INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EEE2113: Electrical Power Systems & Machines**
Date of Examination	:	7 August 2020 (Friday)
Time	:	8.00am – 11.00am Reading Time : Nil
Duration	:	3 Hours

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

Examiner(s)	:	**Mr Richard Lai TF**
Chief Moderator	:	Mr Alan Wong Kam Mun

This paper consists of 7 printed pages, including the cover page

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
EEE2113: ELECTRICAL POWER SYSTEMS AND MACHINES
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) The diagram shown in Figure Q1 (a) represents a radial transmission system. The ratings and reactances of the various components are shown along with the nominal transformer line-voltages. A load of S.I.D. (Student Identity) MW at 0.8 p.f. lagging is taken from the 33 kV substation which is to be maintained at 30 kV. Determine:

(i) The load current. (10 marks)
(ii) The sending end voltage, Vs. (5 marks)

Use 100 MVA as a base for all analysis.

[Hints: Use your student ID last 2 digits for S.I.D MW value. Example, if your ID is P18010350, then the S.I.D value is 50. So, the load value is 50 MW.]

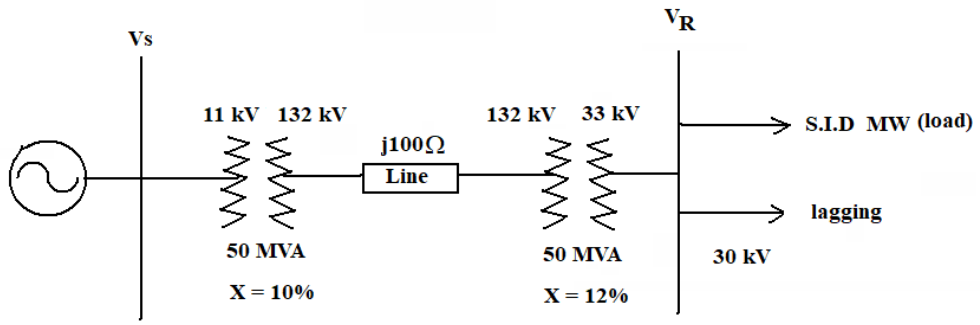

Figure Q1(a)

(b) For the network shown in Figure Q1(b), determine:

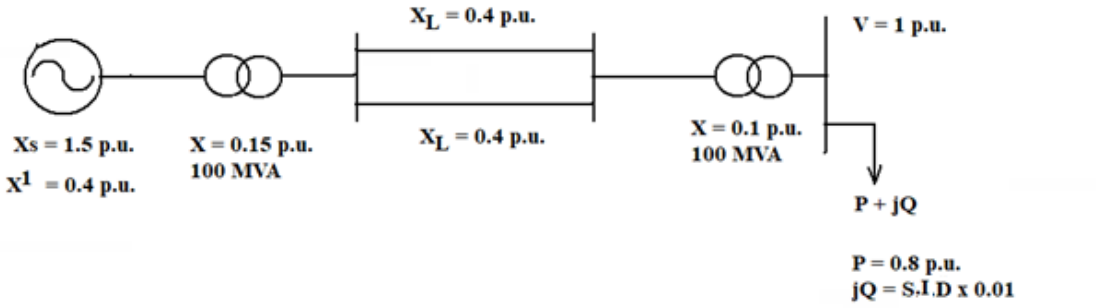

Figure Q1(b)

i. The maximum power when no regulator action. (3 marks)
ii. The maximum power when regulator in action but not continuous. (4 marks)
iii. The maximum power when terminal voltage is constant. (3 marks)

[Hints: Use your student ID last 2 digits for jQ value. Example, if your ID is P18010350, then the jQ value is 50 × 0.01 = 0.5. So, the jQ is 0.5 p.u.]

Question 2

(a) Given a series impedance, **Z** line parameter and **Y** are:

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1 & Z \\ 0 & 1 \end{bmatrix} \qquad \begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ Y & 1 \end{bmatrix}$$

For a network shown in Figure Q2(a), prove that:

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1+Z_1Y_2 & Z_3(1+Z_1Y_2)+Z_1 \\ Y_2 & 1+Y_2Z_3 \end{bmatrix}$$

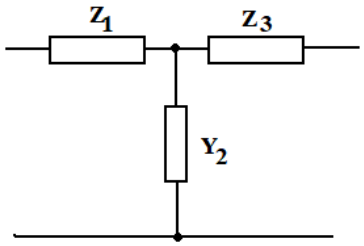

Figure Q2(a)

(6 marks)

(b) A given network shown in Figure Q2(b). Find the transmission parameters **A**, **B**, **C** and **D**. Prove that **AD - BC** = 1.

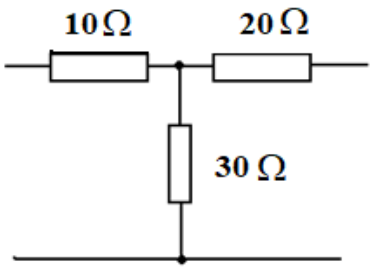

Figure Q2(b)

(15 marks)

(c) Figure Q2(c) shows the bundled of conductors in transmission lines. **STATE FOUR** advantages of bundled conductors in the transmission line.

Figure Q2(c)

(4 marks)

Question 3

(a) Discuss **FOUR** main methods of installing the underground cables.

