Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ELECTRICAL POWER SYSTEM
COURSE CODE	:	DAE 32403
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	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 **SIX (6)** PAGES

Q1 (a) Name **two (2)** independent power producer (IPP) companies in Malaysia.

(4 marks)

(b) List **two (2)** advantages of National Grid Malaysia.

(4 marks)

(c) Explain a general working concept of the normal flow power system together with the related block diagram.

(8 marks)

(d) A nuclear power station generates electricity by utilising energy released from the nuclear fission reaction.

(i) Summarise **two (2)** advantages and disadvantages of the nuclear power plant.

(6 marks)

(ii) A fission nuclear power reactor is considered to deliver the power, $P = 500$ MW. The energy released due to the fission of each nucleus of uranium atom U^{238} is about 150 MeV. Determine the number of uranium atoms fissioned per second. Consider 1 eV = 1.60218×10^{-19} Joule.

(3 marks)

Q2 (a) For the system shown in **Figure Q2(a)**, select a base of 50 kVA in the transmission line. Draw the impedance diagram and express all values as per-unit values.

(9 marks)

(b) Three loads are connected in parallel across a 1400 V_{rms} ,60 Hz single phase supply shown in **Figure Q2(b)**. The loads are given as the following states:

Load 1 : Inductive load , 123 kVA at 0.20 power factor.
Load 2 : Capacitive load , 10 kW and 40 kVar
Load 3 : Resistive load of 13 kW

(i) Calculate the total Real Power.

(2 marks)

(ii) Calculate the total Complex Power.

(2 marks)

(iii) Calculate the total Reactive Power.

(2 marks)

(iv) Determine the power factor of the system.

(2 marks)

(v) Calculate line current in the supply line.

(2 marks)

(c) (i) Find the capacitance of the capacitor connected across the load to improve the overall power factor to 0.85 lagging. Use all the results gained from **Q2(b)** above.

(4 marks)

(ii) Determine the value of capacitor needed to be installed parallel to the load for the system shown in **Figure Q2(b)**.

(2 marks)

Q3 (a) List **five (5)** commonly used insulator in overhead transmission lines.

(2.5 marks)

(b) Briefly explain any **two (2)** types of insulators mentioned in **Q3(a)**.

(4 marks)

(c) With the aid of a diagram, explain the significance of transposition in overhead transmission lines.

(5 marks)

(d) Explain **two (2)** significant differences of the short line and medium line model.

(4 marks)

(e) An 80 km long, short transmission line has $3.125\angle 60°$ Ω/km impedance. The line supplies a 328 kW load (Pagoh town) at 0.85 power factor leading. Calculate the following parameter if the receiving end line to line voltage is 33 kV.

(i) Sending voltage per phase.

(4.5 marks)

(ii) Sending current.

(1 mark)

(iii) Voltage regulation.

(2 marks)

(iv) Line efficiency.

(2 marks)

Q4 (a) **Figure Q4(a)** shows the power system network consisting of three generating stations supplying the loads via **three (3)** transmission lines.

(i) Modify the power system network by placing the circuit breakers at appropriate line locations.

(5 marks)

(ii) Modify the power system network by placing the zone of protections at appropriate locations.

(5 marks)

(b) Consider a three-phase, 50 MVA power transformer installed with a current transformer at both the primary and secondary winding side using the differential protection relay method. Their rating data stated in **Table 4Q(b)**. Produce the circuit by providing a full schematic diagram of the power transformer windings and the differential protection relay connection.

(6 marks)

(c) Define fault in electrical power system.

(2 marks)

(d) Explain what happens when a fault occurs in an electrical power system.

(2 marks)

(e) To protect the power system from faults, protective devices such as fuses, circuit breakers, relays, and other devices are used to detect and isolate faults as quickly as possible. Define **two (2)** of the most common types of faults in electrical power system.

