

UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE
**Department of Electrical and
Electronic engineering**

July 2019

RESIT EXAMINATION

Title of the paper:

Fundamentals of Power and Machines

Course Code: **EEE352**

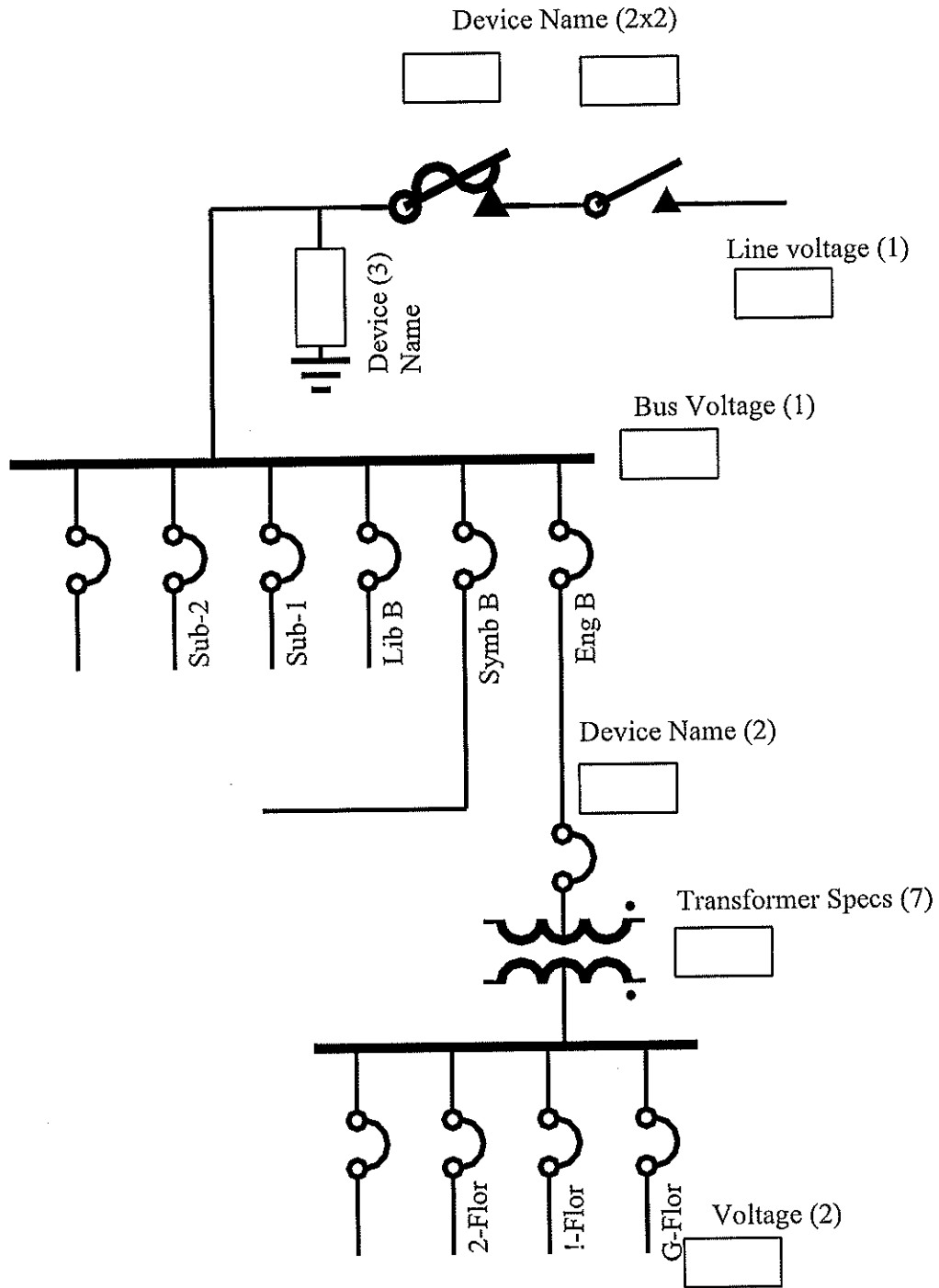
Time allowed: **Three Hours**

Instructions:

