Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	ELECTRICAL POWER SYSTEM
COURSE CODE	:	DAE 32403
PROGRAMME	:	3 DAE
EXAMINATION DATE	:	DISEMBER 2014 / JANUARY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) A power system can be subdivided into **four (4)** major components. Briefly explain with the aid of appropriate block diagram the basic components of electric power system.

(8 marks)

(b) Normally, there are **four (4)** types of system connection in distribution system.

(i) List all the types of system connection system.

(4 marks)

(ii) Explain at least **two (2)** advantages and **two (2)** disadvantages of any one (1) type of the connection systems.

(4 marks)

(c) There are **three (3)** main types of generating stations. Discuss in details the following questions:

(i) The basic operation of any **one (1)** type of power station plants to generate electricity by using an appropriate block diagram.

(5 marks)

(ii) The **two (2)** advantages and **two (2)** disadvantages of type of power station plant stated in **Q1(c)(i).**

(4 marks)

Q2 (a) For the system shown in **Figure Q2(a)** below, 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 Vrms ,60 Hz single phase supply shown in **Figure Q2(b).** The loads are given as the following states:

Load 1 : Inductive load,125kVA at 0.20 power factor.
Load 2 : Capacitive load,10kW and 40 kVar
Load 3 : Resistive load of 15kW

(i) Calculate the total Real Power
(ii) Calculate the total Complex Power
(iii) Calculate the total Reactive Power
(iv) Determine the power factor of the system

(v) Find line current in the supply line.

(10 marks)

(c) (i) Find the capacitance of the capacitor connected across the load to improve the overall power factor to 0.8 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) A 500-kV three-phase transposed line is composed of one ACSR 1,272,0 0-cmil ,45/7 Bittern conductor per phase with horizontal conductor configuration as shown in **Figure Q3(a).** The conductor have a diameter of 1.345 in and a GMR of 0.5328 in. Find the inductance and capacitance per phase per kilometer of the line.

(7 marks)

(b) The line in **Q3(a)** is replaced by two ACSR 636,000-cmil,24/7 Rook conductors which have the sane total cross sectional area of aluminum as one Bittern conductors. The line spacing as measured from the center of the bundle is the same as before and is shown in **Figure Q3(b).** The conductors have a diameter of 0.977 in and a GMR of 0.3924 in. Bundle spacing is 18 in. Calculate :

(i) The inductance per phase per kilometer of the line.

(4marks)

(ii) The capacitance per phase per kilometer of the line.

(4 marks)

(iii) Compare the results with that of **Q3(a).**

(2 marks)

(c) Power lines made up the important aspect of the electrical power system. State the **four (4)** factors considered in designing electrical power lines.

(4 marks)

(d) Briefly explain the **four (4)** types of power lines.

(4 marks)

Q4 (a) There are two categories of fault in power system. List out the **two (2)** categorize and state **two (2)** examples of each types.

(6 marks)

(b) By referring to the circuit shown in Figure **Q4(b),** determine the maximum MVA fault at the indicated location F. Lets take 60MVA as new base.

(5 marks)

(c) Given the following ratings for the circuit shown in **Figure Q4(c).**

Ratings:

G1 – 200MVA, 13.8kV, Xpu= 0.12 pu
G2 – 150MVA, 13.8kV, Xpu= 0.15 pu
G3 – 300MVA, 30kV, Xpu= 0.16 pu
T1 – 250MVA, 13.8 / 132kV, Xpu= 0.12 pu
T2 – 200MVA, 13.8 / 132kV, Xpu= 0.12 pu
T3 – 300MVA, 24.5 / 160kV, Xpu= 0.16 pu

Using a base unit of 200MVA,13.8kV at G1,

(i) Draw the equivalent impedance diagram for the given system.

(3 marks)

(ii) Obtain the load current in pu and ampere.

(3 marks)

(iii) Determine the fault MVA level if fault occur at F.

(3 marks)

(d) State **five (5)** possible faults that might occur in the transmission line of power system by listing and drawing the entire possible faults.

(5 marks)

Q5 (a) Protection schemes must have high sensitivity in its operation when a fault occurs under minimum fault conditions. Discuss the consequences of a fault to the electrical power system.

