INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2020**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EEE2113: Electrical Power Systems & Machines**
Date of Examination	:	17 December 2020 (Thursday)
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)	:	**Richard Lai Tian Fat**
Chief Moderator	:	Johnny Wong Kee Hui

*This paper consists of **6** 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: AUGUST 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) Given the circuit shown in Figure Q1(a):

(i) Find the current in each line (3 marks)
(ii) Find the voltage across the inductor terminals (2 marks)
(iii) Use MultiSIM software to verify the current in each branch and the voltage across each branch (10 marks)

[Hints: Ensure you print screen the results of simulation and paste them into your answer scripts]

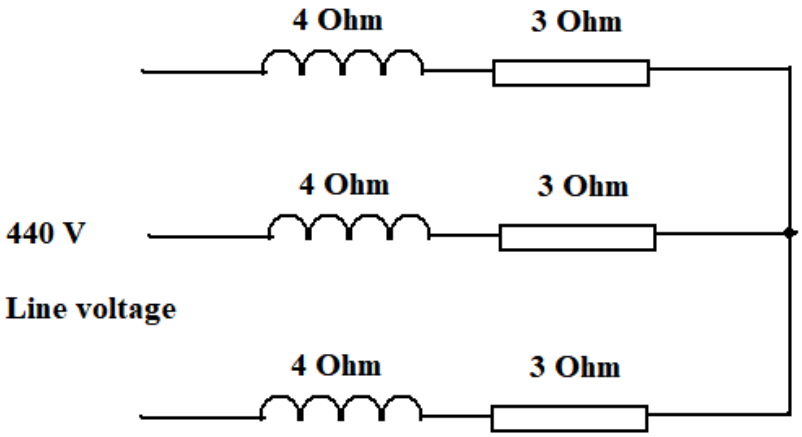

Figure Q1(a)

(b) A 30 MVA, 15 kV, 60 Hz AC generator has a synchronous reactance of 1.2 p.u. and a resistance of 0.02 p.u. Find:

(i) The base voltage, base power and base impedance (3 marks)
(ii) The actual value of the synchronous reactance (2 marks)
(iii) The actual winding resistance per phase (3 marks)
(iv) The total full-load copper losses (2 marks)

Question 2

(a) Given a short transmission model shown in Figure Q2(a):

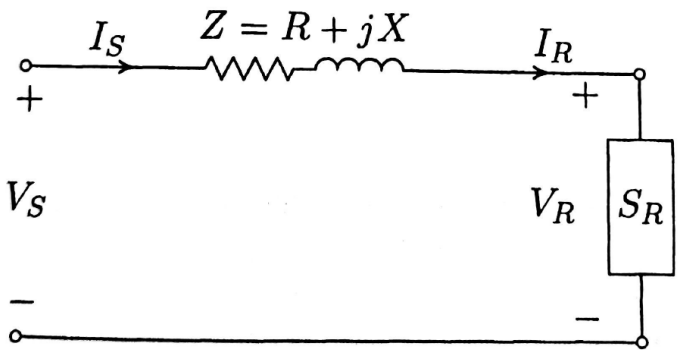

Figure Q2(a)

(i) Show that:

$$\begin{bmatrix} Vs \\ Is \end{bmatrix} = \begin{bmatrix} 1 & Z \\ 0 & 1 \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

(8 marks)

(ii) Sketch the relationship of V_R, V_S and I_R in the form of vector if the power factor is lagging.

(3 marks)

(b) A 220 kV short transmission is 40 km long. The resistance per phase is 0.15 Ω per km and the inductance is 1.3263 mH per km. The shunt capacitance is negligible. Use the short transmission line model to find:

(i) The voltage and power at the sending end (6 marks)
(ii) The voltage regulation (2 marks)
(iii) The efficiency when the line is supply a three phase load of 318 MVA at 0.8 power factor lagging at 220 kV. (2 marks)

(c) State FOUR factors that influence the transmission of electrical power.

