

Electronics and Telecommunications AGH Krakow 2020-2021

Admission test - sample questions and answers Electronics and Telecommunications (MSc level)

Sample question from the entrance exam for the second cycle of full-time Electronics and Telecommunications major. Each question has one example answer shown.

The example answer may be either true or false.
(Its purpose is just to complete the concern of the question)

Question bank includes the syllabi of the following modules:

Electronic Components
Analogue electronic circuits (I & II)
Digital electronics and Programmable Devices
Signal Theory
Digital Signal Processing
Computer Networks
Telecommunications Systems and Networks
High-frequency techniques
Wireless techniques and systems
Antenna systems and wave propagation

Bibliography can be found in syllabuses:

<https://syllabuskrk.agh.edu.pl>

1. For a silicon diode biased in forward direction:
 - a) the higher current, the bigger dynamic resistance.
2. Collector of bipolar transistor in CE (Common Emitter) configuration is the better current source when:
 - a) Early voltage U_A is higher.
3. Mark true statements about silicon p-n junction:
 - a) depletion layer deeper penetrates n type area if donor dopant concentration is higher.
4. For BJT (bipolar junction transistor):
 - a) diffusion capacitance of emitter junction determines switching time for cut-off – saturation transition in CE configuration.
5. Compared to bipolar transistors, field effect transistors are NOT normally characterized by:
 - a) a reverse-biased PN junction.
6. In MOSFET transistor:
 - a) the smaller oxide thickness, the lower gate leakage current.
7. In room temperature a two-terminal device made from n-doped silicon:
 - a) has resistivity, which is weakly temperature-dependent.
8. Output voltage for voltage source:
 - a) is constant for ideal source when load resistance goes down.
9. Through forward-biased p-n junction flow currents
 - a) diffusion of electrons from n to p region.
10. Zener diodes are most commonly used in:
 - a) oscillator circuits.
11. LED diodes are most commonly used in:
 - a) voltage amplifier circuits.

12. For BJT (bipolar junction transistor):

a) $f_{\alpha} = f_{\beta} + f_T$.

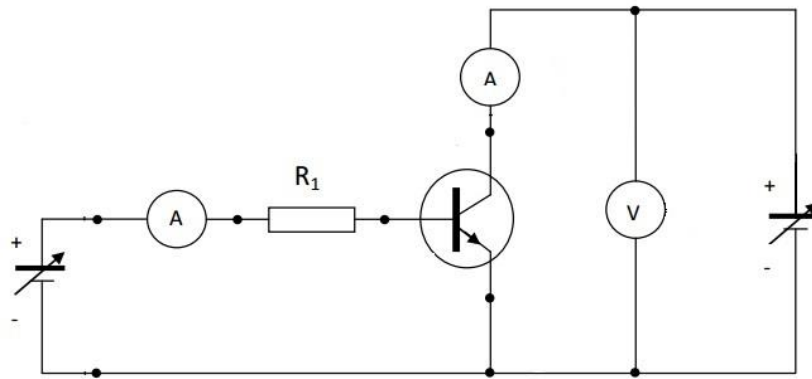
13. What is the approximate peak-to-peak voltage of a 2 VRMS sine wave?

a) 5.6 Vp-p.

14. An amplifier is stimulated by the signal source having internal resistance of 1 kΩ. For this configuration, output of the amplifier was measured to be the sinusoidal signal with amplitude of 600 mV. Additional 10 kΩ serial resistor at the amplifier's input yielded output signal with amplitude dropped down to 200 mV. What is the value of input impedance for this amplifier?

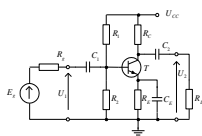
a) 0.5kΩ.

15. Using the measuring stand as in the figure one can measure and determine:



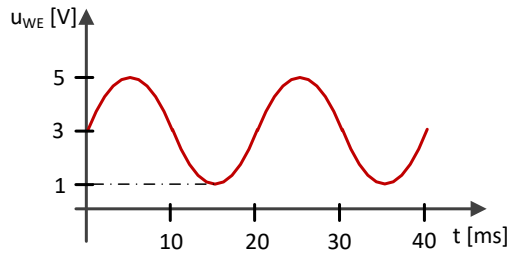
a) input characteristics of the transistor $I_B = f(V_{BE})$, $U_{CE} = \text{const}$.

16. The circuit in the figure has $R_C = 10 \text{ k}\Omega$, $R_L = 10 \text{ k}\Omega$, $r_{b'e} = 4 \text{ k}\Omega$, $r_{ce} \rightarrow \infty$, R_1 i R_2 influence on input impedance can be neglected $R_g = 16 \text{ k}\Omega$, $\beta = 200$. Effective voltage gain $k_{us} = U_2/E_g$ is:



a) $k_{us} = -150$.

