UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE
Department of Electrical and Electronic engineering

July 2016

SUPPLEMENTARY EXAMINATION

Title of the paper:

Fundamentals of Power Engineering

Course Code: **EE351**
Time allowed: **Three Hours**

Instructions:

1. Answer all questions in the following pages.
2. The answer must be written in the space provided in the question book; those in elsewhere considered invalid. Use the answer book as a scratch pad. Both question and answer book must be handed-in and marked with name and ID.
3. This paper has 7 pages, including this page and a blank page for question Q3.

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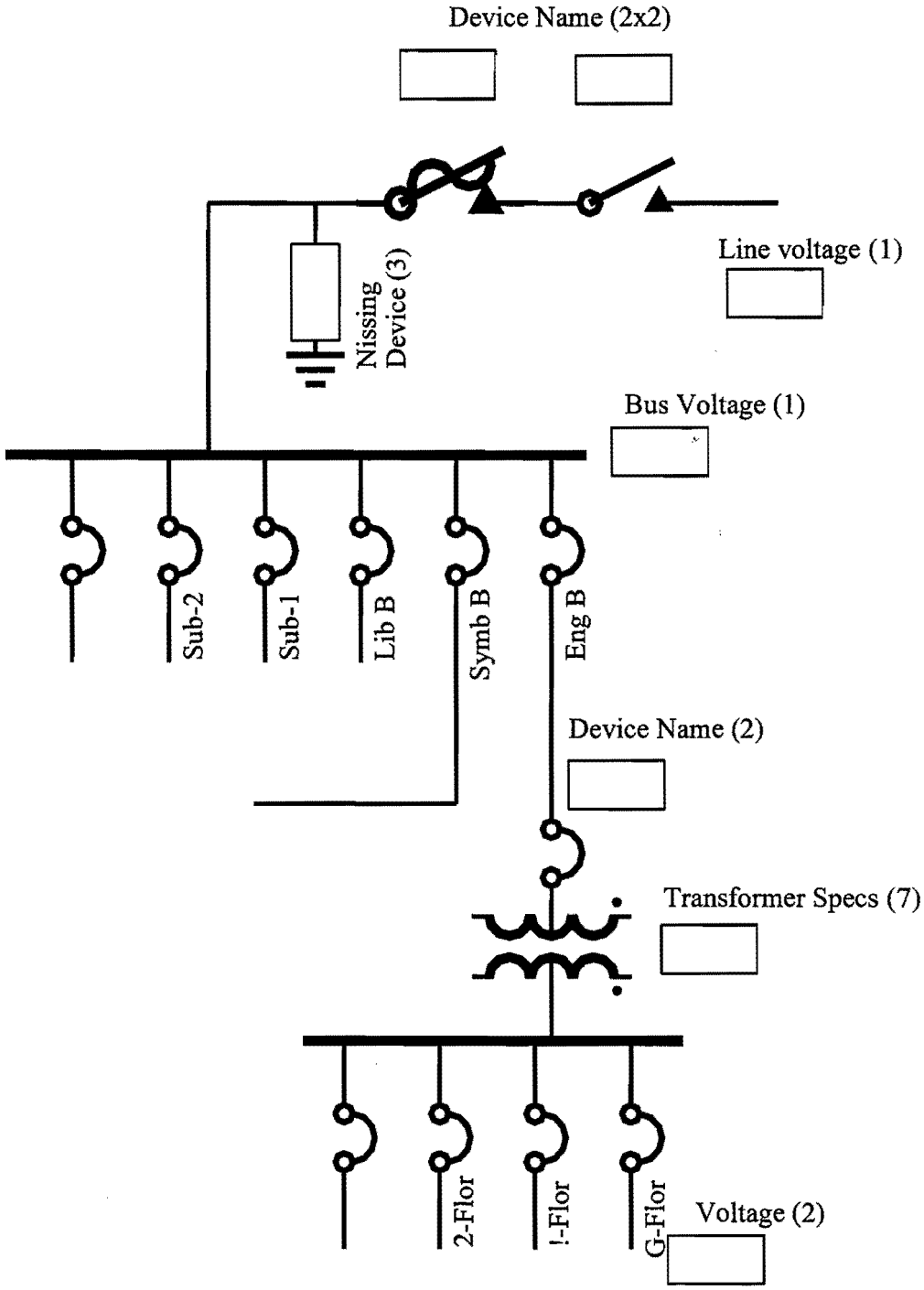
PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR

