King Fahd University of Petroleum & Minerals

Electrical Engineering Department

DESIGN PROJECT

(EE 306-191)

This project is due on 11 December 2019

A furnished beach chalet has the following 220 V appliances:

- Fridge of 500 VA, 0.8 lagging pf.
- Lights of 500 VA, 0.9 lagging pf.
- Washing machine of 2 kVA, 0.85 lagging pf.
- Heater of 3 KW, upf.
- Air condition of 3 kVA, 0.75 lagging pf.
- Electronic appliances of maximum of 1 kVA. (Assume a suitable power factor)

The nearest electrical supply of 2400 V is 200 m away of the cabinet. It is required to supply the beach chalet from this 2400 supply through a step down single-phase transformer and a cable of 210 meters (your_section number meters extra for installation curvatures). The data of the transformer and cable are mentioned as follows.

Transformer

A single-phase 2200/220 transformer has a core resistance of 48,400 Ω, magnetization reactance of 8,940 (+your_two-digit-serial number) Ω, primary winding resistance of 5.2 Ω, primary leakage reactance of 15.65 Ω, secondary winding resistance of 0.052 Ω, and secondary leakage reactance of 0.1565 Ω.

LV Cable

The LV cable of 3 kV specs shown in Table 1. Consider 1mm^2 conductor can carry 3 A.

Required:

Provide an engineering solution to supply the cabinet considering the following calculations.

- The best place for the transformer (close to cabinet or close to supply).
- The voltage drop across the cable.
- The maximum possible cable copper loss.

- The transformer core loss.
- The transformer efficiency at rated load. Assume the power factor based on the connected load.
- The transformer maximum efficacy.

Table 1

Catalogue number	Cross sectional area Nominal mm^2	Number and nominal dia. of wires mm	Overall diameter Approx mm	Max. DC resistance at 20°C ohm/km
CXX1-05X	2.5	7x0.66	1.9	7.4100
CXX1-06X	4	7x0.84	2.4	4.6100
CXX1-07X	6	7x1.02	3.0	3.0800
CXX1-08X	10	7x1.33	4.0	1.8300
CXX1-09X	16	7x1.68	5.0	1.1500
CXX1-10X	25	7x2.11	6.3	0.7270
CXX1-11X	35	7x2.48	7.4	0.5240
CXX1-14X	50	19x1.75	8.8	0.3870
CXX1-16X	70	19x2.11	10.6	0.2680
CXX1-17X	95	19x2.48	12.4	0.1930
CXX1-19X	120	37x2.00	14.0	0.1530

Grading and Submission

Group work is allowed with no more than two students in a group.

Grading will be primarily based on correct results and the clarity of the output results. Writing style and organization (comments, consistency, etc.) will also be graded.

The report must be submitted no later than Wed. Dec. 11th , 2019.

A softcopy of the report should be mailed to your section instructor.

Sec.1: Aboubakr Salem → asalem@kfupm.edu.sa.

Sec. 6, 7 and 8 → ibrahimh@kfupm.edu.sa