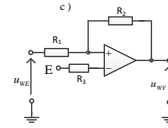
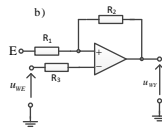
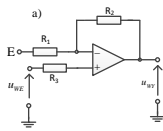
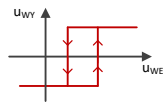
17. To the input of VCO with self-oscillation frequency of 70 kHz and tuning sensitivity of 10 kHz/V a signal sketched below is applied



On the output of VCO we obtain modulated waveform with:

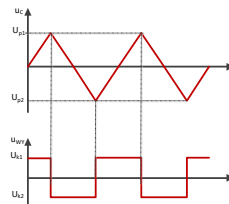
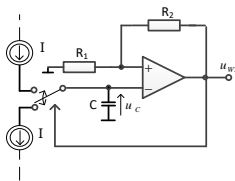
- a) 100 kHz carrier and 20 kHz deviation .

18. The transfer characteristic depicted below corresponds the circuit from :



- a) figure a) .

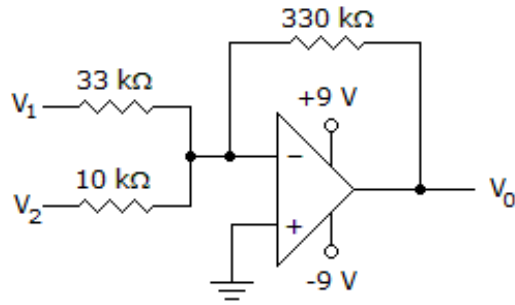
19. VCO of integrator-plus-Schmidt trigger type is depicted in the figure below



If thresholds of the comparator are expanded:

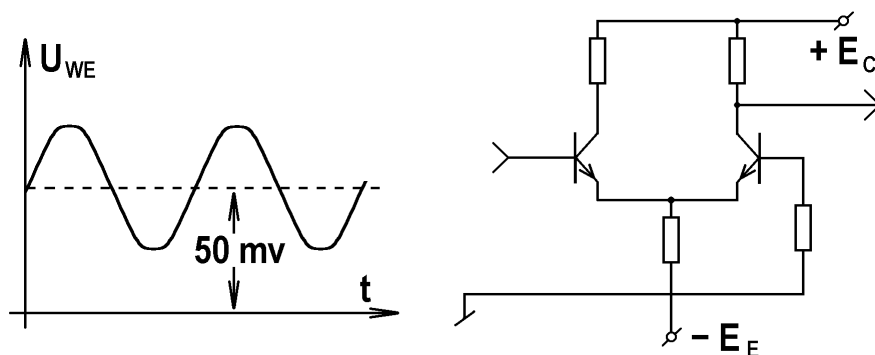
- a) output oscillation frequency will go down.

20. When $V_1 = -0.2V$ and $V_2 = +0.01V$, output voltage V_0 for the circuit in figure will be:



a) 1.67 V .

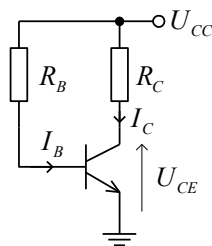
21. For the circuit depicted below a sinewave with DC component is attached.



Output signal will have a form of:

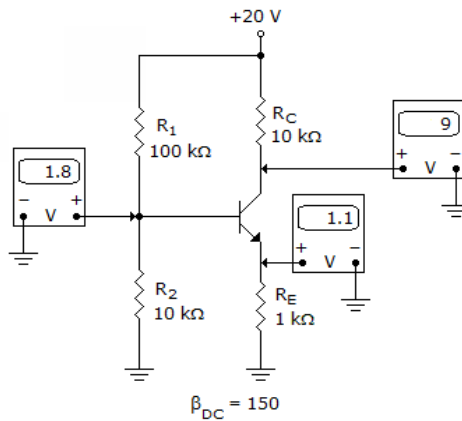
a) non-inverted waveform without DC component.

22. To saturate the BJT (i.e. $U_{CE}=0$) in the circuit below ($\beta=100$, $R_C=2.5k\Omega$, $U_{CC}=+15V$) the base current adjusted by R_B must be:



a) at least 60 μA .

23. Based on voltmeter readout as from the picture it may be stated that



a) BJT is in active mode .

24. In three phase rectifier with resistive-inductive load (time constant of a low $\tau = L/R \gg 20$ ms), supply directly from a grid 3x230 V, mean voltage measured at the resistance of the load is approximately equal:

a) 191 V .

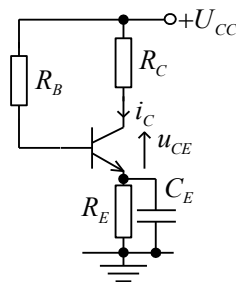
25. If the output filter capacitor in a power supply actually had a value twice its stated value, which of the following symptoms would be found?

a) The output and ripple voltage would be greater than expected.

26. If I_C is 50 times higher than I_B in BJT, then h_{FE} equals to:

a) 50 .

