Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	POLYPHASE CIRCUIT ANALYSIS
COURSE CODE	:	BEF 23803
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	DECEMBER 2018/ JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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Q1 (a) Point out **TWO (2)** possible situations that coursed unbalanced system.

(2 marks)

(b) A balanced 400 V, three-phase supply with RYB sequence feeds an unbalanced four-wire star-connected load. The phase impedances of the load are:

$$Z_R = 3 + j4\,\Omega, \quad Z_Y = 15 + j20\,\Omega, \quad Z_B = 4 + j8\,\Omega$$

By taking V_{RN} as reference,

(i) Calculate the line currents of I_R, I_Y and I_B.

(6 marks)

(ii) Draw the phasor diagram of phase voltage and currents in **Q1(b)(i).**

(2 marks)

(c) An unbalanced three-wire star-connected load shown in **Figure Q1(c)** is supplied from a balanced three phase 400 V with RYB sequence. The load phase impedances are

$$Z_R = 2 + j2\,\Omega, \quad Z_Y = 10 + j10\,\Omega, \quad Z_B = 5 + j5\,\Omega$$

Each conducting wire impedance, Z_L is $0.10 + j0.15\,\Omega$.

By using **Millman's Theorem** and taking V_{RN} as reference, calculate

(i) the potential difference between N and n, V_{Nn}.

(4 marks)

(ii) the line currents, I_R, I_Y and I_B.

(6 marks)

Q2 (a) Differentiate between the complex power (S), the real power (P) and the reactive power (Q).

(6 marks)

(b) Consider a balanced three-phase load connected in star, each phase consists of a resistance (36 Ω) connected in series with an inductance (0.8 H). The load is connected to a three-phase supply of 415 V.

Assume a RYB sequence;

(i) Calculate the line current.

(6 marks)

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(ii) Calculate the total active power absorbed by the load.

(2 marks)

(iii) Calculate the total reactive power absorbed by the load.

(2 marks)

(iv) Calculate the apparent power absorbed by the load.

(2 marks)

(v) Calculate the power factor.

(2 marks)

Q3 (a) (i) Explain the assumption needs in single line diagram.

(2 marks)

(ii) Describe the main purpose of single line diagram in power system.

(2 marks)

(b) **Figure Q(3)(b)** shows the single line diagram of industrial plant which received three-phase supply at 33 kV from the local utility.

(i) Calculate the total active power (P), total reactive power (Q) and total apparent power (S) supplied by the local utility using a power triangle for each line.

(13 marks)

(ii) From the solution in **Q3(b)(i)**, determine the current I_S.

(3 marks)

Q4 (a) Give **TWO (2)** types of a basic transformer.

(2 marks)

(b) State **FOUR (4)** disadvantages of Y-Y transformers.

(4 marks)

(c) Sketch the general diagram of Y-Δ transformer.

(4 marks)

(d) A 132 kV, 50 Hz three-phase system transmission line is 70 km long. The characteristics parameters of transmission line per phase are as follows:

$$r = 0.10\,\Omega/km, \quad x = 1.5mH/km$$

The shunt capacitance is negligable. The line is supplying a three-phase 200 MVA with 0.85 power factor lagging at 132 kV. Find

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(i) the sending end line voltage.

(7 marks)

(ii) the efficiency of the transmission line.

(3 marks)

Q5 (a) State **TWO (2)** advantages of using per unit quantity in power system analysis.

(4 marks)

(b) **Figure Q5(b)** shows the schematic diagram of a radial distribution system where a three-phase generator is supplying an industrial load of 20 MW, 0.8 power factor lagging at 66 kV. The ratings and reactances of the various components are shown therein. Choose base values at the load of 100 MVA and 20 kV.

(i) Calculate the new base current for each zone

(3 marks)

(ii) Determine the per-unit values of all components of the single-line diagram.

(11 marks)

(iii) Draw the impedance diagram.