(6 marks)

(b) Briefly explain the **five (5)** basic design criteria requirement of a proper protection arrangement of electrical power systems.

(10 marks)

(c) There are three major components which are commonly constituted in a power system protection scheme.

(i) List out the **three (3)** major components.

(3 marks)

(ii) Briefly explain with the aid of appropriate diagram the operation and location of each component in the network.

(6 marks)

Q6 (a) Define a substation.

(3 marks)

(b) In each distribution station there will be a system that control the power flows from the transmission lines to the consumer. It also steps down medium voltages to a lower voltage level using a transformer. A transformer is one of the equipment that is located inside the substation. Briefly explain **five (5)** other equipments that are located inside the substation.

(10 marks)

(c) Circuit breakers are used to interrupt short circuit currents. With the aid of an appropriate diagram, briefly explain any **four (4)** of the commonly used circuit breakers in power system protection scheme.

(12 marks)

- END OF QUESTION –

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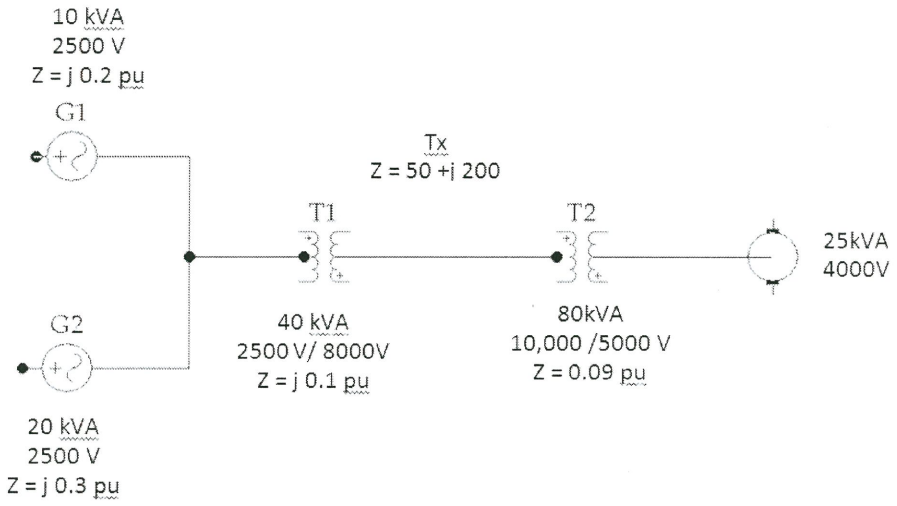

FIGURE Q2(a)

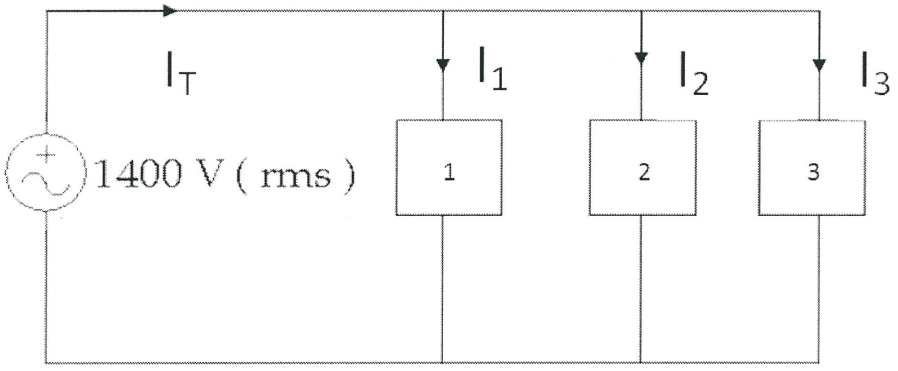

FIGURE Q2(b)

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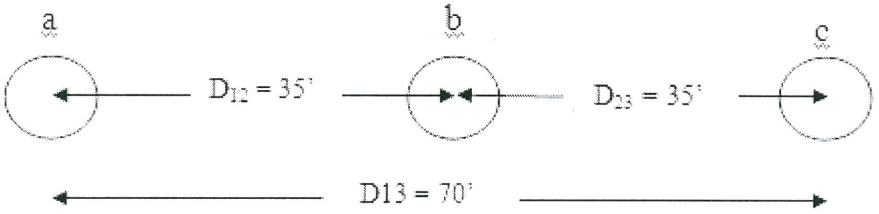

