

# i Cover Sheet December 2021

Department of Physics

Examination paper for TFY4185 Measurement Technique / Måleteknikk

Examination date: 17 December 2021

Examination time (from-to): 09:00-13:00

Permitted examination support material: All support material is allowed

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Technical support during examination: Orakel support services:

Link: [innsida.ntnu.no/wiki/-/wiki/English/Orakel+Support+Services](https://innsida.ntnu.no/wiki/-/wiki/English/Orakel+Support+Services)

Phone: +47 73 59 16 00

## OTHER INFORMATION

Only contact academic contact in case of errors or insufficiencies in the question set.

**Saving:** Answers written in Inspira are automatically saved every 15 seconds. If you are working in another program remember to save your answer regularly.

**Cheating/Plagiarism:** The exam is an individual, independent work. *Examination aids are permitted.* All submitted answers will be subject to plagiarism control. Read more about cheating and plagiarism here: [innsida.ntnu.no/wiki/-/wiki/English/Cheating+on+exams](https://innsida.ntnu.no/wiki/-/wiki/English/Cheating+on+exams)

**Notifications:** If there is a need to send a message to the candidates during the exam (e.g. if there is an error in the question set), this will be done by sending a notification in Inspira. A dialogue box will appear. You can re-read the notification by clicking the bell icon in the top right-hand corner of the screen. All candidates will also receive an SMS to ensure that nobody misses out on important information. Please keep your phone available during the exam.

**Weighting:** *Each correct answer is weighted 4 points. Each incorrect or blank answer is 0 points. Answers are not necessarily exact. You must choose the best or closest answer.*

## ABOUT SUBMISSION

**Your answers will be submitted automatically when the examination time expires and the test closes**, if you have answered at least one question. This will happen even if you do not click "Submit and return to dashboard" on the last page of the question set. You can reopen and edit your answer as long as the test is open. If no questions are answered by the time the examination time expires, your answers will not be submitted.

**Withdrawing from the exam:** If you wish to submit a blank test/withdraw from the exam, go to the menu in the top right-hand corner and click "Submit blank". This **can not** be undone, even if the test is still open.

**Accessing your answer post-submission:** You will find your answer in Archive when the examination time has expired.

## **i Information about the exam**

### **Other information:**

All questions are 4 points for correct answer, 0 for incorrect or blank answer

Answers may not be exact, so **choose the best answer**

The course will be graded pass/fail (bestått/ikke bestått).

This year, in accordance with advice from the NTNU administration, the pass level for the course will be set at the E-level or above. That is, 41% or better will be a pass. You will have to pass both the laboratory section as well as this exam to receive a pass for the course.

# i Logic Help Sheet

## Help pages

### Boolean identities

#### AND function

$$\begin{aligned}0 \cdot 0 &= 0 \\0 \cdot 1 &= 0 \\1 \cdot 0 &= 0 \\1 \cdot 1 &= 1 \\A \cdot 0 &= 0 \\0 \cdot A &= 0 \\A \cdot 1 &= A \\1 \cdot A &= A \\A \cdot A &= A \\A \cdot \bar{A} &= 0\end{aligned}$$

#### OR function

$$\begin{aligned}0 + 0 &= 0 \\0 + 1 &= 1 \\1 + 0 &= 1 \\1 + 1 &= 1 \\A + 0 &= A \\0 + A &= A \\A + 1 &= 1 \\1 + A &= 1 \\A + A &= A \\A + \bar{A} &= 1\end{aligned}$$

#### NOT function

$$\begin{aligned}\bar{0} &= 1 \\ \bar{1} &= 0 \\ \overline{\bar{A}} &= A\end{aligned}$$

### Boolean laws

#### Commutative law

$$\begin{aligned}AB &= BA \\A + B &= B + A\end{aligned}$$

#### Absorption law

$$\begin{aligned}A + AB &= A \\A(A + B) &= A\end{aligned}$$

#### Distributive law

$$\begin{aligned}A(B + C) &= AB + AC \\A + BC &= (A + B)(A + C)\end{aligned}$$

#### De Morgan's law

$$\begin{aligned}\overline{A + B} &= \bar{A} \cdot \bar{B} \\ \overline{A \cdot B} &= \bar{A} + \bar{B}\end{aligned}$$

