Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	POWER SYSTEMS
COURSE CODE	:	BEF 25503
PROGRAMME	:	BEJ
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Describe electric power system.

(4 marks)

(b) Outline how distribution systems are being classified.

(8 marks)

(c) List out **four (4)** functions of distribution substation.

(4 marks)

(d) Illustrate **two (2)** ways the primary distribution lines can be laid.

(4 marks)

Q2 A *Y*-connected synchronous generator rated 100 MVA, 13.2 kV has a rated impedance of $R = 5\%$ and $X_s = 80\%$. It is connected to a j10 Ω transmission line through a 100 MVA, 13.8/120 kV, Δ - *Y* three phase transformer. The rated impedance for the three phase transformer is $R = 2\%$ and $X = 8\%$.

(a) Construct the one line diagram of this system.

(2 marks)

(b) Outline the new impedance diagram for this system when 200 MVA and 120 kV at the transmission line are used as base.

(18 marks)

Q3 (a) Give **four (4)** advantages of the thermal generation system.

(4 marks)

(b) Compare the differences between high-head development and low-head development of hydropower station.

(8 marks)

(c) Calculate the mass of uranium fissioned per hour if an atomic power reactor can deliver 400 MW. Given that, due to fission reaction of each atom ${}_{92}U^{235}$, the energy released is 200 MeV.

(8 marks)

Q4 (a) **Figure Q4(a)** shows an equivalent circuit of a medium length line for nominal π model which the total series impedance, $Z = R + jX$ and shunt reactance, $\frac{Y}{2}$. Generate the equation for *ABCD* constant of the nominal π model.

(5 marks)

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

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

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)

Q5 (a) Outline the operation of the protection scheme of the radial system shown in **Figure Q5(a)**.

(7 marks)

(b) Consider a *Δ/Y*-connected, 15 MVA, 33/11 kV transformer shown in **Figure Q5(b)** 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)

- END OF QUESTIONS -

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I / 2016 / 2017	PROGRAMME	: BEJ
COURSE	: POWER SYSTEM	COURSE CODE	: BEF 25503

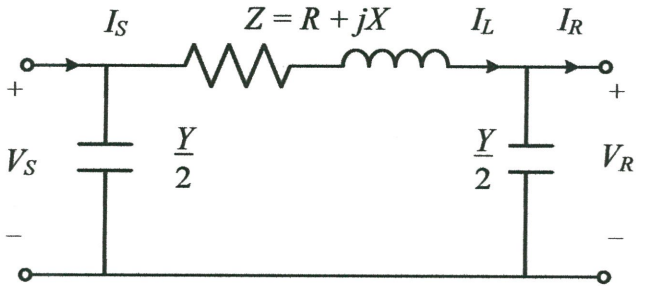

Figure Q4(a)

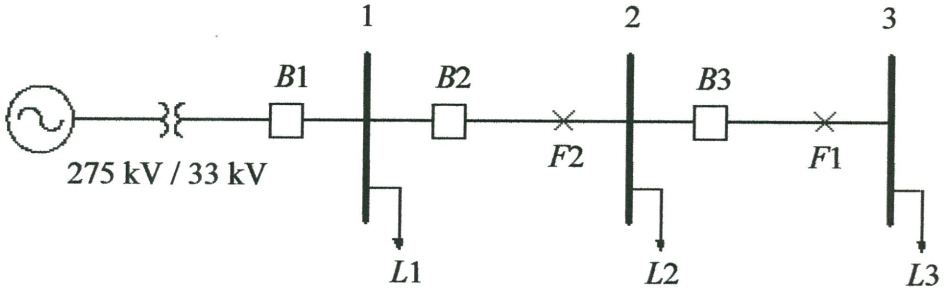

Figure Q5(a)

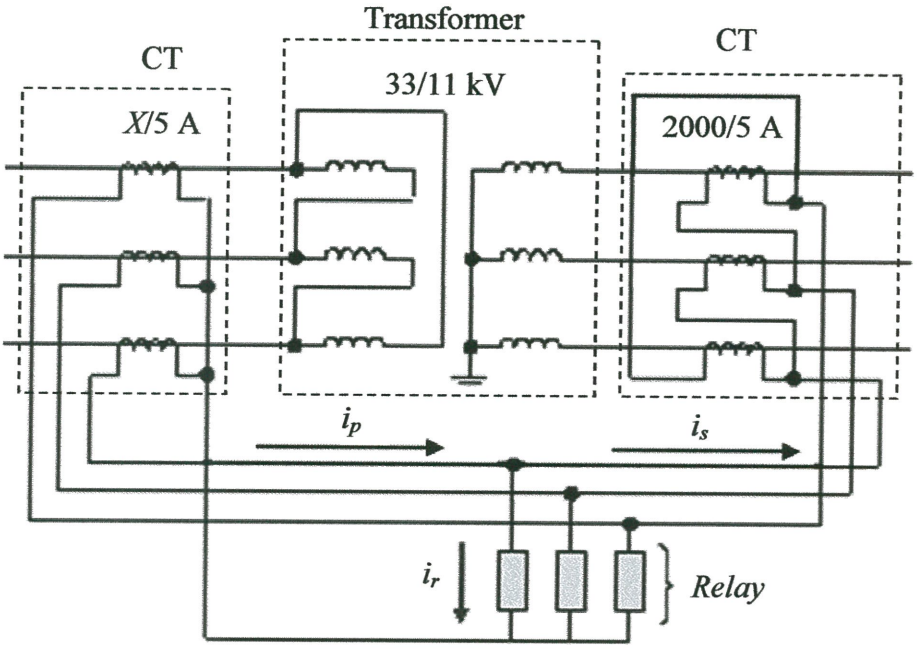

Figure Q5(b)