Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2019/2020

| | | |
|---|---|---|
| COURSE NAME | : | POWER GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEM |
| COURSE CODE | : | BEF 36003 / BEV 30303 |
| PROGRAMME | : | BEV |
| EXAMINATION DATE | : | DECEMBER 2019 / JANUARY 2020 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS |

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

**Q1** (a) List **FOUR (4)** parameters of electrical characteristic for a transmission line.

(4 marks)

(b) Skin effect is caused by magnetic flux set up due to alternating current inside the conductor.

(i) Explain the consequent of the skin effect in cable.

(2 marks)

(ii) Discuss this phenomenon in DC system.

(3 marks)

(c) A three-phase, 50 Hz, 132 kV overhead line has conductors placed as shown in **Figure Q1(c)**. Conductor diameter is 3 cm and the line length is 120 km. Assumed the line is completely transposed and neglecting the effect of ground.

(i) Determine the capacitance of the transmission line per phase.

(11 marks)

(ii) Determine the reactive power from charging the capacitance.

(4 marks)

**Q2** (a) Compare the short and medium transmission lines in terms of the range of length and the model.

(6 marks)

(b) A three-phase, 50 Hz, completely transposed 200 km line has two 795,000-cmil 26/2 ACSR conductors per bundle and the line constants are given as:

Resistance/phase/km = 0.1 Ω
Reactance/phase/km = 0.5 Ω
Susceptance/phase/km = $j10^{-5}$ S

The full load condition at the receiving end of the line is 20 MW at 0.8 p.f. lagging and at 66 kV. Assuming the nominal $\pi$ line model,

(i) Determine the sending end voltage and voltage regulation of the line. Given the calculated ABCD parameters of the nominal $\pi$ line model as:

$$A = D = 1 + \frac{ZY}{2} = 0.9002\angle 1.27^0$$
$$B = Z = 101.98\angle 78.69^0\ \Omega$$
$$C = Y\left(1 + \frac{ZY}{4}\right) = 1.9001 \times 10^{-3}\angle 90.60^0$$

(10 marks)

(ii) If the above transmission line delivers 20 MVA at unity power factor to the load, compare and discuss the new voltage regulation of the transmission line with the one obtained in **Q2(b)(i).**

(9 marks)

**Q3** (a) (i) List **TWO (2)** types of power factor equipment that are widely used and illustrate appropriate diagrams for a 3-phase load.

(4 marks)

(ii) Highlight the disadvantages by using both equipments stated in **Q3(a)(i)**.

(2 marks)

(b) With the information of a single phase motor:

- Voltage = 400 V
- Frequency = 50 Hz
- True Power = 14 kW
- Apparent Power = 20 kVA

Calculate the capacitance required in parallel with the motor to raise the power factor to 0.95 lagging.

(13 marks)

(c) Illustrate the respective phase diagram for the answer in **Q3(b)**.

(6 marks)

**Q4** (a) Describe **FOUR (4)** classification of a distribution systems.

(6 marks)

(b) Referring to **Figure Q4(b)**, calculate:

i. Voltage at mid-point;

(5 marks)

ii. Sending end voltage $V_A$;

(5 marks)

iii. Phase angle between $V_A$ and $V_B$.

(3 marks)

(c) Describe and illustrate **THREE (3)** different ways in which the primary distribution lines can be laid.

(6 marks)

**- END OF QUESTIONS –**

**FINAL EXAMINATION**

SEMESTER/SESSION: SEM I/2019/2020 PROGRAMME : BEV
COURSE NAME : POWER GENERATION, TRANSMISSION AND DISTRIBUTION COURSE CODE: BEF 36003 / BEV 30303

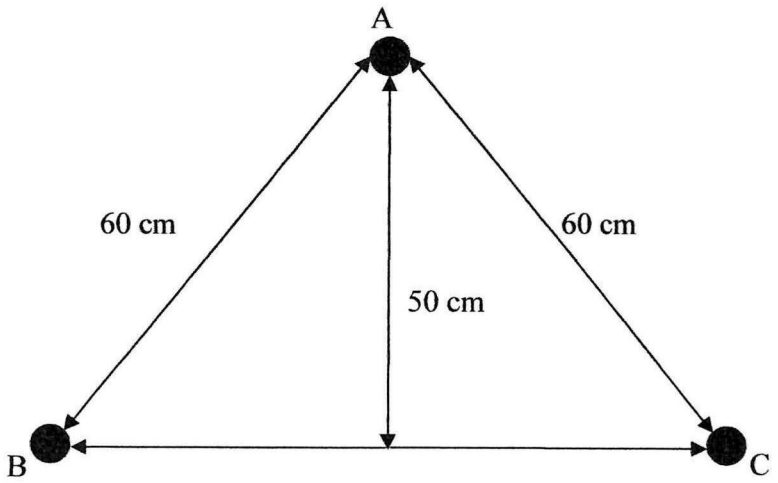


**Figure Q1(c)**

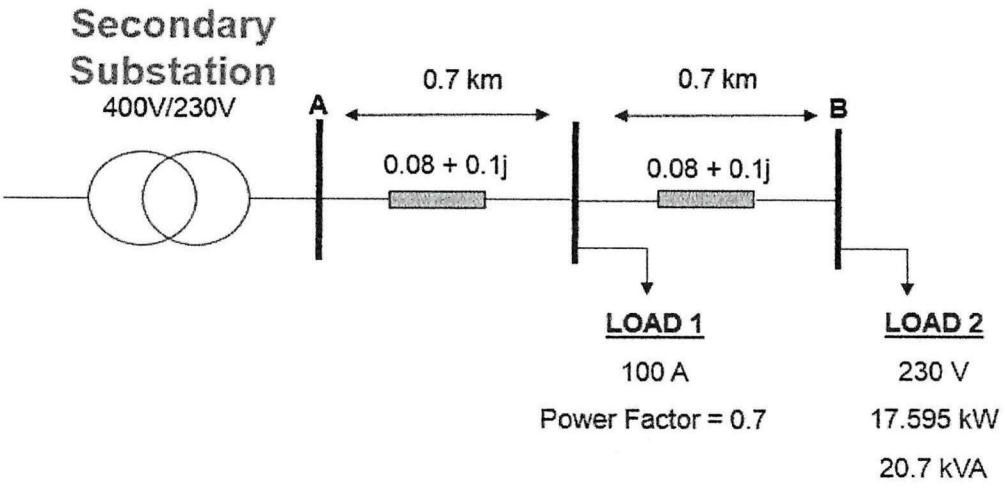


**Figure Q4(b)**