27. A quiescent collector-emitter voltage V_{CEQ} in the circuit below with $V_{CC} = 12$ V, $I_{CQ} = 1$ mA, $R_E = 1$ kΩ, $R_C = 5$ kΩ equals:



a) $V_{CEQ} = 6$ V .

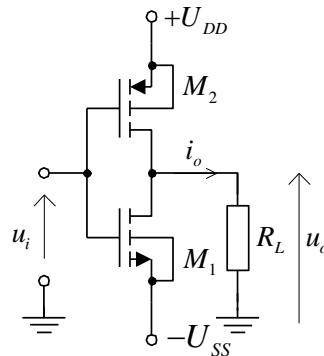
28. Common base amplifier:

a) inverts the output phase and has voltage gain significantly greater than that of common emitter stage.

29. The common collector amplifier (emitter follower)

a) has voltage gain less than unity, large input resistance and small output resistance.

30. In CMOS inverter $g_{mn} = g_{mp} = 0.15 \text{ mS}$ and $g_{dsn} = g_{dsp} = 0.005 \text{ mS}$. Assuming infinite load resistance $R_L = \infty$.



a) $k_U \approx -30$; $r_{out} \approx 50 \text{ k}\Omega$.

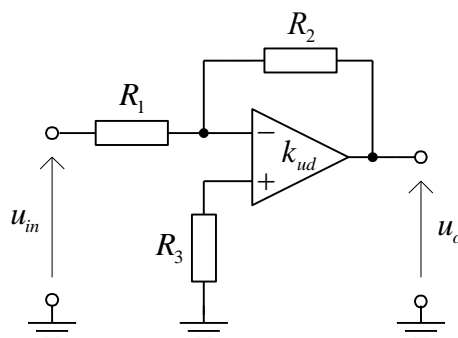
31. Negative feedback with current sensing and current return

a) has no impact on input resistance, decreases output resistance.

32. An amplifier with open-loop parameters of $k_U = 100$, $\omega_g = 1 \text{ MHz}$ was embraced with negative feedback loop with $\beta = 0.01$. Closed-loop parameters of the resulting system are:

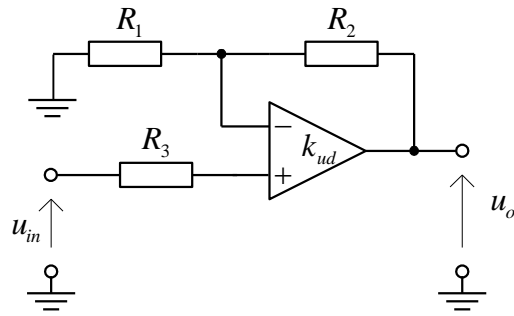
a) $k_{Uf} = 50$, $\omega_{gf} = 2 \text{ MHz}$.

33. With $R_1 = 1 \text{ k}\Omega$; $R_2 = 10 \text{ k}\Omega$ the gain of the circuit below is:



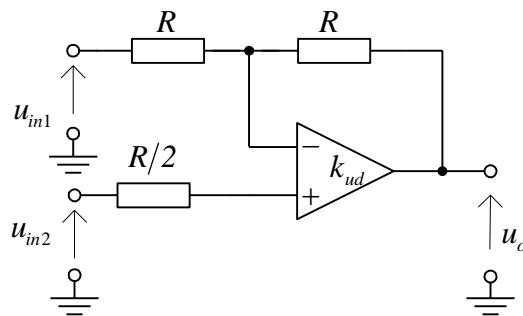
a) $k_{Uf} = 10$.

34. With $R_1 = 10 \text{ k}\Omega$; $R_2 = 100 \text{ k}\Omega$; the gain of the circuit below is:



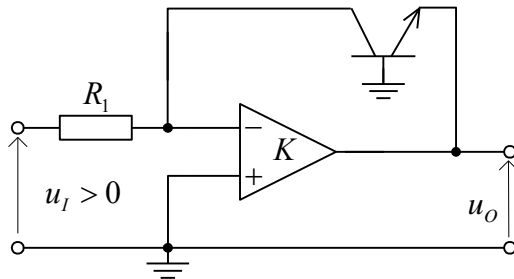
a) $k_{uf} = 11$.

35. The circuit below implements the operation:



a) $u_o = 2(u_{in1} + u_{in2})$.

36. Figure below depicts



a) simple exponential amplifier.

37. Class B amplifier maximum power efficiency is

a) $\pi/4$ at most.

38. LC or RC oscillator oscillates having sinusoidal output signal because:

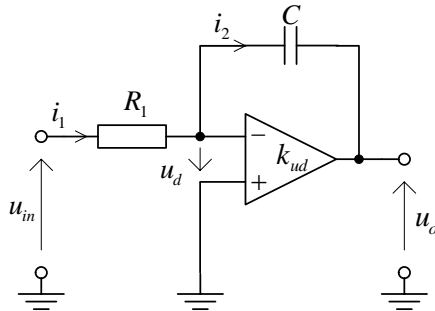
a) oscillations condition is fulfilled only for one particular frequency.