(4 marks)

(b) Given the effective electrical parameters of a 3-phase, 66 kV, 50 Hz underground circuit, S.I.D km in length and comprising three single-core 200 mm^2 cables each of conductor radius 0.195 cm. The internal and external radii of the lead sheath are 2.5 and 2.8 cm, respectively. The cables are in touching equilateral formation and the sheaths are bonded to ground at several points. The conductor A.C. resistance

per kilometre at 15 °C is 0.0875 Ω/km and the resistivity of lead at the operating temperature may be assumed to be 23.2×10^{-6} Ω cm. (Conductor operating temperature assumed to be 65 °C and coefficient of temperature is 0.004). Determine:

(i) The resistance of the sheath. (4 marks)
(ii) Effective A.C. resistance and reactance per cable. (12 marks)

[Hints: Use your student ID last 2 digits for S.I.D km value. Example, if your ID is P18010350, then the S.I.D value is 50. So, the length in km is 50 km.]

(c) In an underground cable system with artificial cooling by water pipes, calculate the thermal resistance to heat flow presented by each pipe. and the pipe wall resistance. The pipe details are as follows:

Internal diameter = 0.75 inch
Material Polythene, g = 570 ℃ cm/W
Wall thickness = 0.125 inch

Coolant details (water) at 20 °C

$\eta = 0.994 \times 10^{-2}$ *g/cm-sec*
$k = 0.00598$ *(W/cm^2)(℃/cm)*
$\rho = 1$ *g/cm^3*
c = 4.2 J/g per ℃
Velocity flow = 7.95 ft/sec

(5 marks)

Question 4

(a) An 11.8 kV busbar is fed from three synchronous generators having the following ratings and reactances:

Generators	**MVA**	**Short Circuit Reactance, X' in p.u.**
G1	20	0.08
G2	60	0.1
G3	20	0.09

Determine the fault current and MVA is a three-phase symmetrical fault occurs on the busbar. The voltage base will be taken as 11.8 kV and the VA base as 60 MVA.

(5 marks)

(b) Figure Q4(b) shows a single line diagram represents a simple single phase power transmission. Vs is the sending voltage and Vr is the receiving end voltage. R1 and L1 are the transmission line parameter. R2 is the load connected in the network. Given that the frequency is 50 Hz and a switch is connected across L1 to show present and absence of the inductance. When switch is not closed, the voltage across R2 is 52.8 V. When the switch is closed, the voltage across R2 is 76 V or 77 V.

(i) Build and Simulate the circuit shown in Figure Q4(b) to show that when switch is closed, voltage across R2 is about 76 V or 77 V. (3 marks)

(ii) Increase Vr in the circuit by injecting the reactive component so that the voltage drops across R2 is also 76 V or 77 V. Shows your simulation results with calculation.

(9 marks)

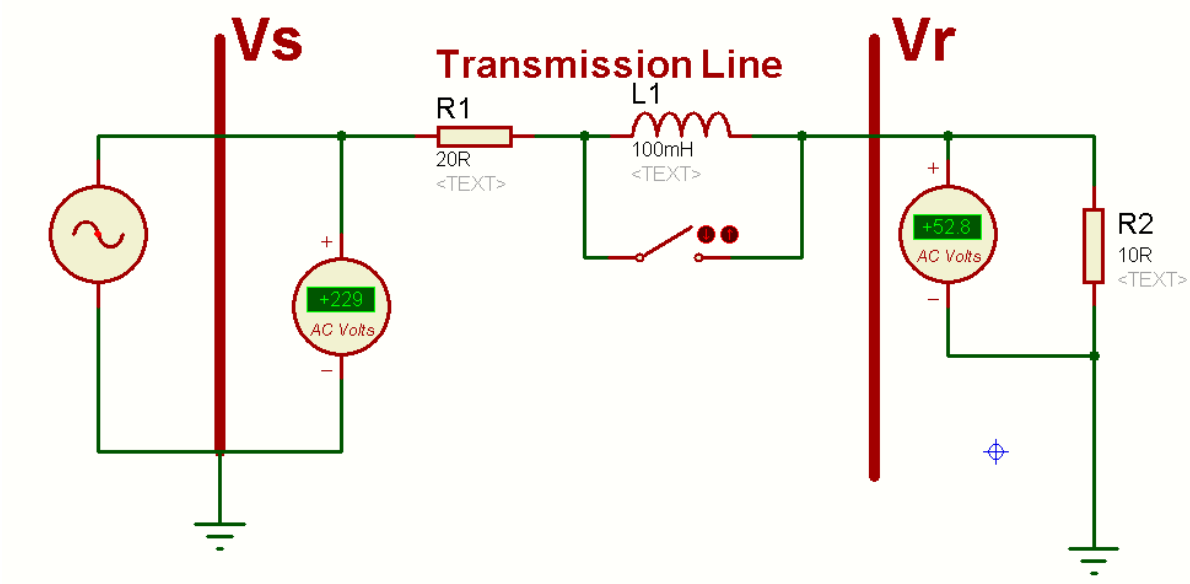

Figure Q4(b)

(c) Given the TNB tariff rate is 21.8 cent/kWh. The following shows the loads operation power in a day. Assume that these loads are operate based on their schedule timing for 30 days and continuous operate for about a month.

Loads	**Quantity**	**Power consumption in Watts**	**Hours of operation**
Fluorescent light	6	40	12
Ceiling fan	3	65	8
Air conditioner	2	1500	5
Refrigerator	1	500	24
Water heater	1	1000	1

(i) Determine total kWh for the loads operate in a day. (3 marks)

(ii) Determine the cost per day. (2 marks)

(iii) Determine the cost of energy consumption in a month (3 marks)

--THE END—

EEE 2113(F)April 20/CL LAI