UTHM
Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2015/2016

| | | |
|---|---|---|
| COURSE | : | POWER SYSTEM |
| COURSE CODE | : | BEF 25503 |
| PROGRAMME | : | BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS |
| EXAMINATION DATE | : | DECEMBER 2015 / JANUARY 2016 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS |

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

**Q1** (a) Express the following terms with brief characteristic and equation for a distribution system:

(i) Maximum demand.

(3 marks)

(ii) Load factor.

(3 marks)

(b) The daily demands of two consumers connected to a station are as shown in **Table Q1(b)**:

(i) Plot the load curve.

(4 marks)

(ii) Determine the maximum load.

(2 marks)

(iii) Calculate the average demand and the load factor.

(8 marks)

**Q2** (a) By referring to the given circuit shown in **Figure Q2(a)**, two loads of $Z_1$=120Ω and $Z_2$=15 + $j$20 Ω are connected across 250 V r.m.s, 50 Hz source.

(i) Calculate the total real and reactive power, the power factor at the source and the total current.

(9 marks)

(ii) Calculate the capacitance of the capacitor connected across the loads in order to improve the overall power factor to 0.9 lagging.

(4 marks)

(b) Explain **three (3)** advantages of the thermal generation system.

(3 marks)

(c) Describe any **two (2)** differences between high-head development and low-head development of hydropower station.

(4 marks)

**Q3** (a) **Figure Q3(a)** shows the equivalent circuit of a medium length line for nominal π model which the total series impedance, $Z = R + jX$ and shunt reactance, $\frac{Y}{2}$. Show that the constant *ABCD* for the nominal π model are as follows:

$$A = D = \left(1 + \frac{ZY}{2}\right)$$

$$B = Z$$

$$C = Y\left(1 + \frac{ZY}{4}\right)$$

(5 marks)

(b) A 220 kV, 200 MVA and 50 Hz, three-phase transmission line is 150 km long completely transposed transmission line has the following positive-sequence impedance and admittance:

$r = 0.11\ \Omega/\text{km}$
$x = 0.90\ \Omega/\text{km}$
$y = 5.0 \text{ X } 10^{-6}\ \text{S/km}$

The voltage at the receiving end of the transmission line is 200 kV, analyse:

(i) The values of series impedance and shunt admittance of the transmission line.

(2 marks)

(ii) The value of sending end voltage if the line supplying rated voltage and rated apparent power at 0.85 PF lagging.

(8 marks)

(iii) The efficiency of the line.

(5 marks)

**Q4** (a) A circuit breaker, feeders and switches are the equipment in the distribution substation system.

(i) Explain the function of circuit breaker in distribution substation system.

(2 marks)

(ii) List and explain **three (3)** types of circuit breaker in distribution substation systems.

(6 marks)

(b) Sketch and label a layout of typically distribution system with the voltage level of 132 kV, 66 kV, 33 kV, 11 kV, 415 V and ended with 240 V single phase loads.

(3 marks)

(c) Construct an example of a power system network including network bus and explain briefly on the **three (3)** types of network bus.

(9 marks)

**Q5** (a) Consider a $\Delta/Y$-connected, 15 MVA, 33/11 kV transformer shown in **Figure Q5(a)** with differential protection applied. The *CT* ratio at the secondary side is 2000/5 A and at the primary side is *X*/5 A. The minimum relay current setting is $i_r = 1.206$ A with 125% overload.

(i) Calculate the relay current when the system is 125% overload.

(2 marks)

(ii) Calculate the *CT* current on the primary side when the current on the secondary side is 3.41 A.

(3 marks)

(iii) Determine the ratio of the *CT* at primary side.

(8 marks)

**(b)** Analyse and explain the operation of the protection scheme of the radial system shown in **Figure Q5(b)**.

(7 marks)

**– END OF QUESTIONS –**

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**TABLE Q1(b)**

| Time | | Consumer 1 | Consumer 2 |
|---|---|---|---|
| Starting Time | Ending Time | | |
| 12 AM | 8 AM | 200 W | No load |
| 8 AM | 2 PM | No load | 600 W |
| 2 PM | 4 PM | 1000 W | 200 W |
| 4 PM | 10 PM | No load | 800 W |
| 10 PM | 12 AM | 200 W | No load |