#### Associative law

$$\begin{aligned}A(BC) &= (AB)C \\A + (B + C) &= (A + B) + C\end{aligned}$$

#### Note also

$$\begin{aligned}A + \bar{A}B &= A + B \\A(\bar{A} + B) &= AB\end{aligned}$$

| Function | Symbol                                                                              | Alternative symbol                                                                  | Boolean expression | Truth table                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Buffer   |  |  | $B = A$            | <table><tr><th>A</th><th>B</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td></tr></table>                                                                                                             | A | B | 0 | 0 | 1 | 1 |   |   |   |   |   |   |   |   |   |
| A        | B                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 0                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 1                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| NOT      |  |  | $B = \bar{A}$      | <table><tr><th>A</th><th>B</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table>                                                                                                             | A | B | 0 | 1 | 1 | 0 |   |   |   |   |   |   |   |   |   |
| A        | B                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 1                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 0                                                                                   |                                                                                     |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| AND      |  |  | $C = A \cdot B$    | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| A        | B                                                                                   | C                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 0                                                                                   | 0                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 1                                                                                   | 0                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 0                                                                                   | 0                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 1                                                                                   | 1                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| OR       |  |  | $C = A + B$        | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| A        | B                                                                                   | C                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 0                                                                                   | 0                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 1                                                                                   | 1                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 0                                                                                   | 1                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1        | 1                                                                                   | 1                                                                                   |                    |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

| Function      | Symbol                                                                              | Alternative symbol                                                                    | Boolean expression          | Truth table                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAND          |  |  | $C = \overline{A \cdot B}$  | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | A | B | C | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| A             | B                                                                                   | C                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 0                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 1                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 0                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 1                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| NOR           |  |  | $C = \overline{A + B}$      | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | A | B | C | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| A             | B                                                                                   | C                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 0                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 1                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 0                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 1                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Exclusive OR  |  |  | $C = A \oplus B$            | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| A             | B                                                                                   | C                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 0                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 1                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 0                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 1                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Exclusive NOR |  |  | $C = \overline{A \oplus B}$ | <table><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | A | B | C | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| A             | B                                                                                   | C                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 0                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0             | 1                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 0                                                                                   | 0                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1             | 1                                                                                   | 1                                                                                     |                             |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

# i Transistor Help Sheet

## BJT parameters for common emitter configuration (subscript <sub>e</sub>)

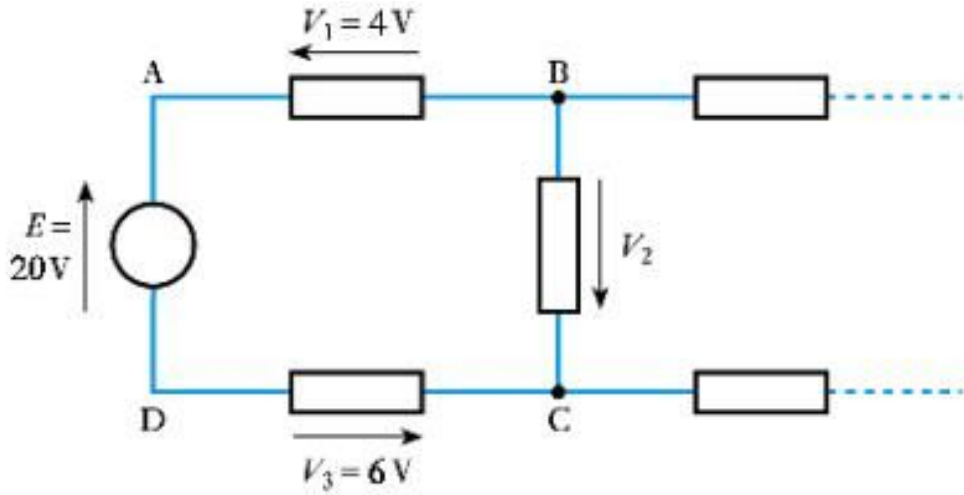
other subscripts: Input<sub>i</sub> Output<sub>o</sub> Forward<sub>f</sub> Reverse<sub>r</sub>