- 39.** Non-inverting amplifier having voltage feedback operational amplifier, for cutoff frequency 20 kHz shows the amplification equal to 100 V/V. What will be the amplification of this amplifier when the cutoff frequency is equal to 400 kHz?
- a) 2 .
- 40.** When we apply an non-symmetric signal into double balanced mixer (e.g. Gilbert multiplier) to prevent unwanted effect a filter tuned for Intermediate frequency must be placed on the path:
- a) prior to the mixer.
- 41.** Class B amplifier power efficiency is
- a) similar to that of class A amplifier .
- 42.** Class A amplifier power efficiency with transformer is
- a) 50% .
- 43.** Crossover distortion in class B amplifier
- a) may be removed by prebiasing and moving to AB class operation.
- 44.** Which of the following statements are valid for power amplifiers of classes A, B and AB:
- a) nonlinear distortion in class B amplifier are greater than in class A.
- 45.** The stability criteria of amplifier can be checked using frequency characteristics of open loop gain $T(j\omega)=k\beta$. Condition for stability, based on Bode criterion, is:
- a) for angular frequency ω_ϕ for which $\arg[T(j\omega_\phi)] = -\pi$, $|T(j\omega_\phi)|$ should be lower than unity (0 dB).
- 46.** Describe the stability criteria for feedback amplifiers. Symbols used in this question:
 $T(j\omega)=k\beta$ - open loop transfer function; $\omega_T : |T(j\omega_T)| = 1$ (0 dB) ; $\omega_\phi : \arg[T(j\omega_\phi)] = -\pi$
- a) if $|T(j\omega_\phi)| < 0$ dB then circuit is stable, otherwise is unstable.
- 47.** In biasing circuit with emitter degeneration
- a) R_E has no influence on bias point.
- 48.** Common base amplifier
- a) exhibits very large input resistance and relatively small output resistance.

49. Negative feedback with voltage sensing and voltage return

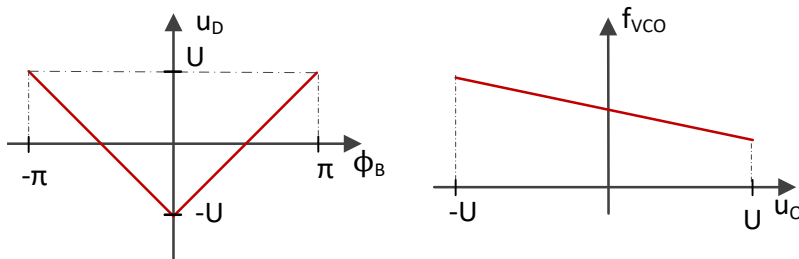
a) increases input resistance, decreases output resistance.

50. A real integrator is implemented on real opamp (compensated) with, $\omega_g = 500 \text{ sec}^{-1}$; $\omega_T = 500 \cdot 10^5 \text{ sec}^{-1}$; $R_1 = 10 \text{ k}\Omega$; $C = 10 \text{ nF}$; integrating occurs within the band:



a) $\omega \{ 2 \cdot 10^{-8} \text{ sec}^{-1} \div 500 \cdot 10^5 \text{ sec}^{-1} \}$.

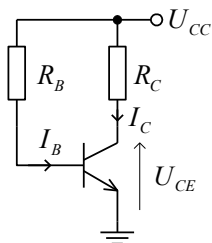
51. W In PLL with given characteristics



if the PLL is locked a phase error may be within:

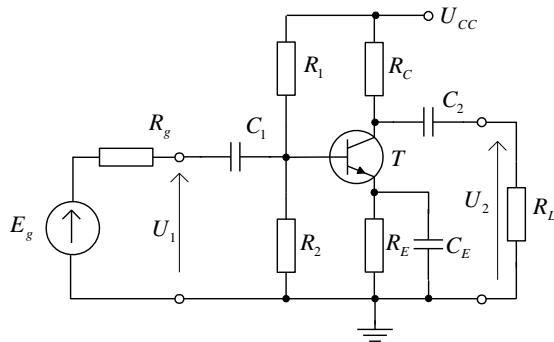
a) from 0 to π .

52. The schematics below presents



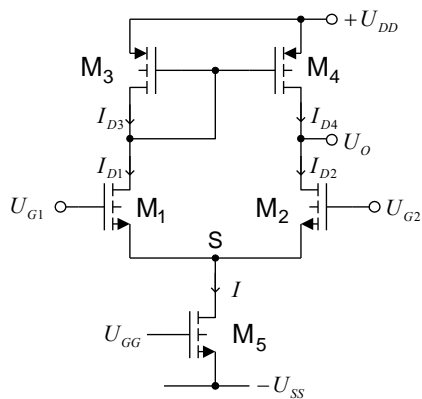
a) constant base current circuit .

