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科目：電力工程
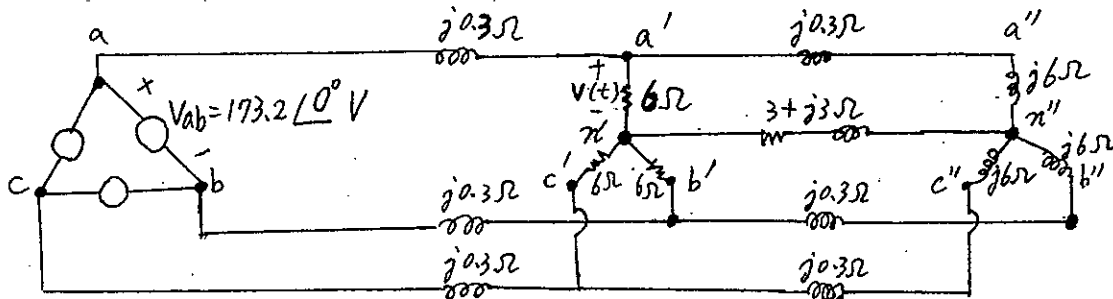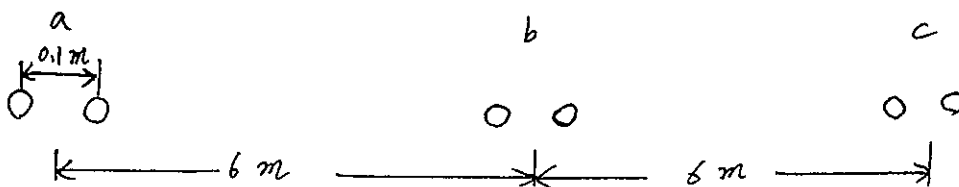節次： 8

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※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

1. Given the 60 Hz, balanced three-phase system shown below, find v (t).　　(11%)

2. Consider the 60 Hz, 345 KV, completely transposed balanced three phase lines as shown below. The radius of each sub-conductor is 0.9 cm. Find the per phase inductance in H/m and per phase capacitance to neutral in F/m.　　(11%)

3. Find the radius and center of the power circle for $S = P + jQ$ with P as the abscissa (x-axis) and Q as the ordinate (y-axis).　　(11%)

$$\theta_{12} = \theta_1 - \theta_2$$
$$0 \le \theta_{12} \le 2\pi$$
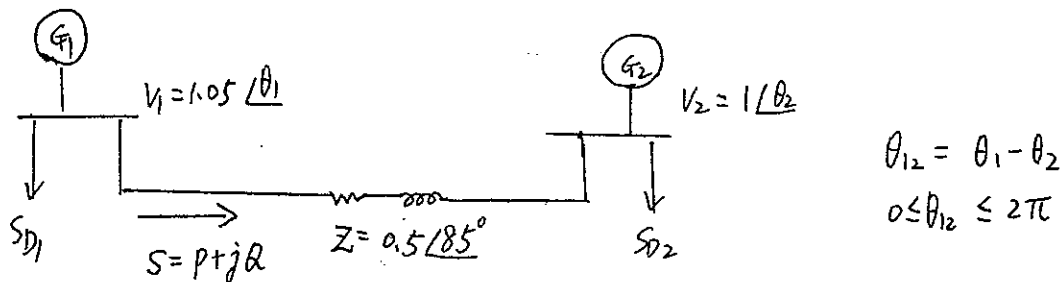
4. A round rotor synchronous generator delivers P = 0.8 (real power) at 0.9 power factor lagging to a bus with voltage of 1.0.　Assume that the synchronous reactance of the generator is 0.6 and the armature resistance can be neglected. Find the open-circuit voltage of the synchronous generator.　　(11%)

5. A 380V, 10HP, four- pole, 60 Hz, Y- connected three phase induction motor has a full-load slip of 3 percent. Find the synchronous speed of this motor and the rotor speed of this motor at the rated load.　　(11%)

6. A 50 KVA, 2200: 220 V, 60 Hz distribution transformer has a leakage impedance of 0.62 + j 1.02 ohm in the high voltage winding and 0.006 + j 0.01 ohm in the low voltage winding. At rated voltage and frequency, the admittance of the shunt branch accounting for the exciting current is 0.003 – j 0.02 mho when viewed from the low voltage side. Draw the equivalent circuit referred to the high voltage side.