|          |                                                                           |                                                     |                                                                  |
|----------|---------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------|
| $h_{FE}$ | DC gain                                                                   | $I_C / I_B$                                         |                                                                  |
| $h_{fe}$ | AC gain                                                                   | $i_c / i_b$                                         | $h_{FE} \approx h_{fe}$ (mostly)                                 |
| $g_m$    | Transconductance                                                          | $\Delta I_C / \Delta V_{BE} = i_c / v_{be}$         | $\sim 40 \cdot I_C \approx 40 \cdot I_E$                         |
| $h_{ie}$ | Small signal input resistance                                             | $\Delta V_{BE} / \Delta I_B = v_{be} / i_b$         | $\sim 1 / (40 \cdot I_B) \Omega \approx h_{fe} / (40 \cdot I_C)$ |
| $h_{oe}$ | Output admittance (1/ $r_o$ )<br>where $r_o$ = Slope in the active region | $\Delta I_C / \Delta V_{CE} = i_c / v_{ce}$         |                                                                  |
| $r_e$    | Emitter resistance                                                        | $\Delta V_{BE} / \Delta I_C = v_{be} / i_c = 1/g_m$ | $\approx v_{be} / i_e$ that is, $h_{ie} = h_{fe} \cdot r_e$      |
| $h_{re}$ | Early effect ( $V_{CE}$ affects bias $V_{BE}$ )                           | $\Delta V_{CE} / \Delta V_{BE}$                     |                                                                  |

|                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $h_{FE} = \frac{I_C}{I_B}$ $I_E = I_C + I_B = (h_{FE} + 1) \cdot I_B$ <p><i>but because <math>h_{FE} \gg 1</math>,</i></p> $I_E \approx h_{FE} \cdot I_B = I_C$ | $I_B = I_{BS} \cdot e^{40 \cdot V_{BE}} \quad \text{where } I_{BS} \text{ is constant}$ $I_C = h_{FE} \cdot I_B = h_{FE} \cdot I_{BS} \cdot e^{40 \cdot V_{BE}}$ $g_m = \frac{\Delta I_C}{\Delta V_{BE}} = \frac{dI_C}{dV_{BE}} = 40 \cdot h_{FE} \cdot I_{BS} \cdot e^{40 \cdot V_{BE}}$ $g_m = \quad \quad \quad = 40 \cdot I_C \approx 40 \cdot I_E$ |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# 1 TFY4185 2021H Solving Circuits 1

Calculate the voltage  $V_2$  in the following circuit.



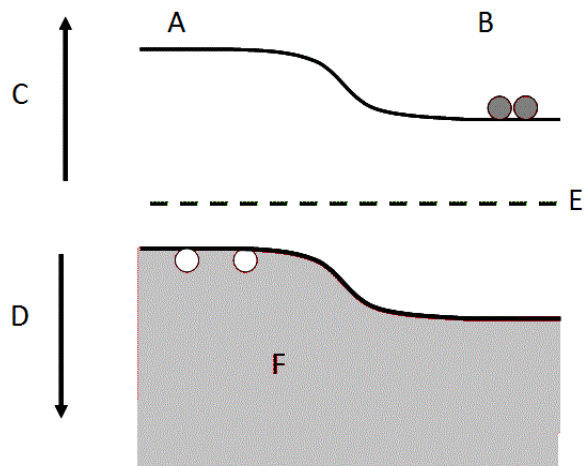
Select one alternative:

- ☒ -10
- ☐ 10
- ☐ 12
- ☐ 10

Maximum marks: 4

## 2 TFY4185 2021H Semiconductors and diodes 4

The diagram below shows a p-n junction that is not connected to an external circuit. Enter the letter labelling the n-type material.



Select one alternative:

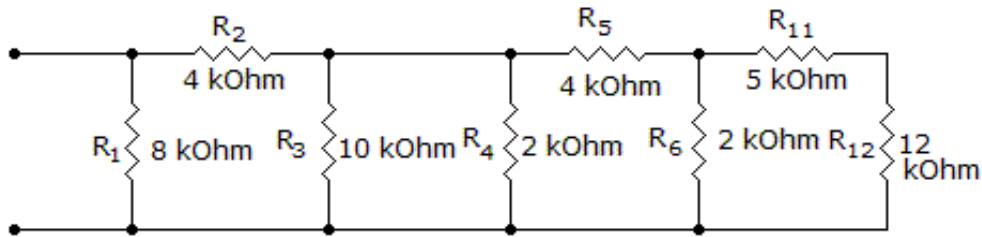
- ☐ A
- ☒ B
- ☐ C
- ☐ D
- ☐ E
- ☐ F

---

Maximum marks: 4

### 3 TFY4185 2021H Resistance 12

What is the total resistance of the circuit below?



