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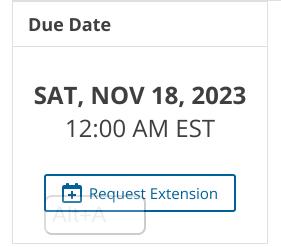Grades   Communication
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← **Phys 232, section 001, Fall 2023**

🎓 INSTRUCTOR

Chapter 26 Circuits DC (Homework) Evangelos Skoumbourdis
Liberty University

Current Score

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14
POINTS	–/1	–/3	–/10	–/1	–/2	**2/2** ✓	–/8	–/2	–/2	–/3	–/2	–/3	–/3	–/3

TOTAL SCORE

2/45	**4.4%**

Due Date

SAT, NOV 18, 2023
12:00 AM EST

📅 Request Extension

Alt+A

Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

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1. **[–/1 Points]**   **DETAILS**   **SERPSE10 26.1.OP.001.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

An aluminum wire having a cross-sectional area equal to 5.20×10^{-6} m^2 carries a current of 6.00 A. The density of aluminum is 2.70 g/cm^3. Assume each aluminum atom supplies one conduction electron per atom. Find the drift speed of the electrons in the wire.

[   ] mm/s

Need Help? [Read It]

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2. **[–/3 Points]**   DETAILS   **SERPSE10 26.1.OP.003.MI.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

The electron beam emerging from a certain high-energy electron accelerator has a circular cross section of radius **1.55** mm.

(a) The beam current is **7.55** μA. Find the current density in the beam assuming it is uniform throughout.

[   ] A/m^2

(b) The speed of the electrons is so close to the speed of light that their speed can be taken as 300 Mm/s with negligible error. Find the electron density in the beam.

[   ] m^{-3}

(c) Over what time interval does Avogadro's number of electrons emerge from the accelerator?

[   ] s

Need Help?   [Read It]   [Master It]

3. **[–/10 Points]** | DETAILS | SERPSE10 26.1.OP.003.MI.SA.

| MY NOTES | | ASK YOUR TEACHER | | PRACTICE ANOTHER |

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

The electron beam emerging from a certain high-energy electron accelerator has a circular cross section of radius 1.30 mm.

(a) The beam current is 8.30 µA. Find the current density in the beam assuming it is uniform throughout.

(b) The speed of the electrons is so close to the speed of light that their speed can be taken as 300 Mm/s with negligible error. Find the electron density in the beam.

(c) Over what time interval does Avogadro's number of electrons emerge from the accelerator?

Need Help? [Read It]

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4. **[–/1 Points]** | DETAILS | SERPSE10 26.1.P.003.

| MY NOTES | | ASK YOUR TEACHER | | PRACTICE ANOTHER |

In the Bohr model of the hydrogen atom, an electron in the 5th excited state moves at a speed of 8.76 × 10^4 m/s in a circular path of radius 1.32 × 10^{-9} m. What is the effective current associated with this orbiting electron?

[   ] mA

Need Help? [Read It]

5. **[–/2 Points]**   DETAILS   SERPSE10 26.1.P.007.

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

The quantity of charge q (in coulombs) that has passed through a surface of area 2.05 cm^2 varies with time according to the equation $q = 7t^3 + 3t + 6$, where t is in seconds.

(a) What is the instantaneous current through the surface at $t = 1.10$ s?

[   ] A

(b) What is the value of the current density?

[   ] kA/m^2

Need Help?   Read It   Watch It

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6. **[2/2 Points]**   DETAILS   PREVIOUS ANSWERS   SERPSE10 26.2.OP.005.

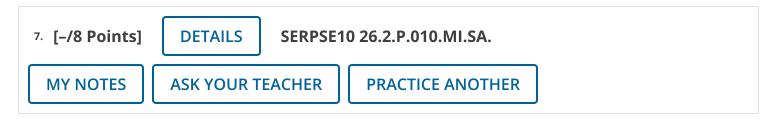MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

(a) A lightbulb has a resistance of 155 Ω when operating with a potential difference of 145 V across it. What is the current in the lightbulb (in mA)?

935.4838   ✔   mA

(b) **What If?** What would be the current in the lightbulb (in mA) if it were used in Nigeria, where the potential difference across it would be 240 V?

1548.3870   ✔   mA

Need Help?   Read It   Watch It

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7. [–/8 Points]   DETAILS   SERPSE10 26.2.P.010.MI.SA.

