

**FINAL
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : April 2022

Programme : Diploma In Mechanical Engineering (DMEN)

Course : EEE 2115: Electrical Power & Machines

Date of Examination : 05 August 2022 (Friday)

Time : 12.00pm- 02.30pm Reading Time : Nil

Duration : 02 hours 30 minutes

Note: 30 minutes is added into the duration of the examination to factor in any connectivity matters and for you to scan and upload your scripts

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) : Khadijah Kamarulazizi

Chief Moderator : Manickam

This paper consists of 4 printed pages, including the cover page

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EEE 2115: ELECTRICAL POWER & MACHINES
EXAMINATION: APRIL 2022 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) Explain about breakdown torque, locked- rotor torque and locked rotor as applied to an induction motor
(8 marks)

The power input to the rotor of a 415 V, 50 Hz, 6-poles, 3-phase induction motor is 75kW.

- (b) The rotor voltage is observed to make 120 complete alternations per minute. The stator losses is negligible. Determine the:
- (i) Slip. (4 marks)
 - (ii) Rotor speed. (5 marks)
 - (iii) Rotor copper loss. (4 marks)
 - (iv) Mechanical power developed. (4 marks)

Question 2

- (a) A 750 kW, 11 kV, 3-phase, star-connected synchronous motor has a synchronous reactance of $35 \Omega/\text{phase}$ and negligible resistance. Determine the excitation voltage per phase when the motor is operating on full load at 0.8 power factor leading with an efficiency of 93%. (10 marks)
- (b) A 100 hp, 3-phase, star-connected, 60 Hz, 420 V ,4-pole cylindrical rotor synchronous motor is operating at rated conditions and at 80 percent power-factor leading. The efficiency, excluding field and stator losses is 96%, and the synchronous reactance is $2.72 \Omega/\text{phase}$. Determine the:
- (i) Developed torque.. (4 marks)
 - (ii) Armature current. (5 marks)
 - (iii) Excitation voltage. (4 marks)
 - (iv) Power angle. (2 marks)

Question 3

- (a) A 1000 kVA, 6.6 kV, 3-phase, star connected synchronous generator has a synchronous reactance of $25 \Omega/\text{phase}$. It supplies full-load current at 0.8 lagging power factor and at rated terminal voltage.
- (i) Calculate the excitation voltage, E_f . (9 marks)
- (ii) Calculate the new terminal voltage V_T for the same excitation as computed in (i) above when the generator supplies full load current at 0.8 leading power factor. (6 marks)
- (b) A factory takes 600 kVA at 0.6 lagging power factor. A synchronous motor is to be installed to raise the power factor to 0.9 lagging when the synchronous motor is taking in 200 kW. Stretch the power phase diagram and calculate the corresponding apparent power (in kVA) taken by the synchronous motor and the power factor at which it operates. (10 marks)

Question 4

- (a) Define synchronous speed of a three-phase induction motor. State the factors that influence synchronous speed. (6 marks)
- (b) A 240 V, 10 hp, 4-pole, 50 Hz, star-connected induction motor has a full load slip of 6 %. Calculate the:
- (i) Synchronous speed of the motor. (4 marks)
- (ii) Rotor speed at the rated load. (4marks)
- (iii) Rotor voltage frequency at the rated load. (5 marks)
- (iv) Shaft torque at the rated load. (6 marks)

~THE END~