Select one alternative:

- ☒ 3.2 k $\Omega$
- ☐ 4.2 k $\Omega$
- ☐ 5.2 k $\Omega$
- ☐ 2.2 k $\Omega$

---

Maximum marks: 4

### 4 TFY4185 2021H Semiconductors and diodes 6

The diffusion potential across an unbiased p-n junction

Select one alternative:

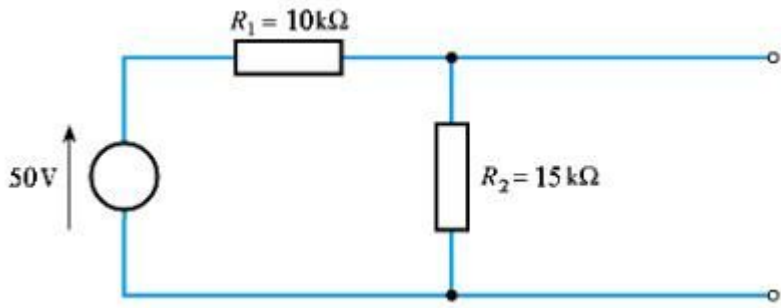
- ☐ increases with decreasing band gap
- ☐ decreases with increasing doping concentration
- ☐ does not depend on doping concentrations
- ☒ increases with increased doping concentrations

---

Maximum marks: 4

## 5 TFY4185 2021H Solving Circuits 3

Determine the short-circuit current of the following circuit.



Select one alternative:

- ☐ 6.67 mA
- ☐ 2 mA
- ☐ 3.33 mA
- ☒ 5 mA

---

Maximum marks: 4

## 6 TFY4185 2021H AC Power 2

The voltage across a component is measured as 80 V r.m.s. and the current through it is 4 A r.m.s. If the current leads the voltage by  $20^\circ$  what is the apparent power in the component?

**Select one alternative:**

☐ 109 VA

☒ 320 VA

☐ 301 VA

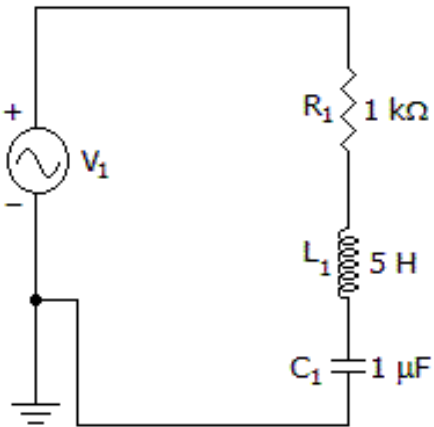
☐ 116 VA

---

Maximum marks: 4

## 7 TFY4185 2021H RLC and Transients 6

What is the resonant frequency of the circuit below?



Select one alternative:

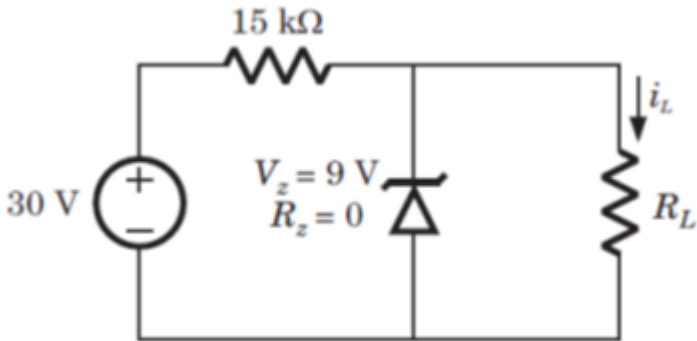
- ☐ 32 Hz
- ☐ 200 Hz
- ☐ 447 Hz
- ☒ 71 Hz

---

Maximum marks: 4

## 8 TFY4185 2021H Zener Diodes

In the voltage regulator circuit in the figure below, what is the maximum load current,  $i_L$ , that can be drawn?



