INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EEE2113: Electrical Power Systems & Machines**
Date of Examination	:	8 December 2021 (Wednesday)
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. All questions carry equal marks.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

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

*This paper consists of **5** 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 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Question 1

(a) Show the series DC motor and Shunt DC motor schematic diagram and winding diagrams.

(4 marks)

(b) A shunt DC motor rotating at 1500 r/min is fed by a 120 V source. The line current is 51 A and the shunt field resistance is 120 Ω. If the armature resistance is 0.1 Ω. Find:

(i) The current in armature (2 marks)
(ii) The counter e.m.f. (3 marks)
(iii) The mechanical power developed by the motor (4 marks)

(c) A generator shown in Figure Q1(c) generates 240 V between adjacent brushes and delivers a current of 2400 A to the load.

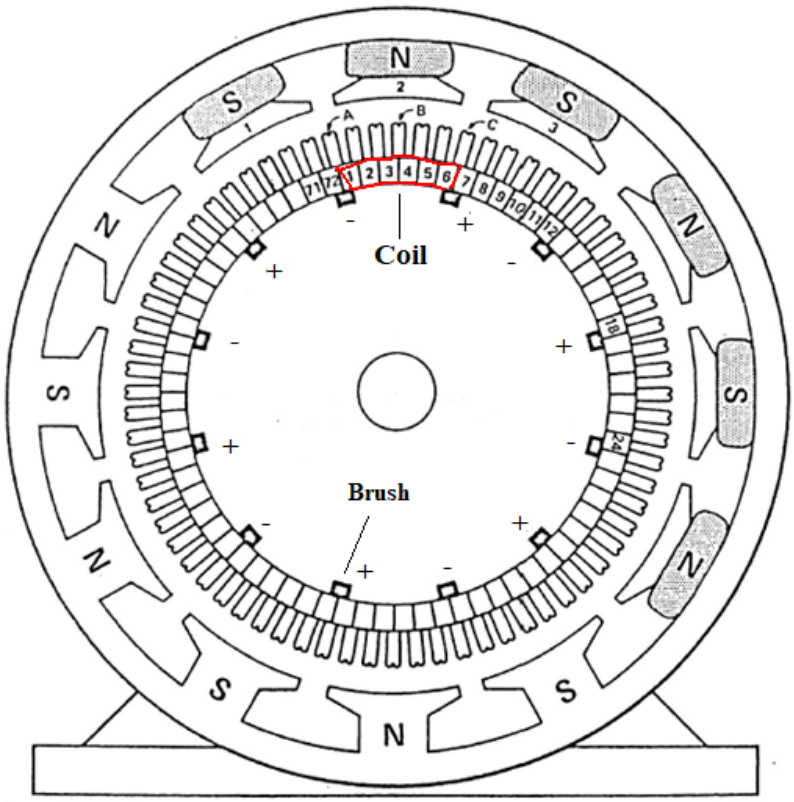


Figure Q1(c)

Find:

(i) The current delivered per brush set (2 marks)
(ii) The current flowing in each coil (2 marks)
(iii) The average voltage induced per coil (2 marks)

(d) A 2000 kW, 500 V, variable speed DC motor is driven by a 2500 kW DC generator using Ward-Leonard control system shown in Figure Q1(d). The total resistance of the DC motor and DC generator armature circuit is 10 mΩ. The DC motor turns at a nominal speed of 300 r/min, when E_o is 500 V. Find the DC motor torque and speed when E_s = 400 V and E_o = 380 V.

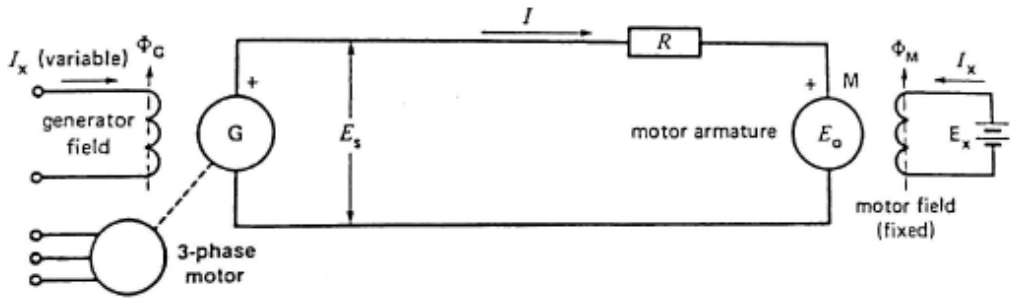


Figure Q1(d)

(6 marks)

Question 2

(a) A single phase transformer rated at 3000 kVA, 69 kV/4.16 kV, 60 Hz has a total internal impedance Z_p of 127 Ω, referred to the primary side.

Find:

(i) The rated primary and secondary currents (2 marks)
(ii) The voltage regulation from no load to full load for a 2000 kW resistive load, knowing that the primary voltage is fixed at 69 kV.