(2 marks)

- **END OF QUESTIONS** -

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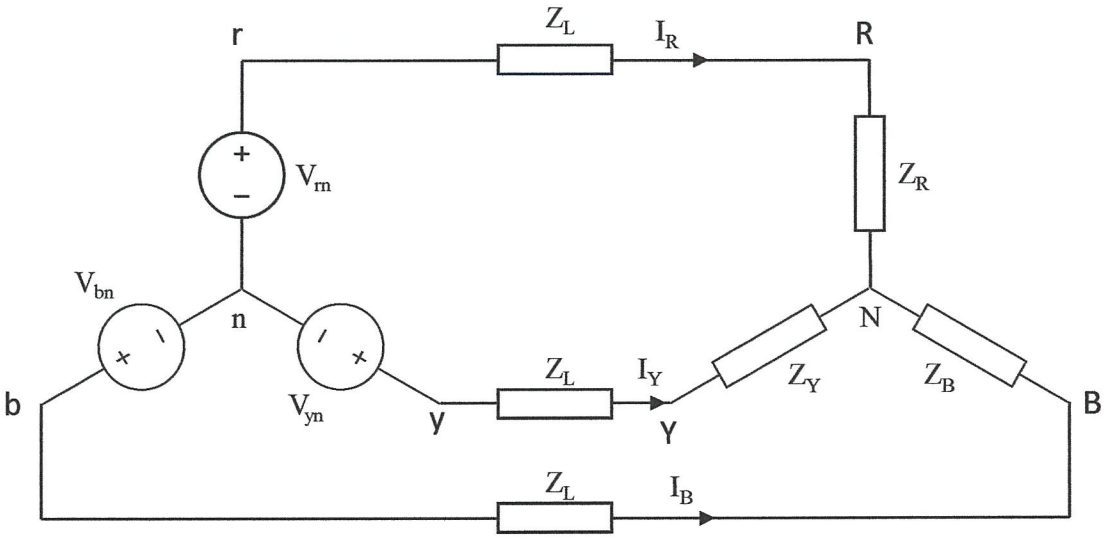

Figure Q1(c)

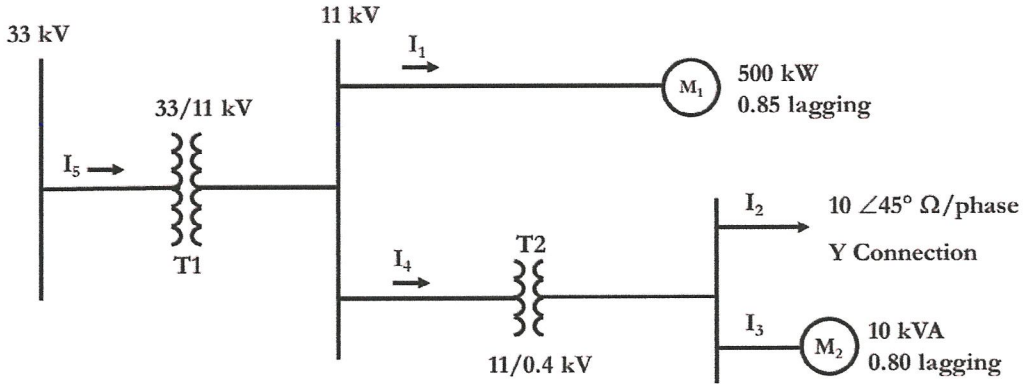

Figure Q3(b)

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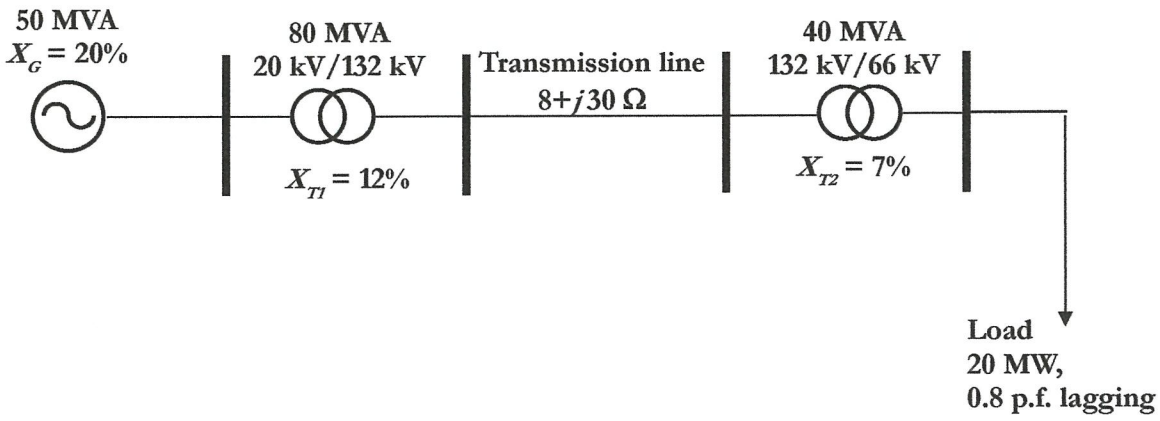

Figure Q5(b)

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