Select one alternative:

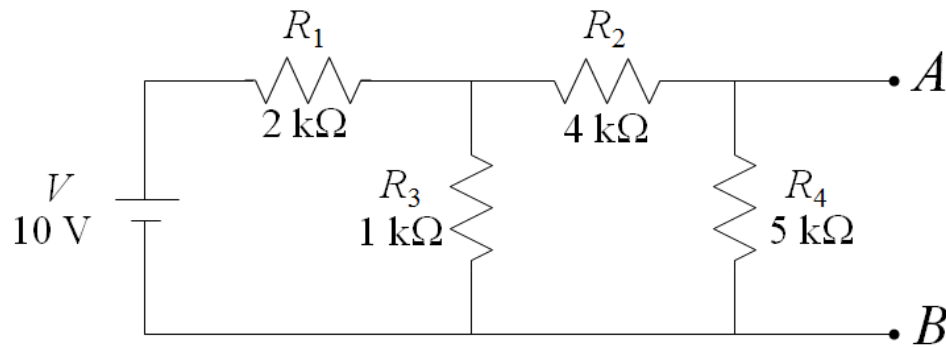
- ☐ 2.5 mA
- ☒ 1.4 mA
- ☐ 1.8 mA
- ☐ 2.3 mA

---

Maximum marks: 4

## 9 TFY4185 2021H Thevenin Norton 1

In the circuit below, what is the Thevenin voltage and resistance?



Select one alternative:

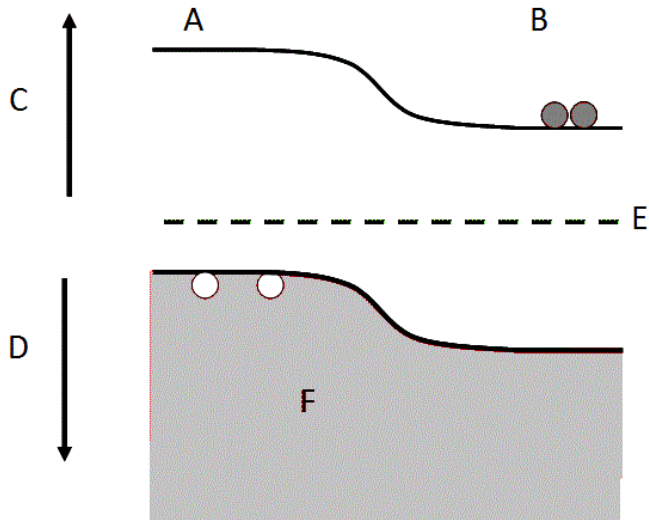
- ☒ 1.72 V and 2.41 k $\Omega$
- ☐ 3.10 V and 9.90 k $\Omega$
- ☐ 3.10 V and 2.41 k $\Omega$
- ☐ 1.72 V and 666  $\Omega$

---

Maximum marks: 4

## 10 TFY4185 2021H Semiconductors and diodes 2

The diagram below shows a p-n junction that is not connected to an external circuit. Enter the letter labelling the Valence band.



Select one alternative:

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E
- ☒ F

---

Maximum marks: 4

## 11 TFY4185 2021H BJT 1

In a bipolar junction transistor the base region is made very thin so that:

**Select one alternative:**

- ☒ recombination in base region is minimum
- ☐ the electric field gradient in base is high
- ☐ the base can be easily fabricated
- ☐ the base can be easily biased

---

Maximum marks: 4

## 12 TFY4185 2021H FET 2

What are the three terminals of an FET transistor called:

**Select one alternative:**

- ☐ cathode, anode, grid
- ☒ source, gate, drain
- ☐ none of the answers are correct
- ☐ emitter, base, collector

---

Maximum marks: 4

### 13 TFY4185 2021H Op amp 2

What does negative feedback derived from the output voltage do to a voltage amplifier?

Select one alternative:

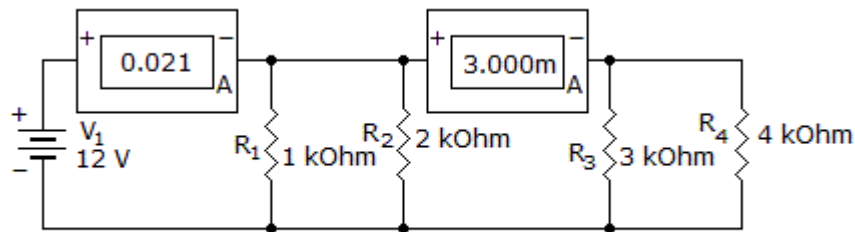
- ☒ It increases the input impedance and bandwidth.
- ☐ It increases the input and output impedances.
- ☐ It decreases the output impedance and bandwidth.
- ☐ It does not affect impedance or bandwidth.