53. For the common emitter amplifier (see below) the following statements are valid



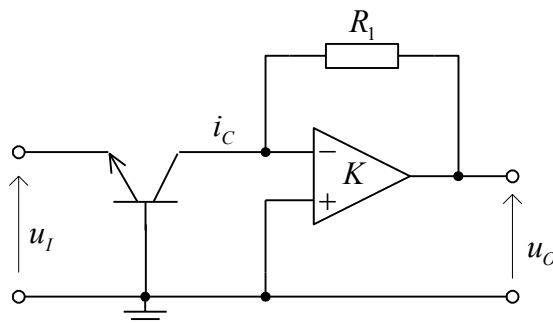
a) the voltage gain is independent on R_C .

54. Calculate differential voltage gain and the output resistance of the circuit below assuming: $g_{m1,2} = 0.2 \text{ mA/V}$; $g_{ds1,2} = 0.002 \text{ mA/V}$; $g_{ds3,4} = 0.003 \text{ mA/V}$



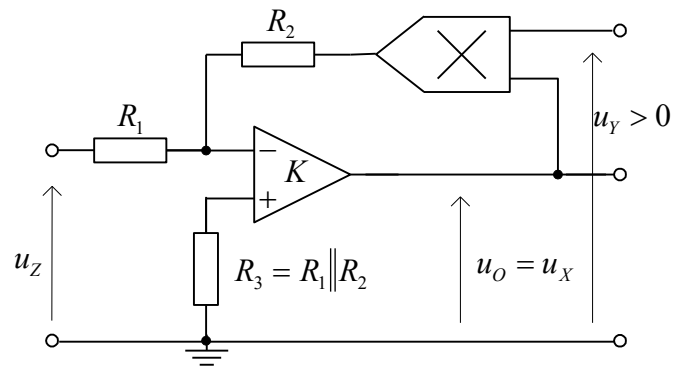
a) $k_{ur} \approx 40$; $R_o \approx 200 \text{ k}\Omega$.

55. Figure below presents



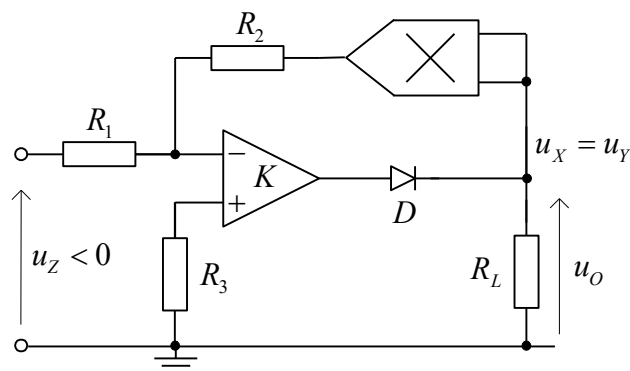
a) an inverting amplifier ($R_1=1/g_m$) .

56. What kind of math operation performs the circuit below:



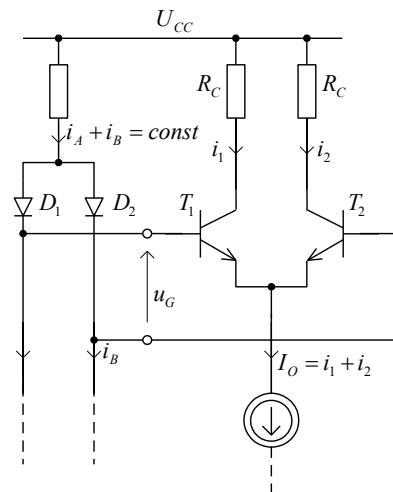
a) $u_O = u_X \approx -\frac{R_2}{R_1} E_R \frac{u_Z}{u_Y}$.

57. The output voltage of the circuit below is equal to:



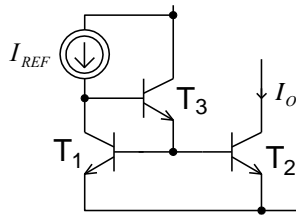
a) $u_O = u_X \cong \sqrt{-\frac{R_2}{R_1} E_R u_Z^2}$.

58. To perform a linearization in Gilbert's multiplier the following conditions have to be fulfilled



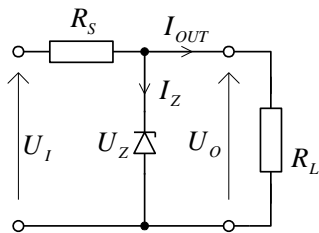
a) $i_1 + i_2 = i_A + i_B$.

