Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	POWER SYSTEMS
COURSE CODE	:	BEJ 20603
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

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

Q1 (a) (i) Define electric power system.

(2 marks)

(ii) State **THREE (3)** main elements of an electric power system.

(3 marks)

(iii) State **THREE (3)** advantages of a high voltage transmission line power system.

(3 marks)

(iv) State **THREE (3)** types of electric loads.

(3 marks)

(b) (i) State **TWO (2)** of the renewable power plants.

(2 marks)

(ii) Draw and state **FOUR (4)** elements of a photovoltaic power system.

(8 marks)

(c) (i) List **TWO (2)** hydropower stations in peninsular Malaysia.

(2 marks)

(ii) List **TWO (2)** power stations in Sarawak, Malaysia.

(2 marks)

Q2 (a) A current source is expressed as:

$$i(t) = 15\cos(377\mathrm{t} - 45^{o})\ A$$

(i) Find the rms value of the current.

(2 marks)

(ii) Find the period of the current.

(2 marks)

(iii) Find the phase value of the current.

(1 mark)

(b) An equivalent AC circuit is shown in **Figure Q2(b)** consist of a single-phase input voltage, a transmission line as Z_{AB} and a load as Z_{BC}. Given the input voltage $V_{in} = 240\ V_{rms}$ at a frequency of 50 Hz.

(i) Determine the current that flows in the transmission line.

(5 marks)

(ii) Determine the power factor at the source.

(2 marks)

(iii) Determine power losses at the transmission line.

(3 marks)

(iv) If a 50 μF capacitor is connected in parallel with the Z_{BC} load, calculate the new power losses in the transmission line and find the reduction of the losses.

(10 marks)

Q3 (a) A balanced three phase Y-connected source, is connected to a balanced three phase delta-connected load. If the phase sequence is positive or ABC-sequence,

(i) Draw and label the circuit configuration.

(3 marks)

(ii) Calculate the phase current of the loads.

(5 marks)

(iii) Calculate the line currents.

(4 marks)

(b) A balanced Y-connected ABC-sequence source, $V_{AN} = 230V_{rms}$ is connected to a Y-connected unbalanced load; $Z_{AN} = 10 + j3\ \Omega$, $Z_{BN} = 8 + j4\ \Omega$, and $Z_{CN} = 5 + j2\ \Omega$. Assume phase A as reference,

(i) Find the phase voltage across each load.

(3 marks)

(ii) Calculate the line current and neutral current.

(5 marks)

(iii) Calculate the total complex power supply by the source.

(5 marks)

Q4 (a) Explain the formula for power factor calculation of a non-linear load system.

(5 marks)

(b) With the help of a power triangle diagram, explain the difference between lagging and leading power factor.

(4 marks)

(c) Describe the effect of low power factor to the rating and size of electrical machines.

(3 marks)

(d) A 230 V_{rms} 50 Hz source supplies a 4 kVA machine with power factor 0.8 leading parallel with a 25 kVA induction motor with power factor 0.7 lagging.

(i) Determine the total apparent power of the system.

(6 marks)

(ii) Find the power factor of the system and draw the power diagram.

(2 marks)

(iii) Calculate the value of capacitor required to adjust the power factor to 0.95 lagging.

(5 marks)

- **END OF QUESTIONS** -

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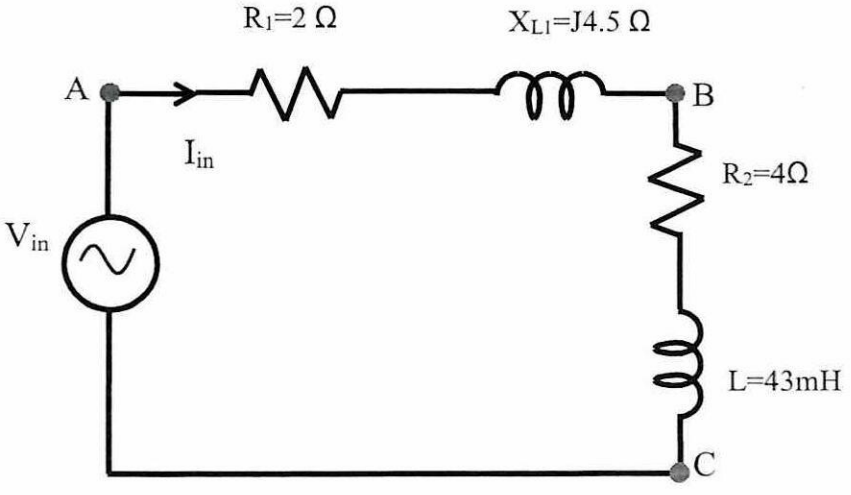

Figure Q2(b)