---

Maximum marks: 4

### 14 TFY4185 2021H Resistance 10

Which component is open in the circuit below?



Select one alternative:

- ☒  $R_3$
- ☐  $R_1$
- ☐  $R_4$
- ☐  $R_2$

---

Maximum marks: 4

**15 TFY4185 2021H Logic Combinational 7**

Decimal number 9 in Gray code is:

**Select one alternative:**

☐ 1001

☐ 111

☒ 1101

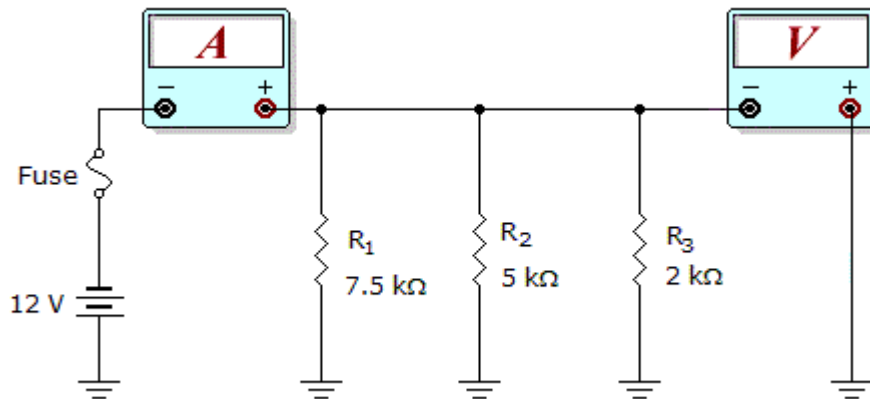
☐ 1100

---

Maximum marks: 4

## 16 TFY4185 2021H Resistance 17

What would meter readings of  $I = 10.0 \text{ mA}$  and  $V = 12 \text{ V}$  indicate about the circuit in the circuit given below?



Select one alternative:

- ☐  $R_2$  is open
- ☐  $R_3$  is shorted
- ☒ There is nothing wrong with the circuit, it is functioning normally
- ☐  $R_3$  is open
- ☐ The fuse is open
- ☐  $R_1$  is open

---

Maximum marks: 4

17 **TFY4185 2021H Reactance 3**

What is the capacitive reactance if  $I = 1$  amp,  $V = 2$  volts,  $C = 5$  F, and frequency = 10 Hz?

**Select one alternative:**

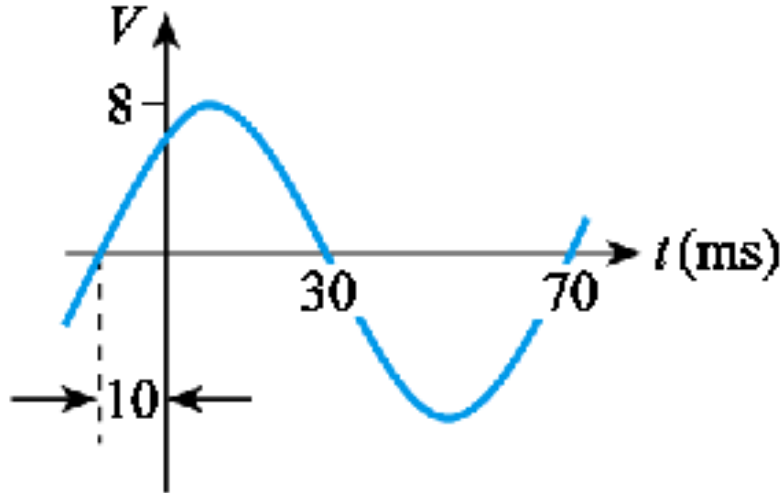
- ☐ 0.02  $\Omega$
- ☐ 0.5  $\Omega$
- ☒ 0.003  $\Omega$
- ☐ 0.2  $\Omega$

---

Maximum marks: 4

18 TFY4185 2021H AC Fundamentals 1

Which of the following equations describes the waveform shown here?



