



Electrical Machines II (ET-222)
Semester / Session: 4th / Fall2018
Mid-Term Exam: Spring-2020

Date: 16 – 04 - 2020

Time Allowed: 150 minutes

Total Marks = 30

Note:

1. Attempt all questions.
2. Midterm is close book and close notes/Lecture slides.
3. Attempt the question in 150 Minutes and during that time make sure your books and notes are closed.
4. Try to explain your solutions in clear unambiguous words or figures/ diagrams or mathematical expressions. Marks will not be awarded on what you intended to write but what you actually wrote down.
5. Scan the hand written midterm question paper and answer book and send through email at ateeq.shaheen@uos.edu.pk on Friday dated 17/04/2020 before 10:00AM in morning.
6. Name the scan file as “Mid_your name_your ID.pdf” e.g. Mid_Ateeq_BEEF19M003.pdf
7. Write the subject of the email as “Mid term paper EM-II”. Do not email without subject.

Q # 01

Marks: 10

PLO: 04, CLO: 01

A 460-V, 85-hp, four-pole, Y-connected induction motor has the following parameters:

$$R_1 = 0.058 \Omega \quad R_2 = 0.037 \Omega \quad X_M = 9.24 \Omega \quad X_1 = 0.320 \Omega$$

$$X_2 = 0.386 \Omega \quad P_{F\&W} = 650 \text{ W} \quad P_{\text{misc}} = 150 \text{ W} \quad P_{\text{core}} = 600 \text{ kW}$$

For a slip of 0.025, find

- a) The line current I_L
- b) The stator power factor
- c) The rotor power factor
- d) The rotor frequency
- e) The stator copper losses P_{SCL}
- f) The air-gap power P_{AG}
- g) The power converted from electrical to mechanical form P_{conv}
- h) The induced torque
- i) The load torque
- j) The overall machine efficiency

Q # 02

Marks: 10

PLO: 04, CLO: 01

A wound-rotor induction motor is operating at rated voltage and frequency with its slip rings shorted and with a load of about 25 percent of the rated value for the machine. If the rotor resistance of this machine is doubled by inserting external resistors into the rotor circuit, explain what happens to the following:

- a) Motor speed nm



- b) The rotor current
- c) The induced torque
- d) Output power
- e) P_{RCL} .
- f) Overall efficiency

Q # 03

Marks: 5+5

PLO: 04 , CLO: 01

- A. A 220 V, 3-phase, 50 Hz, two-pole induction motor is running at a slip of 4.5 percent.
Find:
- a) The speed of the magnetic fields in radians per minute
 - b) The speed of the rotor in radians per minute
 - c) The slip speed of the rotor
 - d) The rotor frequency in hertz
- B. Write brief answers for the following questions.
- e) What will be the rotor copper loss at high slip value?
 - f) How the starting current is reduced in squirrel cage induction motor?
 - g) Derive the rotor circuit equivalent model
 - h) What will be the value of P_{AG} at high slip?