59. The relationship between reference and output current in the circuit below



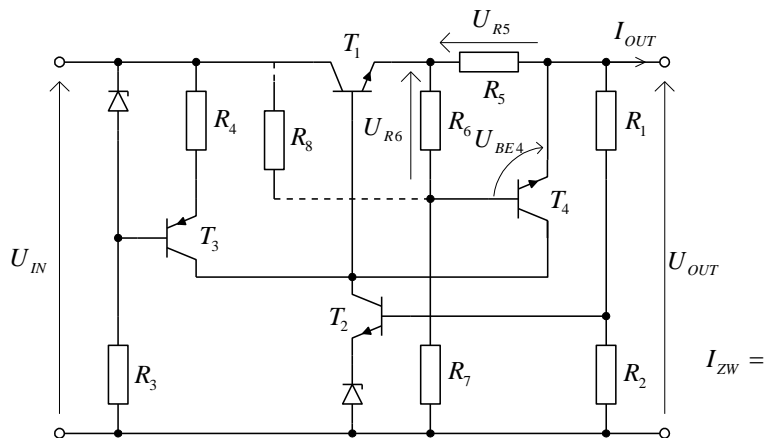
a)
$$I_O = \frac{I_{REF}}{1 + \frac{2}{\beta_0(\beta_0 + 1)}}$$

60. In parametric regulator below $U_I=6,2V$, $U_Z=4,7V$, $R_S=12\Omega$. Assuming the Zener's diode current may be between $5mA \leq I_Z \leq 100mA$ the output current range is:



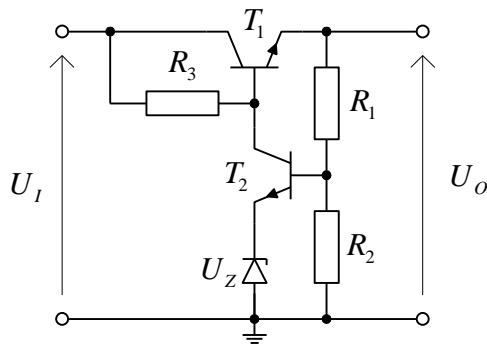
a) $25mA \leq I_O \leq 120mA$.

61. In voltage regulator with short-circuit protection: $U_{IN} = 10V$, $U_{OUT} = 5V$, $U_{BEP} = 0.7V$, $R_5 = 1.0\Omega$, $R_6 = 3k\Omega$, $R_7 = 7k\Omega$. Short-circuit current will be:



a) $I_{ZW} = 0.7A$.

62. For the simple power supply below $U_I = 12\text{ V}$; $R_1 = R_2$; Calculate the nominal output voltage U_O if $U_Z = 3.3\text{ V}$



- a) $U_O = 8\text{ V}$.
63. The resonant frequency of lossy resonant circuit is $f_0 = 10\text{ MHz}$ while its Q factor $Q_0 = 20$. The magnitude of complex impedance falls down by 3dB with respect to its value @ f_0 at:
- a) $f_1 = 9.795\text{ MHz}$; $f_2 = 10.205\text{ MHz}$.
64. A crystal oscillator compared with conventional resonant circuits exhibit exceptionally high Q factor (up to 10^6). This is result of
- a) big L_k / C_k ratio and small r_k . (loss resistance).
65. A LC/RC oscillator gives a sinewave output shape, because
- a) an amplifier has very large gain.
65. Which statements about volatile memory are correct?:
- a) data are lost after power-off.
66. Choose true statements about flash A/D converters
- a) in given time just one comparator is active.
67. Microcontroller from megaAVR family directly after RESET executed the program show below. What will be the state of R16 register after execution?

```
.equ const=0xAA ; 'const' symbol definition
ldi r16, const+1 ;load immediately
sts const, r16 ;store directly
lds r16, const ;load directly
sts const, r16 ;store directly
```

- a) 0xAB .

68. Immediately after the RESET operation, MegaAVR family microcontroller performed the set of instructions given below. What will be the state of R16 register after the end of execution.

```
.equ arg=128 ; 'arg' symbol definition  
ldi r16, arg1 ; load immediately  
asr r16 ;arithmetic shift to the right
```

a) 256 .

69. What should be an initial value of 11-bit counting-up, in order to send an interrupt after 10 ms if the clock frequency is 1MHz. Timer sends an interruption request after reaching 0.

a) 1048 .

70. Express the number (1110011110010100101) in binary format into hexadecimal one :

a) 73CA5 .

71. Choose true statements about DMA System

a) DMA (**Direct Memory Access**) system may serve for data transmission between different input/output devices.

72. Choose proper statements for N-bit analog-to-digital converter:

a) value of LSB quant is proportional to 2^{-N} .

73. What is the minimal (t_{min}) and maximal (t_{max}) time, which can be measured with the aid of 9-bit counter working with clock frequency of 1MHz

a) $t_{min}=1\mu s$, $t_{max}=511 \mu s$.

74. Choose proper statement about IO bus system in computer architecture

a) IO devices are of either 'master' or 'slave' type.

75. The main function of the multiplexer is:

a) selecting one of many input signals.

76. Number 1111 represented in two's complement (2C) code:

a) is equal to -7.

77. A standard Random Access Memory (RAM) is an electronic device which input/output interface has the following signals:

a) address.