Select one alternative:

- ☐  $v = 8 \sin (90t - \pi / 4)$
- ☐  $v = 8 \sin (90t + \pi / 4)$
- ☐  $v = 8 \sin (79t - \pi / 4)$
- ☒  $v = 8 \sin (79t + \pi / 4)$

---

Maximum marks: 4

## 19 TFY4185 2021H Semiconductors and diodes

An ideal  $pn$  junction diode is operating in the forward bias region ( $V_d > 0.1 \text{ Volt}$ ). The change in diode voltage, that will cause a factor of 9 increase in current, is

**Select one alternative:**

☐ 85 mV

☐ 45 mV

☒ 55 mV

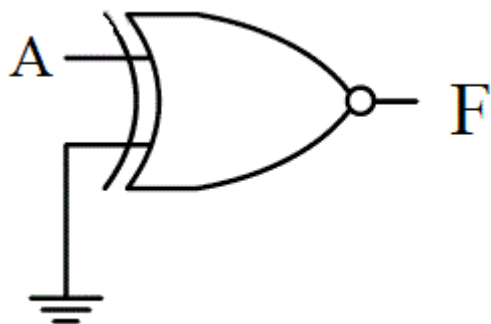
☐ 35 mV

---

Maximum marks: 4

## 20 TFY4185 2021H Logic Combinational 6

The output of the logic gate in figure is



Select one alternative:

☐ 1

☐  $A$

☒  $\overline{A}$

☐ 0

---

Maximum marks: 4

## 21 TFY4185 2021H Logic Combinational 2

The Boolean expression  $[A \cdot C + B \cdot \overline{C}]$  is equivalent to:

Select one alternative:

☒  $A \cdot B \cdot C + \overline{A} \cdot B \cdot \overline{C} + A \cdot B \cdot \overline{C} + A \cdot \overline{B} \cdot C$

☐  $\overline{A} \cdot C + B \cdot \overline{C} + A \cdot C$

☐  $\overline{B} \cdot C + A \cdot C + B \cdot \overline{C} + \overline{A} \cdot C \cdot \overline{B}$

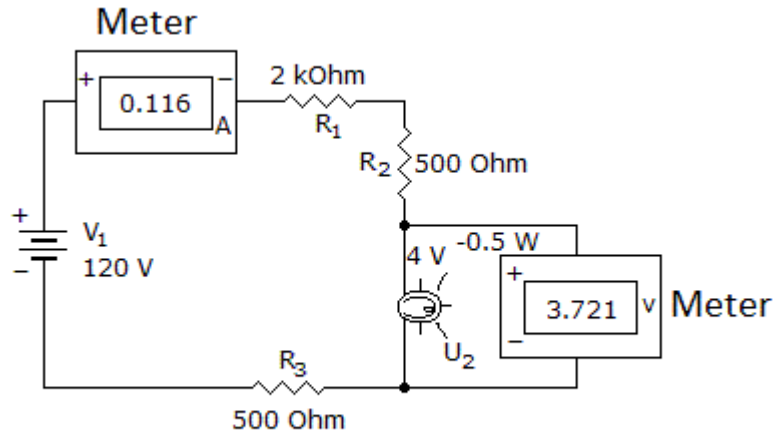
☐  $A \cdot C + B \cdot \overline{C} + \overline{B} \cdot C + A \cdot B \cdot C$

---

Maximum marks: 4

## 22 TFY4185 2021H Resistance 4

What is wrong, if anything, with this circuit?



Select one alternative:

- ☐  $R_2$  is open
- ☐  $R_2$  is shorted
- ☐  $R_1$  is open
- ☒  $R_1$  is shorted
- ☐ There is nothing wrong with the circuit

---

Maximum marks: 4

### 23 TFY4185 2021H AC Power 2

If the reactive power of a circuit is 0.05 var while the apparent power is 64 mVA, then what is the active power of the circuit?

**Select one alternative:**

- ☐ 14 mW
- ☒ 40 mW
- ☐ 1.6 mW
- ☐ 114 mW
- ☐ 80 mW

---

Maximum marks: 4

### 24 TFY4185 2021H Op Amp 6

A common-mode signal is applied to:

**Select one alternative:**

- ☐ The input end of the feedback resistor
- ☐ The inverting input
- ☐ The non-inverting input
- ☒ Both inputs

---

Maximum marks: 4

## 25 TFY4185 2021H RLC and Transients 2

As a capacitor is being charged, the current flowing into the capacitor will:

**Select one alternative:**

- ☐ cannot tell
- ☐ stay the same
- ☒ decrease
- ☐ increase

---

Maximum marks: 4