(4 marks)

Question 3

(a) Given a transmission line that produce a magnetic flux when carrying the current as seen in Figure Q3(a). Based on the information given, shows that the inductance per meter of the line is given by:

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$$L = \frac{\mu}{2\pi} \ln \frac{D_2}{D_1}$$

(5 marks)

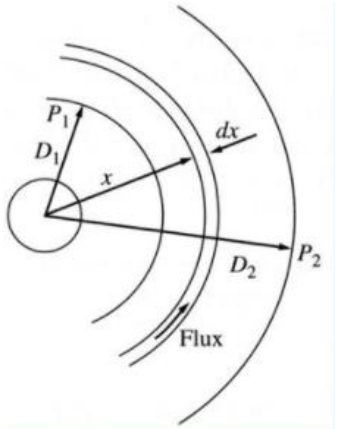

Figure Q3(a)

(b) State FIVE main objectives of fault analysis? (5 marks)

(c) An 11.8 kV bus bar is fed from three synchronous generators having the following ratings and reactances (See Figure Q3(c)):

20 MVA, X' 0.08 p.u. 60 MVA, X' 0.1 p.u. 20 MVA, X' 0.09 p.u.

Find the fault current if a three phase symmetrical fault occurs on the bus bar.
[Hints: Take the voltage base is 11.8 kV and the VA base as 60 MVA].

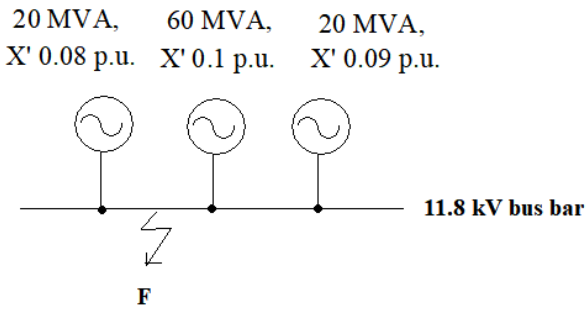

Figure Q3(c)

(3 marks)

(d) In the radial transmission system shown in Figure Q3(d) all per unit values are referred to the voltage bases shown and 100 MVA. Find the power factor at which the generator must operate.

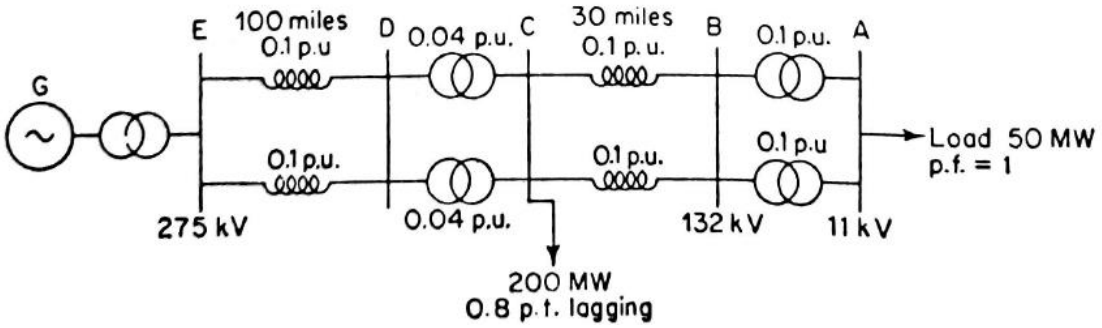

Figure Q3(d)

(7 marks)

(e) A 132 kV line is fed through an 11/132 kV transformer from a constant 11 kV supply. At the load end of the line the voltage is reduced by another transformer of nominal ratio 132/11 kV. The total impedance of the line and transformers at 132 kV is (25 + j66) Ω. Both transformers are equipped with tap-changing facilities which are so arranged that the product of the two off-nominal settings is unity. If the load on the system is 100 MW at 0.9 p.f. lagging, find the settings of the tap-changers required to maintain the voltage of the load bus bar at 11 kV.

(5 marks)

Question 4

(a) A consumer has the following connected load: 10 lamps of 60 W each and two heaters of 1000 W each. His maximum demand is 15000 W. On the average, he uses 8 lamps for 5 hours a day and each heater for 3 hours a day. Find his total load, monthly energy consumption and load factor.

(4 marks)

(b) The load survey of a small town gives the following categories of expected loads as shown below:

	Type	Load in kW	% D.F.	Group D.F.
1.	Residential lightning	1000	60	3
2.	Commercial lightning	300	75	1.5
3.	Street lightning	50	100	1.0
4.	Domestic lightning	300	50	1.5
5.	Industrial power	1800	55	1.2

Find the kVA capacity of the sub-station assuming a station power station of 0.8 lagging?

(12 marks)

(c) A power station has a load cycle as under:

- 60 MW for 6 hours;
- 200 MW for 8 hours;
- 160 MW for 4 hours;
- 100 MW for 6 hours

If the power station is equipped with 4 sets of 75 MW each, find the load factor and the capacity factor from the above data.

(6 marks)

(d) Define the flat rate tariff. (3 marks)

~THE END~