UNIVERSITY OF ALASKA FAIRBANKS

COLLEGE OF ENGINEERING & MINES

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SPRING 2022

Student Name Jacob Guenther

Course Name	Course Number	Course Section	Course CRN	Examination
INTRODUCTION TO ELECTRICAL AND COMPUTER ENGINEERING	EE F102	F01	34544	QUIZ
Examination Date	**Examination Day**	**Examination Time**	**Examination Venue**	**Number of Printed Pages**
31 JAN 2022	MONDAY	10:00 – 10:15	DU 252	6
Number of Questions	**Maximum Points**	**Examination Type**	**Materials Allowed?**	**Calculators Allowed?**
1	50	CLOSED BOOK	NO	YES
Course Instructor				
DR. MAHER AL-BADRI				

Formulas you may need:

$$\text{Life (h)} = \frac{\text{Capacity (Ah)}}{\text{Drain (A)}}$$

$$P = VI$$

$$\eta = \frac{P_{out}}{P_{in}}$$

1 hp=746 W

$$\eta = \frac{P_{out}}{P_{out} + P_{loss}}$$

Problem QZ-2-1 — Points Distribution

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A dc motor operates at 120 V.
The motor's full load is 10 hp.
The motor is used to operate a mechanical load which accounts for 75% of the motor full load.
The load draws a current of 50 A.

For this operating conditions:

(a) Determine the power, in watts, drawn by the load. (15)

(b) Determine the power, in watts, the motor draws from the electric power supply to operate the load. (15)

(c) Determine the efficiency of the motor at this operating condition. (10)

(d) Determine the total losses in the motor. (10)

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SOLUTION:
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Determine the power in watts drawn by the load

$1\,hp = 746\,W$

operates at 120V

full load is 10 hp $10 \cdot 746 = 7460\,W$ full load

motor accounts for 75% of load

load draws a current of 50A

Power P

$P = VI$

$V = 120\,V$

$I = 50\,A$

$P = 120\,V \cdot 50A$

a) $P = 6000\,W$

~~$P_{in} = 6000W \cdot 0.75$~~

~~b) $= 4500\,W$~~

~~$\eta = \frac{P_{out}}{P_{in}}$~~

~~$\eta = \frac{4500\,W}{6000\,W}$~~

~~c) $\eta = 0.75$~~

$P_L = 7460W\ 0.75$

b) $P_L = 5595\,W$

$\eta = \frac{P_{out}}{P_{in}}$

$= \frac{5595\,W}{6000\,W}$

c) $\eta = 0.9325$

$\eta = \frac{P_{out}}{P_{out} + P_{loss}}$

$\eta \cdot (P_{out} + P_{loss}) = P_{out}$

$\eta P_{out} + \eta P_{loss} = P_{out}$

$\eta P_{loss} = P_{out} - \eta P_{out}$

$P_{loss} = P_{out} - \eta P_{out}$

d)

$P_{loss} = \frac{5595 - 0.75 \cdot 5595}{5595} = 1865\,W$