Q1: (20 pts) The Uniswa distribution system structure is shown below. Fill in the blank boxes the proper data indicated near the box. (pts assigned in the figure)



Q2: (20 pts) Draw a per-unit reactance diagram for the 3-Φ system shown in Fig. Q2-1. Choose a 80 MVA, 66 KV base at the transmission line. (8 pts for structure; -2 pts for each component mistake until a total 12)

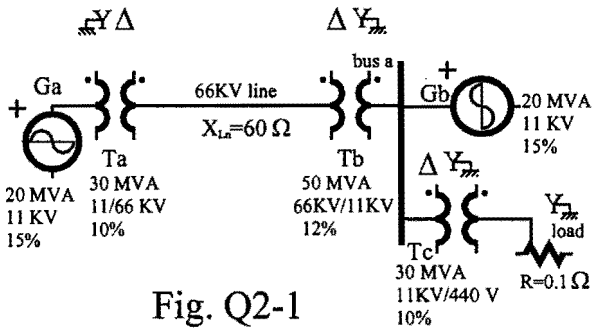


Fig. Q2-1

Q3: (20 pts) 3 impedances, $\mathbf{Z_a}$=3<0°, $\mathbf{Z_b}$= 4<60°, and $\mathbf{Z_c}$=5<90° Ω, are connected in Δ. This Δ-connected load is supplied by a 60 Hz, balanced positive sequence Δ-connected 3-phase source, $\mathbf{E_{ab}}$= 240∠0 V,. Determine (i)(6 pts). the line currents; (ii)(6 pts). the power drawn by each impedance; (iii)(4 pts). the reactive power in each phase; and (iv)(4 pts). the over-all power factor of the load.

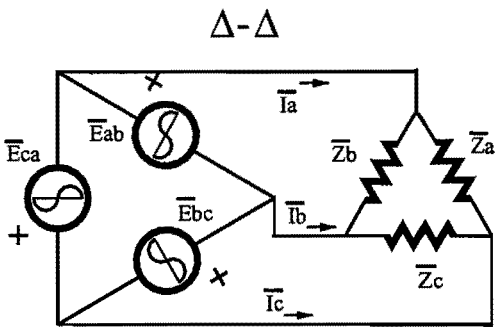


Fig. Q3-1

Q4: (20 pts) The system is shown in Fig. Q4-1. Improve the system PF with a capacitor, its X_C=1.5 Ω. If no load, the capacitor is also off the circuit. If tie X_C at load side, calculate the VR(10 pts) and power efficiency (10 pts).

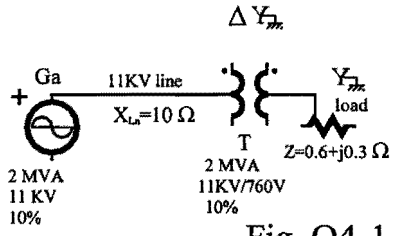


Fig. Q4-1

Q5: (20 pts) The power system shown in Fig. Q5-1 is a part of Q2. (i) Convert the one-line diagram into circuit diagram. (ii) Solve the no load voltage V_{NL} and (iii) the full load voltage V_{FL}. And (iv) calculate the voltage regulation. (note the Δ-Y connection and the load is resistive) (5 pts each)

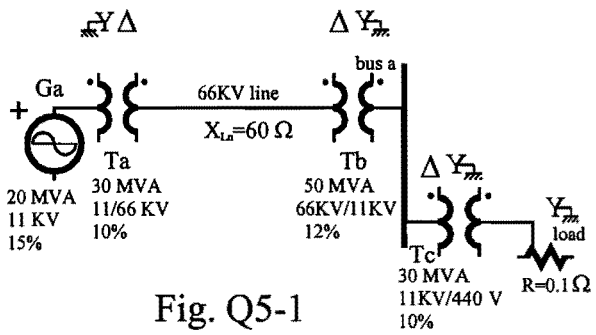


Fig. Q5-1