　　(11%)

見背面

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[7] True or False [20 pts]

7a. A sine wave and triangle wave have the same (positive and negative) amplitude. The RMS value is the same for both waveforms. [2 pts]

7b. Average power is equivalent to real power, and RMS power is equivalent to reactive power. [2 pts]

7c. For a periodic waveform, the average value will always be the same or lower than the RMS value. [2 pts]

7d. For a periodic waveform, the maximum theoretical value for total harmonic distortion (THD) is 1. [2 pts]

7e. In the square-wave shown below, the amplitude of the fundamental component is larger than A. [2 pts]
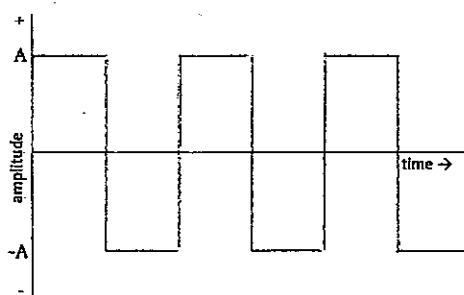
7f. The total harmonic distortion (THD) of a pure square wave (50% duty) is the same regardless of frequency and amplitude. [2 pts]

7g. For a diode rectification circuit with a resistive and inductive (R-L) load, the instantaneous output voltage (over the load) may become negative. [2 pts]

7h. For an ideal buck converter operating in discontinuous conduction mode (DCM), the input-to-output voltage relationship does not depend on the output capacitor value C. [2 pts]

7i. A half-bridge inverter creates 2 different voltages over the output, while the full-bridge inverter creates 4 different voltages over the output. [2 pts]

7j. For a flyback converter, ideally, the coupled inductor has zero magnetizing inductance. [2 pts]

[8] Short Answer [6 pts]

8a. Name two converter topologies with galvanic isolation between input and output. [2 pt]

8b. Explain why galvanic isolation is sometimes required and give a specific example. [2 pts]

8c. A buck-boost converter is operating in discontinuous conduction mode (DCM). The inductor value is doubled, but switching frequency, duty ratio, and average inductor current remain the same. Which mode does the new circuit operate in? Explain your answer. [2pts]

[9] Rectifier circuit analysis: [8 pts]

For the circuit below, the output resistor is $R = 1\ \Omega$ and output voltage source is $V_{dc} = 10$ V. The input is a sine wave with RMS value $V_{i,RMS} = 24$ V and period $T = 1$ s. Assume all diodes have a voltage drop of $V_D = 0.5$ V and the circuit is operating in steady state.
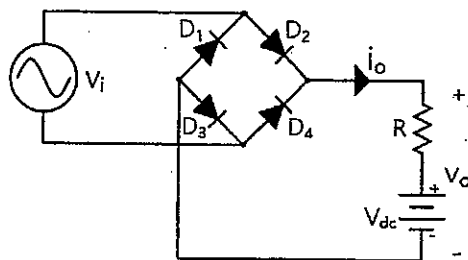
9a. Find the maximum value of the input voltage v_i. [1 pts]

9b. Find the maximum value of the output voltage v_o. [1 pts]

9c. Calculate the average output voltage value, $<v_o>$. [2 pts]

9d. Calculate the average power through the resistor, P_R. [2 pts]

9e. Next, a capacitor is added over the output (v_o). Which of the previous values (parts a to d) will change? [2 pts]

試題隨卷繳回