Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	POWER SYSTEM
COURSE CODE	:	BEJ 20603 / BEF 25503
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	FEBRUARY 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 **FOUR (4)** PAGES

Q1 (a) The increasing electricity demand has led to significant interest in distributed generation. Give **three (3)** impacts of implementing distributed generation in modern power systems.

(3 marks)

(b) Describe **three (3)** ways of defining the power factor.

(3 marks)

(c) The heating element in a soldering iron has a resistance of 0.8 kΩ. It is connected to an AC voltage source with peak to peak voltage of 651 V.

(i) Find the average power dissipated in the soldering iron.

(3 marks)

(ii) Calculate the current that flows into the heating element.

(2 marks)

(d) A current source, $i(t) = 5\sin(120\pi t) - 2\cos(120\pi t - 50°)$ A is connected to a 10 Ω resistor.

(i) Determine the average power delivered to the resistor.

(4 marks)

(ii) Deduce the instantaneous voltage, v(t) across the resistor.

(4 marks)

(iii) Establish the instantaneous power, p(t) equation of the resistor.

(6 marks)

Q2 (a) A three-phase load consists of three 100 Ω resistors that can be either Y-connected or Δ-connected with a line voltage of 400 V. Prove that the Δ-connected load will absorb higher average power. Assume zero line impedance.

(11 marks)

(b) In a balanced three-phase Δ-Y circuit, the source is connected in the negative sequence with $V_{ab} = 220 \angle 20°$ V and $Z_Y = 20 + j15$ Ω.

(i) Calculate the line currents.

(3 marks)

(ii) Define the balanced system based on your answers in **Q2(b)(i)**.

(1 mark)

(c) Three identical Y-connected loads, each having a resistance of 150 Ω in series with an inductance of 0.5 H, are connected to a three-phase supply of 400 V with 50 Hz frequency. Sketch the circuit connection and determine the load's real power and power factor.

(10 marks)

Q3 (a) A three-phase line has an impedance of 1 + j3 Ω per phase. The line feeds a balanced Δ -connected load, which absorbs a total complex power of 12 + j5 kVA. The line voltage at the load end has a magnitude of 240 V.

(i) Sketch the equivalent circuit.

(3 marks)

(ii) Calculate the magnitude of the line voltage at the source end.

(7 marks)

(iii) Find the complex power of the source.

(2 marks)

(b) A three-phase supply of 400 V is connected across a balanced Δ-connected load of each consisting of 32 Ω resistance and 24 Ω inductive reactance. Sketch the three-phase connection and determine the current drawn from the supply. Use VRY as a reference in the RYB sequence.

(9 marks)

(c) List **four (4)** possible connections of a balanced three-phase system.

(4 marks)

Q4 (a) Most of the loads in the electrical distribution systems are inductive. Hence, the system possesses a low power factor, which is highly undesirable. States **five (5)** disadvantages of having poor power factor within the electrical distribution system.

(5 marks)

(b) A 230 Vrms 50 Hz source supplies a parallel combination of a 5 kW heater and a 30 kVA induction motor whose power factor is 0.7.

(i) Determine the complex power of the system.

(11 marks)

(ii) Find the power factor of the system.

(2 marks)

(iii) Calculate the kVA rating of a capacitor required to adjust the system power factor to 0.9 lagging.

(3 marks)

(iii) Deduce the value of the capacitor required.

(2 marks)

(iv) Compute the new reactive power of the system.

(2 marks)

- END OF QUESTIONS –