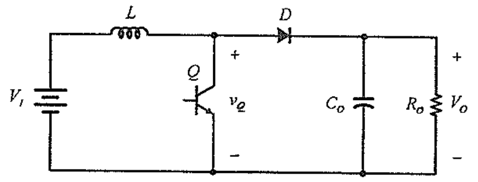
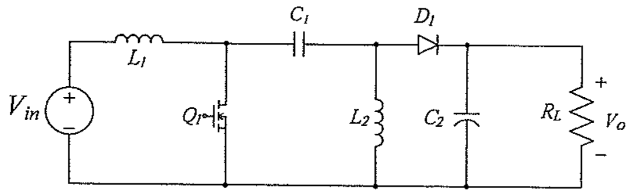
7. An ideal boost converter operates at steady-state has the following specifications: V_I=12 V, output voltage V_O=24 V, C is very large, Switching frequency f_s=100 kHz, Output power P_O = 120 W.

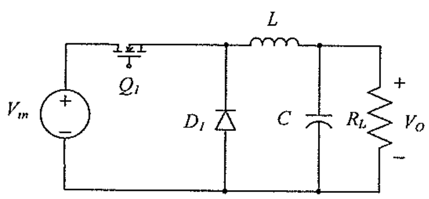


(a) How many modes if the converter operates in continuous conduction mode (CCM)? Draw the equivalent circuit of each mode. (4%)
(b) Determine the inductance of L if the converter is operating at the boundary conduction mode (BCM), where inductor current touches zero right before switch turn-on. (4%)
(c) Follow question (b). Draw the time waveforms of below variables for two switching periods. Mark the peak and valley values. Define the variable polarity in the circuit. Calculation procedure is required.
Duty cycle, current through L, current through C_O, voltage across L. (8%)

8. Answer below questions. Explanation or mathematic derivations are required.
(a) What is the dc voltage across C_I when the converter below is in steady-state operation? (5%)



(b) Find the RMS value of a sine wave signal with peak value of 10 V. (3%)
(c) Why the diode D_I in the buck converter below will turn-on after Q_I turn-off? (3%)



(d) Why the integration of inductor voltage across a switching period is zero for a buck converter at steady-state? (3%)
(e) Follow (c). Assume there is a small inductor in series with R_L. Draw the voltage waveform of this inductor voltage for two switching periods. (4%)

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