78. For First-In First-Out buffer the following sentence is true:

a) Empty and Full signals describes the buffer state.

79. De Morgan's Theorem states:

a) $(A+B+C+D+E)' = A'*B'*C'*D'*E'$; $(ABCDE)' = (A' + B' + C' + D' + E')$.

80. In synchronous counter:

a) All flip-flops must have clear input and clock enable input.

81. A number "5" in 4-bit Gray code is expressed as follows:

a) 0101.

82. A number „-2" can be writes as:

a) 1010 in sign-module code.

83. Which of the following sentences about non volatile memory are true:

a) volatile memory is usually slower than non volatile one.

84. Mark the correct statements about PWM (**Pulse Width Modulation**) converter:

a) It is DAC (not ADC).

85. Connecting output of two buffers of below described gates we obtain:

a) logical AND when connecting open drain gates with pull-up resistor.

86. What should be the initial value of N-bit down-counter so as to trigger an interrupt after time= T_0 ms? Counter is fed from the clock operating with frequency F_0 and interrupt is raised each time value 0 is reached. ($N=11$, $T_0=1\text{ms}$, $F_0=1\text{ MHz}$)

a) 1000.

87. To drive a periphery CPU uses a B bit in fifth position in the 8-bit R registry located under address 0xFFFF8008 in microcontroller memory. For programming in C some symbols have been defined:

```
#define R_Register ((unsigned char*) 0xFFFF8008)
#define B_Bit 5
```

How the user properly zeroes B bit

a) $R_Register \&= (1 \ll B_Bit)$.

88. Mark proper statements about IO buses in computer architecture:

a) A bus arbiter is necessary for proper operation.

89. Linear circuit:

a) produces signal being linear combination of input signals.

90. Mark the proper definitions of average power for complex signal

a) $P = \frac{1}{T} \int_0^T x^2(t) dt$.

91. Magnitude characteristics of filter's input signal and magnitude part of frequency response of the filter are subject of:

a) Adding.

92. Hilbert transform of the signal is equivalent to:

a) phase shifting for all signal components by -90 degrees without modification of their magnitude.

93. The anti-aliasing filter is:

a) a lowpass filter.

94. Fast Fourier Transform

a) is used for calculating analog signals spectra.

95. Lossy signal compression

a) is based on signal quantization.

96. Impulse filter response is:

a) output signal for Dirac delta as an input.

97. The perfect reconstruction is

a) errorless signal recovery from signal spectrum.

98. Shannon theorem:

a) Requires infinite duration of the signal.

99. Which Matlab program generates correctly $N=1000$ samples of a sinusoid with frequency $f_0=100$ Hz (when sampling frequency is equal $f_s=1000$ Hz)?

a) $x=\sin(2*\pi*100*(0:N-1))$.

100. Which formulae defines the discrete Fourier transform (DFT) of a signal $x(n)$ having N samples ($n=0,1,2,\dots, N-1, k=0,1,2,\dots, N-1$)?

a) $X(k) = \sum_{n=0}^{N-1} x(n)e^{-j2\pi N/(kn)}$.

101. What are values $X(0), X(2)$ for the 4-point DFT (discrete Fourier transform) of a signal $x(n)$ consisting of the following $N=4$ samples $\{1,3,5,7\}$.

a) $\{10, -8\}$.

102. $N=64$ -point DFT has been calculated for a signal sampled with frequency $f_s=3200$ Hz. With what frequencies are associated the spectral samples $X(0), X(1), X(2)$, (one by one)?

a) 0, 50, 100.

103. $N=64$ -point DFT has been calculated and the following spectral samples have been obtained $X(0), X(1), \dots, X(63)$. Let's assume that $X(2)=3+4j$. In consequence, what another spectral sample is known and what is its value?

a) $X(62) = 3-4j$.

104. How many complex multiplications are calculated in the 32-point Fourier transform algorithms: slow DFT and fast FFT?

a) DFT = 512, FFT = 160.

105. What is the Z transform of a signal having samples: $x(-1)=10, x(2)=20$ (the rest = 0)?

a) $X(z) = 10z^1 + 20z^{-2}$.

106. What transfer function $H(z)$ has a digital filter defined by the equation:

$$y(n) = 2x(n) + 4x(n-2) - 8y(n-1) + 12y(n-3) ?$$

a) $H(z) = \frac{2+4z^{-2}}{1-8z^{-1}+12z^{-3}}$.

107. Put in order the time window functions, starting from the window having the lowest attenuation of the spectral side lobes and ending with the window with the highest attenuation of the spectral side lobes. What sequence(s) is (are) correct?

a) triangular, Hamming, Blackman.

108. A window function (e.g. the Hamming one) has the following Fourier spectrum: normalized width of its main lobe $W=0.1$, attenuation of the side lobes $A=80$ decibels. How will change these values after shortening the window 4 times?

a) $W=0.025, A=80$.