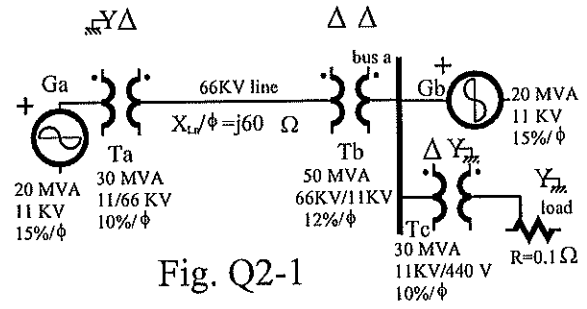
1. Answer all questions in the following pages.
2. The answer must be written in the space provided in the question book; those in elsewhere considered invalid. Use the answer book as a scratch pad. Both question and answer book must be handed-in and marked with name and ID.
3. This paper has 6 pages, including this page.

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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 balanced 3- Φ system shown in Fig. Q2-1. Choose 80 MVA and 66 KV at the transmission line as the system base. (8 pts for structure; -2 pts for each component mistake until a total 12)



Q3: (20 pts) 3 impedances, $Z_{ab}=3\angle 0^\circ$, $Z_{bc}=4\angle 60^\circ$, and $Z_{ca}=5\angle 90^\circ \Omega$, are connected in Δ . This Δ -connected load is supplied by a 60 Hz, balanced positive sequence Y-connected 3-phase source, $E_a=220\angle 0^\circ$ V. Determine (i)(10 pts). the total line current; (ii)(10 pts). the line current of each phase.

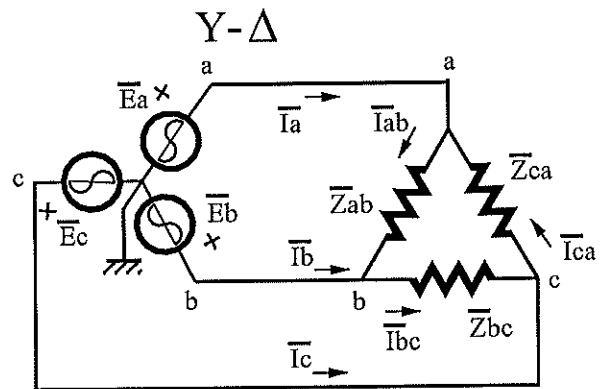


Fig. Q3-1

Q4(20 pts):

- (i)(4 pts) Given a 300 rpm, 60 Hz, and 3- Φ synchronous machine, find how many pairs of poles per phase?
- (ii)(4 pts) Describe the prominent differences between a synchronous generator and a synchronous motor.
- (iii)(12 pts) (a). Draw a complete transformer equivalent circuit.
(b). Maximize or minimize which components to make a CT.
(c). Maximize or minimize which components to make a PT.

Q5(20 pts): A rotating magnetic field, shown in Fig. Q5-1 has two coils Ch and Cv; each is energized respectively by the current:

$$i_h = I \cdot \sin \omega_e t \quad i_v = I \cdot \cos \omega_e t$$

such that i_h produces a field B_h and i_v a field B_v . where ω_e is electric frequency.

(i)(15 pts). Prove the resultant magnetic field will rotate at a mechanical angular speed $\omega_m = \pm \omega_e$. (ii)(5 pts) Find out the rotating is CCW or CW.

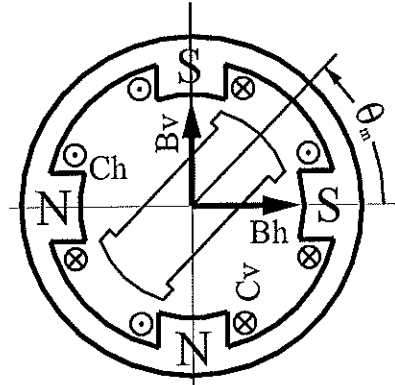


Fig. Q5-1