ELEKTRONIKAI ALAPISMERETEK ANGOL NYELVEN
KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2012. május 25. 8:00

Az írásbeli vizsga időtartama: 180 perc

NEMZETI ERŐFORRÁS
MINISZTÉRIUM
Important information

You may use only a pocket calculator that cannot store or display texts, drawing tools, templates, and rulers as auxiliary tools for solving this written test. Use a blue-ink pen for writing and a black lead pencil for drawing. For solving simple short questions, use the free space below each question in the exam sheet. For solving complex questions, use supplementary sheets to be distributed by supervising teachers, by specifying your name and class on them. Attach a page number to each supplementary sheet.

When solving questions requiring calculations, take care to write down relationships (formulas) correctly, make substitutions properly, and do calculations accurately. If you fail on any of those, points will be deducted from your score. Maximum points for an end-result will only be given to you when its amount and measurement unit are both fully correct.

When solving questions, take care to produce a neat and well-organised written test, to use standard symbols, and to meet requirements in terms of engineering, format, and aesthetics. Points will be deducted for the lack of any of them. Cross erroneous parts, if any, by a diagonal line.

Within the duration of the examination, you may prepare a fair copy too. In that case you will prepare a “Draft” copy and a “Fair” copy by using continuous page numbering.
Simple, short questions

1.) Complete the table based on the sample provided in the first column. (3 points)

<table>
<thead>
<tr>
<th>mA</th>
<th>μH</th>
<th>Ω</th>
<th>μS</th>
<th>nF</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>120</td>
<td>5</td>
<td>25</td>
<td>47</td>
</tr>
<tr>
<td>1.5 \times 10^{-3}</td>
<td></td>
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</tr>
</tbody>
</table>

2.) Determine the resultant resistance of three resistors connected in parallel.
Data: \(R_1 = 10 \, kΩ, R_2 = 15 \, kΩ, R_3 = 30 \, kΩ\) (3 points)

\[ R = \]

3.) Determine the value of the series resistor required to extend the measurement limit of a basic instrument from \(U_0 = 0.2 \, V\) to \(U = 7.5 \, V\). \(I_0 = 200 \, \mu A\) flows through the basic instrument when it is subjected to \(U_0 = 0.2 \, V\). (3 points)

\[ R_s = \]

4.) Complete the table below. The table must express the inductive reactance as a function of frequency. (3 points)

<table>
<thead>
<tr>
<th>f (kHz)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(X_L (\Omega))</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.) Determine the supply voltage of an RL series circuit.
Data: \(I = 2 \, mA, R = 2 \, kΩ, X_L = 1.5 \, kΩ\) (4 points)

\[ U = \]

6.) Determine the impedance of an RC parallel circuit.
Data: \(U = 6 \, V, I_R = 10 \, mA, I_C = 7.5 \, mA\) (4 points)

\[ Z = \]

7.) Determine the voltage amplification values in decibels in the table below. (3 points)

<table>
<thead>
<tr>
<th>(A_u)</th>
<th>1</th>
<th>80</th>
<th>(\sqrt{2})</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a_u (dB))</td>
<td></td>
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</tbody>
</table>
8.) Calculate the output voltage of an amplifier loaded with a load resistor of $R_l = 7.5 \, \text{k}\Omega$. The amplifier, when unloaded, has an output resistance of $R_{out} = 2.5 \, \text{k}\Omega$ and an output voltage of $U_{out0} = 800 \, \text{mV}$. (3 points)

$$U_{out} =$$

9.) Determine the voltage amplification of a basic common-source amplifier circuit. Data: $y_{21S} = 5 \, \text{mS}$, $y_{22S} = 25 \, \mu\text{S}$, $R_D = 5 \, \text{k}\Omega$, $R_l = 7.5 \, \text{k}\Omega$. (4 points)

$$A_{ul} =$$

10.) Draw a basic common-collector amplifier circuit. Parts: 1 NPN transistor, 3 resistors, 2 electrolytic capacitors. (4 points)

11.) Write down the conjunctive serial number form of the logic function below. ‘A’ is used to denote the variable of the highest place value. (3 points)

$$F^4 = \overline{A} + B + \overline{C} + \overline{D} \cdot (A + \overline{B} + \overline{C} + D) \cdot (A + B + C + D)$$

$$F^4 =$$

12.) Write down the disjunctive normal form of the logic function below. (3 points)

$$F^4 = A \cdot \overline{B} \cdot C + B \cdot C \cdot D + A \cdot \overline{B} \cdot C \cdot \overline{D}$$

$$F^4 =$$
Complex questions

Question 1

Maximum points: 60

Calculate a DC network

Tasks:

a) Determine the resultant capacitance (C) of the capacitor network C1, C2, C3, C4, C5.

b) Determine the resultant charge (Q) and the voltage appearing across each capacitor (U1, U2, U3, U4, U5).

c) After the removal of the generator, the capacitor network is discharged through resistor R. Determine the time factor (τ) of the discharge.

Question 2

Maximum points: 15

Calculate an AC circuit

Tasks:

a) Determine the impedance of the circuit and the current through it (Z, I).

b) Determine the voltage appearing across each element in the circuit (UR, UC, UL).

c) Determine the values of the inductor and the capacitor (L, C).
Question 3  
Maximum points: 15

Calculate a low frequency amplifier

![Amplifier Diagram]

Data:

\[ A_u = 10 \quad R_1 = 27 \text{k}\Omega \quad R_2 = 30 \text{k}\Omega \quad U_g = 500 \text{mV} \quad R_g = 5 \text{k}\Omega \]

\[ C_2 = 10 \mu\text{F} \quad R_t = 2 \text{k}\Omega \]

The operational amplifier may be considered to be ideal for the purposes of the calculation. The capacitive reactance of the capacitors is negligible in tasks a), b), and c).

Tasks:

a) Determine the input resistance of the amplifier (\(R_{in}\)).
b) Determine the value of resistor \(R_3\).
c) Calculate the input- and output voltage of the amplifier (\(U_{in}, U_{out}\)), and its output power (\(P_{out}\)).
d) Determine the limit frequency (\(f_l\)) of the output coupling component (\(C_2-R_t\)).

Question 4  
Maximum points: 15

Design a combinational circuit

The Veitch-table of a conjunctive logic function is given as follows:

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>C</th>
<th>A</th>
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<tbody>
<tr>
<td>1</td>
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Tasks:

a) Write down the serial number form of the conjunctive function.
   \('A'\) is used to denote the variable of the highest place value.
b) Simplify the function through the graphical method.
c) Realize the function by using NOT, AND and OR gates.
   (The variables are available in original form only.)
d) Realize the function by using NOR gates.
   (The variables are available in original form only.)
Elektronikai alapismeretek angol nyelven középszint

Név: ............................................................ osztály:......
<table>
<thead>
<tr>
<th>topic</th>
<th>serial number of question</th>
<th>Maximum points</th>
<th>Achieved points</th>
<th>Maximum points for topic</th>
<th>Achieved points for topic</th>
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Score of the written part of the examination: 100

correcting teacher

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

javító tanár / correcting teacher

jegyző / notary

Dátum/Date: .........................

irásbeli vizsga 1212