

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：2110 電機工程系碩士班甲組

第一節 電力系統 試題

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注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Derive the equation of internal inductance of a solid cylindrical conductor due to internal flux. For a relative permeability of 10,000, compute the internal inductance of conductor per unit length (henrys per meter). (20%)
2. A 60-Hz transmission line is 200 km long (medium length). The series impedance and shunt admittance per unit length are of $0.527 \angle 79.04^\circ \Omega/\text{km}$ and $3.191 \angle 90^\circ \mu\text{S}/\text{km}$, respectively. Draw the nominal- π circuit model and calculate the generalized circuit constants (ABCD constants). The load on the line is 100 MW at 100 kV with 80% lagging power factor. Find the voltage and current magnitudes, real power at the sending end, and voltage regulation of the line. Also determine the characteristic impedance of the line. (30%)
3. The three-phase ratings of a three-winding transformer are:
Primary winding: Δ -connected, 161 kV, 60 MVA, leakage impedance $(0.2+j2)\%$
Secondary winding: Y-connected, 22.8 kV, 30 MVA, leakage impedance $(0.4+j5)\%$
Tertiary winding: Y-connected, 11.4 kV, 30 MVA, leakage impedance $(0.8+j10)\%$
All the leakage impedances are based on 60 MVA and their rated voltages. If the secondary and tertiary windings all supply constant impedance loads with same ratings of windings and 80% lagging power factor, and the primary voltage magnitude is 161 kV.
 - (1). Draw equivalent circuit which includes transformer winding leakage impedances and load impedances (in per unit based on 60 MVA). (10%)
 - (2). Determine the actual power in MW and voltage magnitude in kV of each load. (10%)
 - (3). The power loss in MW of transformer. (10%)
4. A 11.4 kV three-phase-four-wire transmission line supplies single phase loads (connected between phase lines and neutral line). The equivalent three single-phase load impedances are: $Z_a=100\Omega$, $Z_b=50\Omega$, $Z_c=j20\Omega$. Find the positive sequence current, negative sequence current, zero sequence current, and neutral line current magnitudes. (20%)