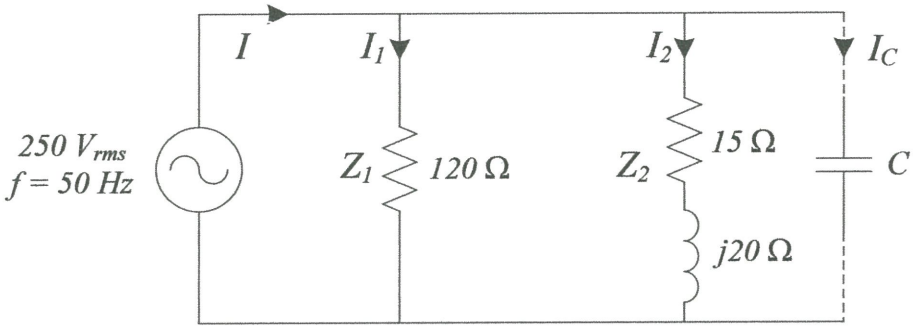


**FIGURE Q2(a)**

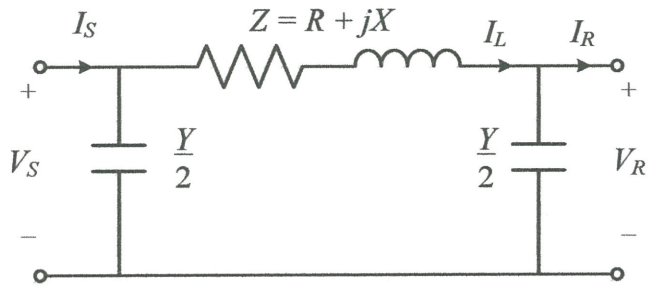


**FIGURE Q3(a)**

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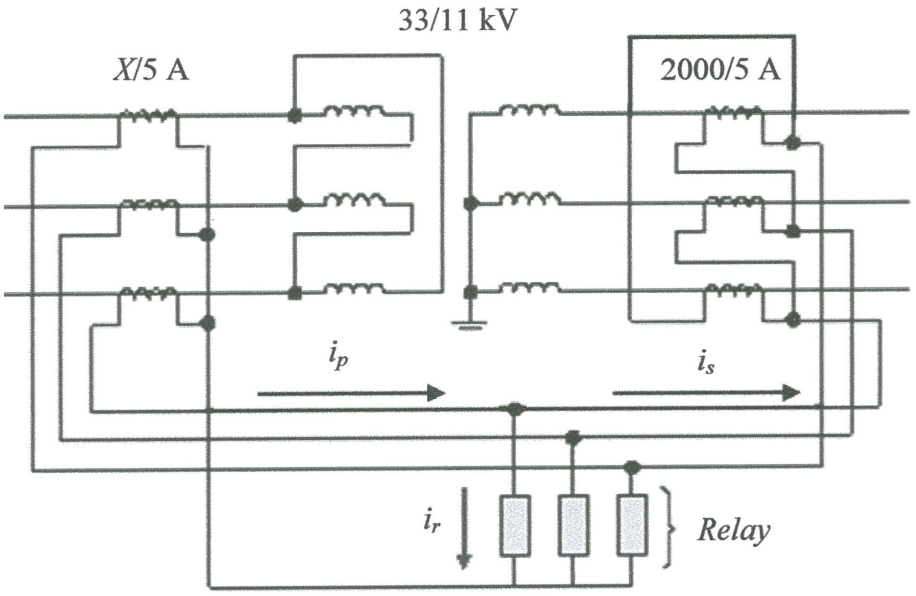


**FIGURE Q5(a)**

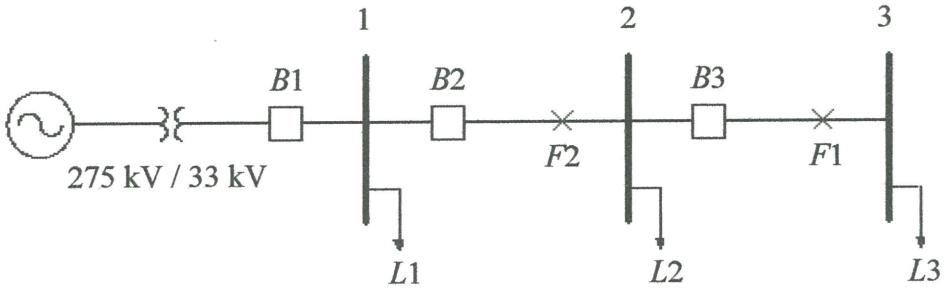


**FIGURE Q5(b)**