**EEE210 – Energy conversion and power system fundamentals**

In class quiz 3

Department of Electrical and Electronic Engineering, XJTLU

The quiz will:

- last for 50 minutes;
- account for 5% of your overall marks for EEE210.

After completing the quiz. You need to upload the softcopy of your answers on LMO.

**Q1**

**Q2**

**Total**

1. A two-winding transformer rated at P=24 kVA, $V_L/V_H = \frac{120}{180}V$, $f = 60\ Hz$. This transformer has a core loss $Loss_{core} = 400$ W and a full-load copper loss $Loss_{copper} = 750$ W. [25]

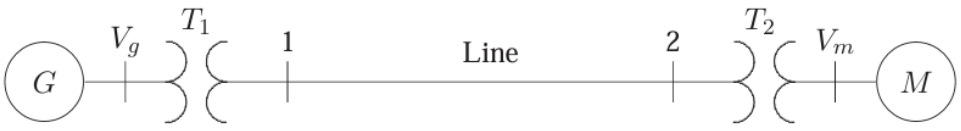
(a) Calculate the magnitude of currents on the low voltage side $I_{LV}$ and high voltage side $I_{HV}$. [6]

(b) The above transformer is to be connected as an autotransformer, i) calculate the secondary current $I_{secondary}$ of the autotransformer; ii) draw the relevant diagram and label all relevant currents and voltages. [12]

(c) As an autotransformer, the transformer supplies a load at 180 V from a 300 V source. Calculate the load apparent power in kVA that can be supplied without exceeding the current of the windings. [3]

(d) Calculate the efficiency $\eta$ with the load of the question (c) and power factor $p_f = 0.8$. [4]

2. The three-phase power and line-line ratings of the electric power system shown in the following figure are given below.




The rated parameters are shown as follows: [25]

| | | | |
|---|---|---|---|
| G | 80 MVA | 20 kV | X = 9% |
| $T_1$ | 60 MVA | 20/200 kV | X = 10% |
| $T_1$ | 60 MVA | 200/22 kV | X = 10% |
| M | 50 MVA | 18 kV | X = 8% |
| Line | | 220 kV | $Z = 140 + j220\ \Omega$ |

(a) Calculate impedances of all system components in per unit on a 100-MVA base. Choose 20 kV [10]

as the base voltage at the generator side.

(b) Draw an impedance diagram showing all impedances in per unit values. [5]

(c) The motor is drawing 60 MVA, 0.8 power factor lagging at a line-to-line terminal voltage of 18 kV. Determine: [10]

1) the current in per unit value flows in the system;
2) the terminal voltage and the internal emf of the generator in per unit and in kV.