FIGURE 3(a)

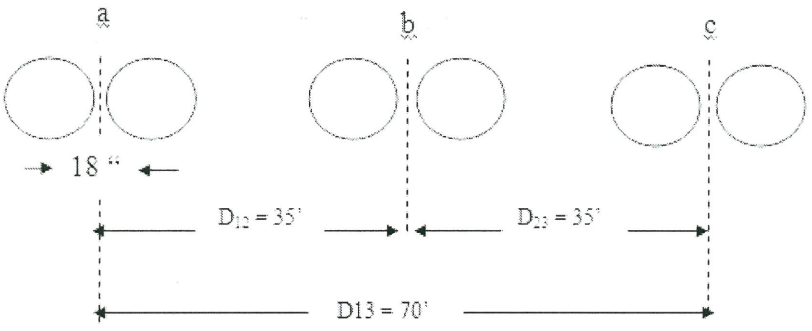

FIGURE 3(b)

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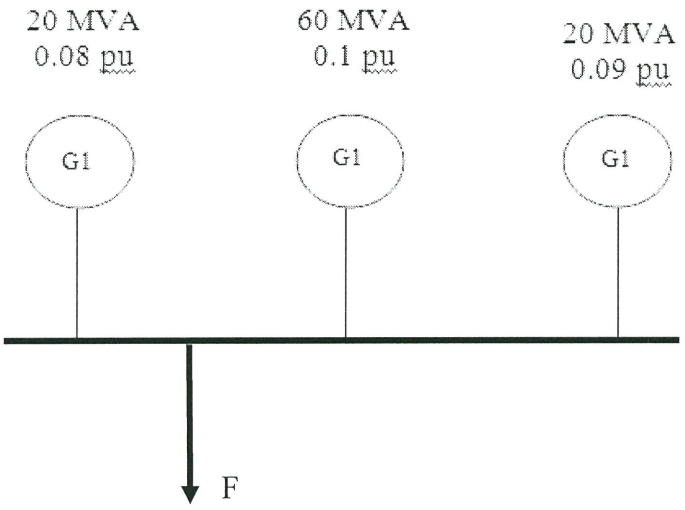

FIGURE Q4 (b)

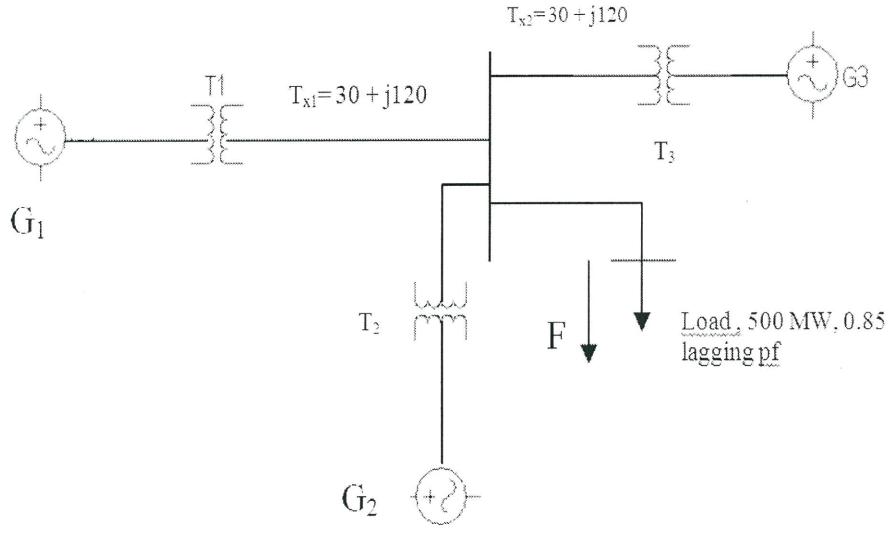

FIGURE Q4(c)