ELEKTRONIKAI
ALAPISMERETEK
ANGOL NYELVEN
KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA
2009. május 22. 8:00
Az írásbeli vizsga időtartama: 180 perc

Pótlapok száma
Tisztázati
Piszkozati

OKTATÁSI ÉS KULTURÁLIS
MINISZTÉRIUM
Important Information

You may use a non-programmable calculator as an only auxiliary tool for solving this written examination. Use blue ink pen for writing and black lead pencil for drawing. For solving questions of test nature, use the free spaces left available below them in the test form. For solving assignments, use supplementary sheets distributed by supervising teachers. Write a page number and your name on each supplementary sheet. When solving questions requiring calculations, you should take care to write down equations (formulas) correctly, to perform substitutions properly, and to make calculations correctly. If you omit any of them, your points will be reduced. You cannot receive full points for an end result unless its value and measurement unit are both correct.

When solving assignments, you should take care to produce a well-organised and neat written examination; to apply standard symbols; and to meet requirements in terms of engineering, format, and aesthetics. If you fail to meet any of those requirements, your points will be reduced. If you make a mistake in your solution, draw a diagonal line across the incorrect part.

It is possible to finalize your solution within the time provided for the examination. In this case, make a “Rough draft” and a “Final draft” with continuing page numbers.
Questions requiring short answers

1.) Calculate the increase in the resistance of a DC coil when its temperature increases from $T_1 = 0 \degree C$ to $T_2 = 50 \degree C$. The DC resistance of the coil at a temperature of $0 \degree C$ is $R_1 = 100 \Omega$, the thermal resistance coefficient is: $\alpha = 0.004 \, 1/\degree C$.  

\[ \Delta R = \]

2.) Complete the table below. The table should express the relationship between the loading resistance and the terminal voltage of an ideal current generator. 

<table>
<thead>
<tr>
<th>$R_t$ (k$\Omega$)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_k$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

3.) Calculate the resultant capacity of capacitors placed in series. 
Data: $C_1 = 10$ nF, $C_2 = 15$ nF, $C_3 = 30$ nF. 

\[ C = \]

4.) Write in the table below the missing momentary values of a sinusoidal AC voltage with an effective value of $U = 24$ V and a frequency of $f = 50$ Hz at points in time counted from the start of the period. 

<table>
<thead>
<tr>
<th>$t$ (ms)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>$u$ (V)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

5.) Determine the impedance of a serial R-L connection. Data: $R = 20 \, \Omega$, $X_L = 15 \, \Omega$. 

\[ Z = \]

6.) Determine the resonance frequency of an oscillating circuit. Data: $L = 1 \, mH$, $C = 1 \, nF$. 

\[ f_0 = \]
7.) Determine the $h_{1IE}$ parameter of a bipolar transistor. Measured values: $U_{IN1} = 0.62 \text{ V}$ at $I_{B1} = 20 \mu\text{A}$; and $U_{IN2} = 0.65 \text{ V}$ at $I_{B2} = 30 \mu\text{A}$. 

$h_{1IE} =$

8.) Determine the current amplification value of an amplifier at known values of voltage amplification ($A_u$), input resistance ($R_{be}$), and loading resistance ($R_t$). Data: $A_u = 100$, $R_{IN} = 2 \text{k}\Omega$, $R_t = 5 \text{k}\Omega$. 

$A_1 =$

9.) Draw the circuit diagram of a common emitter amplifier by using 1 NPN transistor, 4 resistors ($R_{B1}$, $R_{B2}$, $R_C$, $R_E$), and 3 capacitors.

10.) Determine the effective value of the output voltage of a power amplifier. 

Data: $P_{OUT} = 50 \text{ W}$, $R_t = 8 \Omega$. 

$U_{OUT} =$

11.) Complete the table below. The table should express the relationship between the fill factor (k) of an ideal square signal and the mean value of its voltage ($U_k$). 

<table>
<thead>
<tr>
<th>k (%)</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
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</thead>
<tbody>
<tr>
<td>$U_k$ (V)</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12.) Write down the algebraic form of the logical function below. Use ”A” as a symbol of the variable with the highest position. 

$F^4 = \Sigma^4 (0, 7, 14)$

$F^4 =$
Complex exercises

Assignment 1

Calculate a DC network

Assignment:

a) Determine the resultant resistance (R) of the resistor network consisting R₁, R₂, R₃, R₄, R₅ and the value of U.
b) Determine current values (I₁, I₄) of resistors R₁ and R₄.
c) Determine the terminal voltage of the generator at no load (U₀).

Assignment 2

Calculate an AC network

Assignment:

a) Determine current values (I, Iᵣ, Iᶜ) in the network.
b) Determine the impedance (Z) of the network.
c) Draw a vector diagram of the circuit (free hand sketch). Indicate voltage U and currents I, Iᵣ and Iᶜ in the vector diagram.
d) Determine the absolute value of the phase angle (φ) between the supply voltage (U) and the supply current (I).
Assignment 3

Calculate a low frequency amplifier

Data:
- $R_1 = 15 \, \text{k}\Omega$
- $R_2 = 300 \, \text{k}\Omega$
- $R_t = 2 \, \text{k}\Omega$
- $\hat{U}_{OUT} = \pm 10 \, \text{V}$

All undetermined characteristics of the operational amplifier are considered to be of ideal. The AC resistance of coupling capacitors can be neglected in calculations.

Assignment:

a) Determine the voltage amplification ($A_t$) and input resistance ($R_{IN}$) of the stage.
b) Determine the value of resistor $R_3$.
c) Determine the effective values of the highest sinusoidal output voltage ($U_{OUT_{max}}$) and that of the associated input voltage ($U_{IN_{max}}$).
d) Determine the effective value of the highest sinusoidal output power ($P_{OUT_{max}}$).

Assignment 4

Design a combination network

The disjunctive serial number form is known for a logical function:

$$F^4 = \Sigma^4(2, 6, 7, 10, 12, 13, 15)$$

Assignment:

a) Simplify the disjunctive function by using the graphical method. Use “A” as a symbol for the variable of the highest position.
b) Realise the simplified function by using NOT-AND-OR gates. Variables are available in positive form only.
c) Realise the simplified function by using NAND gates. Variables are available in positive form only.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Question number</th>
<th>Maximum points</th>
<th>Points scored</th>
<th>Maximum points awardable for the topic</th>
<th>Points scored in topic</th>
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**Written examination score** 100

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Correcting teacher:

Date: .........................

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Elért pontszám
Points scored

Programba beírt pontszám
Points entered into programme

Egyszerű, rövid feladatok / Questions requiring short answers

Összetett feladatok / Complex exercises

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javító tanár / Correcting teacher

jegyző / Notary

Dátum/Date: .........................

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irásbeli vizsga 0801 8 / 8 2009. május 22.