Solution Key

جامعة بيرزيت

BIRZEIT UNIVERSITY

Electrical and Computer Engineering Department

Electrical Machines ENEE 2408

Short Exam # 5 (10*mins*)

Student Name: **ID:** **January 8, 2025**

A 10hp, 300V, shunt DC motor has an R_A=0.5 Ω. When loaded, the motor was found to draw an armature current of 30A and to have a speed of 2000rpm. If the rotational losses were 500W then:

a) Calculate the induced torque

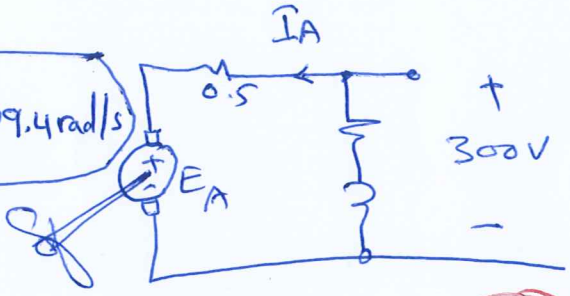
b) Calculate the efficiency of the motor

Solution

a) $n = 2000 rpm \Rightarrow \omega = \frac{2000 \times 2\pi}{60} = 209.4 rad/s$ (1.5)

$I_A = 30A$

$P_{F\&W} = 500W$



$T_{ind} = \frac{P_{conv}}{\omega} = \frac{E_A I_A}{\omega}$

But $E_A = 300 - R_A I_A \Rightarrow E_A = 300 - 0.5(30) =$ **285 V = E_A** (1.5)

$\therefore P_{conv} = 285 \times 30 =$ **8550 W = P_{conv}** (2)

$\therefore T_{ind} = \frac{8550}{209.4} =$ **40.83 N.m** (2)

b) $\eta = \frac{P_{out}}{P_{in}} \times 100\%$

$P_{out} = P_{conv} - P_{F\&W} = 8550 - 500 =$ **8050 W = P_{out}** (1)

$P_{in} = V_T I_A = 300(30) =$ **9000 W = P_{in}** (1)

$\therefore \eta = \frac{8050}{9000} \times 100\% =$ **89.44 % = η** (1)