(8 marks)

(b) A 3 phase, 208 V induction motor having a synchronous speed of 1200 r/min runs at 1140 r/min when connected to a 215 V line and driving a constant torque speed load. Find the speed if the voltage increases to 240 V.

(7 marks)

(c) Define the following torques for the synchronous motor:

(i) Starting torque. (2 marks)
(ii) Running torque. (2 marks)
(iii) Pull in torque. (2 marks)
(iv) Pull out torque. (2 marks)

Question 3

(a) Determine the A,B, C and D of the transmission line parameters for the network shown in Q3(a). Present the parameters in the form of matrix.

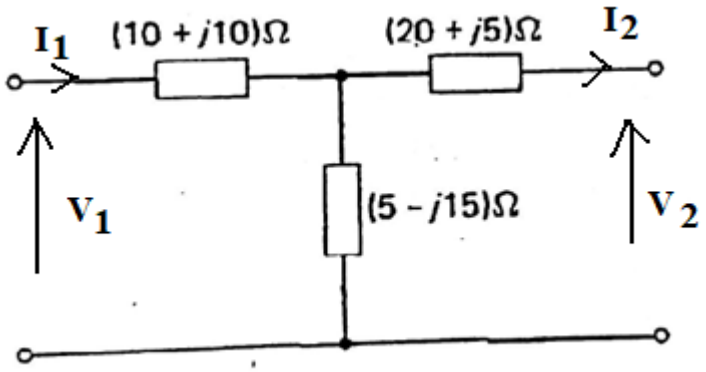
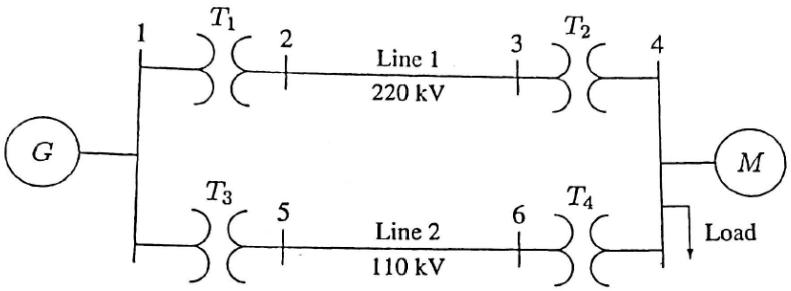


Figure Q3(a)

(10 marks)

(b) The one-line diagram of a three phase power system is shown in Figure Q3(b). Select a common base of 100 MVA and 22 kV on the generator side. Draw an impedance diagram with all impedances including the load impedance marked in per-unit.



G:	90 MVA	22 kV	X = 18 %
T_1:	50 MVA	22/220 kV	X = 10 %
T_2:	40 MVA	220/11 kV	X = 6.0 %
T_3:	40 MVA	22/110 kV	X = 6.4 %
T_4:	40 MVA	110/11 kV	X = 8.0 %
M:	66.5 MVA	10.45 kV	X = 18.5 %

Figure Q3(b)

(15 marks)

Question 4

(a) Defined what is symmetrical fault in the power system refers to single phase.

(1 marks)

(b) 100 MVA, 13.8 kV, Y-connected, 3 phase 60 Hz synchronous generator is operating at the rated voltage and no load when a 3 phase fault occurs at its terminals. Its reactances per unit to the machine's own base are:

$X_s = 1.00$ $X' = 0.25$ $X'' = 0.12$

Where X_s is the reactance of the generator, X' is the transient reactance and X" is the subtransient reactance. Assuming the time constant are are T' = 1.1 second and T" = 0 .04 second. Given that the initial DC component average 50% of the initial AC component. Find:

(i) AC component of the current in this generator at the instant after the fault.

(4 marks)

(ii) Total AC + DC current right after the fault.

(1 marks)

(iii) AC components of the currents after 2 cycles and after 5 seconds.

(3 marks)

(c) Explain simple tariff and two part tariff. (5 marks)

(d)

A two-bus system shown in Figure Q4(d). If 100 MW is transmitted from plant 1 to the load, a transmission loss of 10 MW is incurred. Find the equivalent generation for each plant and the power received by load when the system λ is RM 25/ MWh.

(11 marks)

$$\frac{dC_1}{dP_{G1}} = 0.02P_{G1} + 16 \qquad \text{RM/ MWh}$$

$$\frac{dC_2}{dP_{G2}} = 0.04P_{G1} + 20 \qquad \text{RM/MWh}$$

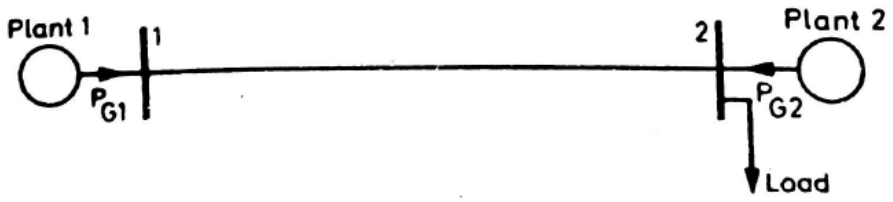


Figure Q4(d)

~THE END~