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

A wire 50.0 m long and 2.00 mm in diameter is connected to a source with a potential difference of 9.11 V, and the current is found to be 36.0 A. Assume a temperature of 20.0°C and, using this table, identify the metal out of which the wire is made.

Need Help? | Read It |

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8. [–/2 Points]   DETAILS   SERPSE10 26.2.P.013.MI.

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

Suppose you wish to fabricate a uniform wire from 1.50 g of copper. The wire is to have a resistance of $R = 0.340$ Ω and all the copper is to be used.

(a) What must be the length of this wire?

[   ] m

(b) What must be the diameter of this wire?

[   ] μm

Need Help? | Read It | | Master It |

9. [–/2 Points]   **DETAILS**   **SERPSE10 26.6.OP.018.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

A toaster is rated at 0.87 kW when connected to a 120 V source.

(a) What current (in A) does the toaster carry?

[   ] A

(b) What is its resistance (in Ω)?

[   ] Ω

Need Help?   Read It

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10. [–/3 Points]   **DETAILS**   **SERPSE10 26.6.OP.020.MI.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

(a) A well-insulated electric water heater warms 123 kg of water from 20.0°C to 43.0°C in 23.0 min. Find the resistance (in Ω) of its heating element, which is connected across a 240 V potential difference.

[   ] Ω

(b) **What If?** How much additional time (in min) would it take the heater to raise the temperature of the water from 43.0°C to 100°C?

[   ] min

(c) What would be the total amount of time (in min) required to evaporate all of the water in the heater starting from 20.0°C?

[   ] min

Need Help?   Read It   Master It

11. **[–/2 Points]**   DETAILS   **SERPSE10 26.6.OP.021.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

Batteries are rated in terms of ampere-hours (A · h). For example, a battery that can produce a current of 2.00 A for 3.00 h is rated at 6.00 A · h.

(a) What is the total energy stored in a 9.0-V battery rated at 57.0 A · h?

[_____] kWh

(b) At $0.0590 per kilowatt-hour, what is the value of the electricity produced by this battery?

$ [_____]

Need Help?   [Read It]   [Watch It]

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12. **[–/3 Points]**   DETAILS   **SERPSE10 26.6.OP.023.**

MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

A spool of aluminum wire 290 m long and with a diameter of 0.440 mm is at 20.0°C. For aluminum, the resistivity is 2.82×10^{-8} Ω · m and the temperature coefficient of resistivity is 3.90×10^{-3} (°C)$^{-1}$.

(a) What is the magnitude of the electric field (in V/m) in the wire if it carries a current of 0.450 A?

[_____] V/m

(b) What is the electric power (in W) delivered to the spool while it carries a current of 0.450 A?

[_____] W

(c) What is the power (in W) delivered to the spool if the potential difference across the wire is held constant and the temperature is increased to 280°C?

[_____] W

Need Help?   [Read It]

13. **[–/3 Points]**   DETAILS   **SERPSE10 26.6.OP.026.**
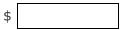
MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

The mechanical power output of an electric motor is 2.40 hp. The motor is connected to a 120 V source and is 83.0% efficient in converting power that it takes in by electrical transmission into mechanical power. Determine the following.

(a)   current (in A) delivered to the motor

[   ] A

(b)   energy (in MJ) delivered to the motor by electrical transmission in 2.00 h of operation

[   ] MJ

(c)   the cost to run the motor (in dollars) for 2.00 h, if the electric company charges $0.110/kWh

$ [   ]

Need Help?   Read It

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14. **[–/3 Points]**   DETAILS   **SERPSE10 26.6.P.027.**
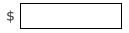
MY NOTES   ASK YOUR TEACHER   PRACTICE ANOTHER

The cost of energy delivered to residences by electrical transmission varies from $0.070/kWh to $0.258/kWh throughout the United States; $0.110/kWh is the average value.

(a) At this average price, calculate the cost of leaving a 140-W porch light on for two weeks while you are on vacation?

$ [   ]

(b) At this average price, calculate the cost of making a piece of dark toast in 3.00 min with a 915-W toaster?

$ [   ]

(c) At this average price, calculate the cost of drying a load of clothes in 40.0 min in a 5.90×10^3-W dryer?

$ [   ]

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