(5 marks)

– END OF QUESTIONS –

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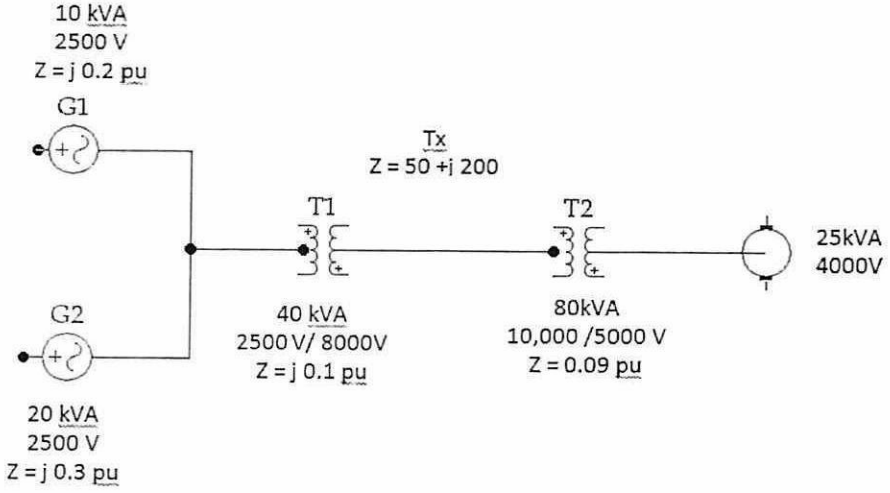
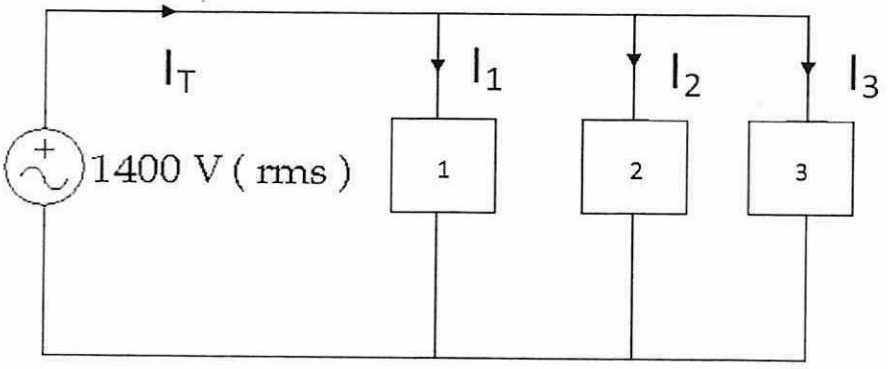


Figure Q2(a)



FigureQ2(b)

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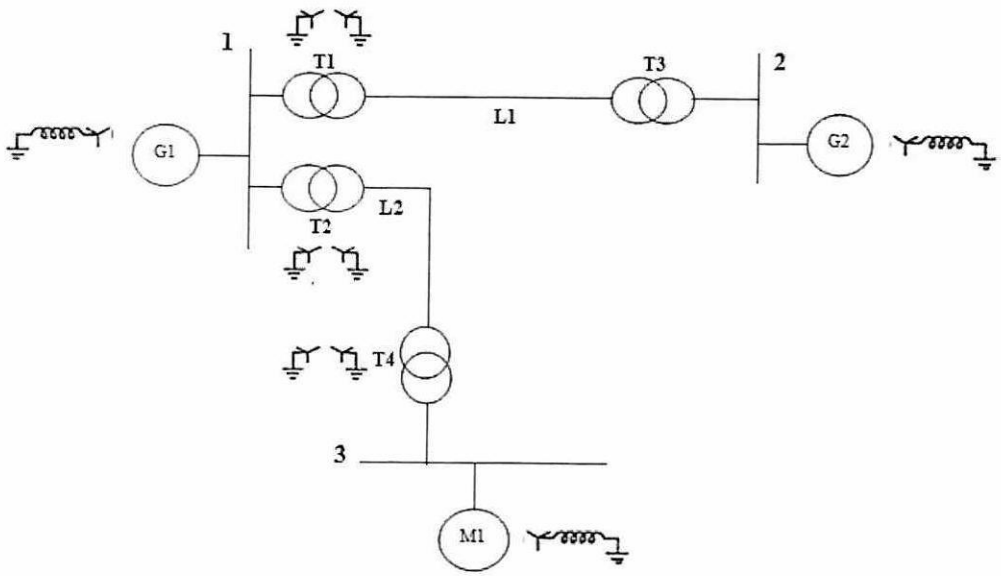

Figure Q4(a)

Table Q4(b)

Equipment	Primary Circuit	Secondary Circuit
Three-phase Transformer (T1)	132 kV / Δ	11 kV / Y
Current Transformer (CT)	500 A / 5 A / Y	5000 A / 5 A / Δ