

University of Jordan
School of Engineering
Mechatronics Eng. Department



Summer Semester 2020/2021
August, 19, 2021

Mid Term Exam
Total marks: 30 marks
Examination weight: 30%

Electrical Machines
(0908321)
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No. of questions: 3
No. of pages:3
Examination Time: 60 Minutes

Q1) Answer the following questions.

(8 Marks)

1. According to the linear DC machine, when the motor effect happens and when does it stop?
2. Why do the electricity generation companies use transformers before and after transmission?
3. List four categories of losses occurring in DC machines.
4. What are brushless dc motor types

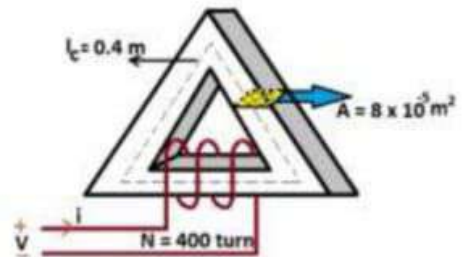




Q2) Solve the following four parts.

(16 Marks)

1. If the total flux inside the core shown in the figure is $16 \times 10^{-5} \text{ Wb}$ and the magnetic field intensity in the core is $800 \text{ A} \cdot \text{turns/m}$, find:
(a) The flux density in the core
(b) The current i needed to flow in the coil.
Assume uniform flux and cross-section area (A) through the whole core length (l_c)



2. If we have: 220KVA, ideal, 50Hz, 220/2200V, step-up transformer. Answer the following questions:
(a) The transformer turns ratio.
(b) The value of primary current
(c) The value of secondary current.
(d) The value of secondary impedance as seen from the primary side (referred)

3. The figure shows a rotating loop between curved 6 pole faces, the poles cover 70% of the rotor area, for the rotor the length is 50 cm and the radius is 20 cm. The rotor has wave-windings ($a = 2$) with 40 coils each 4 turns, If the average flux density under each pole face is 0.4 T; answer the following questions:
(a) The total number of conductors in the rotor.
(b) The geometry constant of the rotor.
(c) The flux.
(d) The induced rotor voltage if the speed of the rotor is 800 rpm



4. A 50-hp, 220-V, shunt dc motor has a rated armature current of 160 A, and a rated field current of 5 A. The armature resistance R_A is 0.08Ω , the field resistance R_F is 40Ω . The brush voltage drop is assumed to be 2.5 V. The friction and windage losses are 600 W, the core losses are 1800 W, and the stray losses are negligible. Answer the following questions:
(a) How much power is output from this motor at rated conditions?
(b) What is the motor's efficiency?



Q3) Design the hardware with approximate needed calculation for the following description (Your design should concentrate on electrical machine related components). (6 Marks)

4.8V Cordless Screwdriver Forward Reverse Action LED Indicator Palm-Sized

- Forward and reverse action
- Palm-sized compact design
- Supplied with screwdriver bits and AC mains charger
- Built-in LED indicators
- No-load speed 180 RPM
- Precise Control
- Variable Speed
- Max Torque 6Nm