109. Transfer function $H(s)$ of an analog low-pass order-3 ($N=3$) Butterworth filter with cut-off radial frequency $\omega_{3dB}=10$ [rd*Hz] (rd/s) has the following poles:

a) $b=10e^{j180^\circ}$.

110. What should have the transfer function $H(z)$ of a digital filter in order to attenuate (cancel, remove) completely a signal having frequency $f_0=50$ Hz (for sampling frequency $f_s=1000$ Hz) ?

a) zero $z_0 = e^{j2\pi \frac{50}{1000}}$.

111. Which formulae defines the **bilinear transformation** of an analog prototype filter into a digital filter?

a) $s = \frac{z^2 + \alpha^2}{\Delta \omega z}$.

112. What sequence of numbers will result from **convolution** of two signals:

$$x(n) = \dots, 0, 1, 2, 3, 0, \dots \text{ and } y(n) = \dots, 0, 4, 5, 0,$$

a) $\dots, 0, 1, 2, 3, 4, 5, 0, \dots$

113. What is the impulse response $h(n)$, $n=0,1,2,3,4,\dots$, of a digital filter defined by the formulae: $y(n) = x(n) + (1/2)*x(n-2)$

a) $1, 0, 1/2, 0, \dots$

114. Where are placed in the complex z -plane the poles of a stable digital filter?

a) inside the unit circle.

115. What digital filters can be designed with the use of the window method?

a) non-recursive.

116. Input signal spectrum and frequency response of the filter:

a) are being multiplied.

117. Linear system can:

a) produce the output signal which changes linearly in time.

118. Mark the correct statement:

a) bandwidth of wideband FM is proportional to the frequency deviation

119. Z-transfer function is :

a) a ratio of output signal spectrum to the input one.

120. Main method of FIR synthesis is based on:

a) rules and methods for analog filters.

121. IIR filters

a) are iterative calculation procedures.

122. VLANs (Virtual LAN) are used to:

a) isolate data of particular types.

123. Which addresses are correct private address of IPv4.

a) 255.255.255.254.

124. The use of static router, compared to dynamic routing always make possible:

a) better network security.

125. Packet switching drawback is:

a) packet switching has no drawbacks.

126. *Jitter* is:

a) difference in latency.

127. In channel switching

a) transmission latency is varying.

128. VLAN Networks are used among the others for:

a) to protect devices against unauthorised access.

129. In contrast to dynamic routing, the static routing always allows to:

a) obtain shorter propagation of the transmitted data.

130. The network computer - router - computer has been built. The connection was realised with the use of Ethernet. Information about of which parameters is needed so that the exchange of echo-request and echo-replay communications is possible?

a) IP addresses.

131. A drawback of packet switching is:

a) strong dependency on protocols.

132. MPLS is:

a) a modern and universal network layer protocol.

133. RSVP path is created:

a) RSVP is not used for path creation.

134. In a switch compliant with IEEE 802.3 standard, working using the default settings, a frame with unknown source and destination address was received. MAC address table

a) has 2 new records.

135. Two devices compliant with IEEE 802.3 are connected only with each other. In the first one the transmission mode was set to half-duplex and the transmission speed was set to 100 Mbit/s. In the second one all of the transmission parameters were set automatically. Access method used in the second device is

a) CSMA/CD.

136. VLAN Networks are used f.e.:

a) to split the network in parts.

137. In a frame compliant with the IEEE 802.1Q, Q-Tag(also called C-Tag) is located:

a) between Source and Destination MAC addresses.

138. According to IEEE 802.1Q standard, the maximum number of tags in VLAN network is:

a) 2^{12} .

139. Which of the given IP addresses are correct private IPv4 addresses?

a) 173.16.3.10.

140. Which of the given addresses are the subnetwork address and the broadcast address of IPv4 address 149.145.123.144/23

a) 149.145.123.144.

141. Address Resolution Protocol (mark the correct continuation of the sentence):

a) requires the knowledge of the default gateway.

142. In Ethernet network composed of 4 switches a spanning tree (compliant with 802.1D standard) was created. In the switch, which is not connected directly to the root of the spanning tree, 2 paths to the root exist. One of the paths is leading through the switch S1 and another through the switch S2. The cost of both paths is identical. Which path is chosen?

a) leading through the designated port for that switch.

143. In Ethernet network using STP(IEEE 802.1D) how long may it take to switch from the basic path to alternate path.

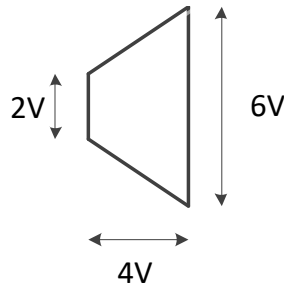
a) 60 seconds.

144. In contrast to the RSTP protocol, the MSTP protocol allows to:

a) enable load balancing.

145. In contrast to dynamic routing, the static routing always allows to:

- a) reroute traffic for a failed link.
- 146.** In contrast to the first version of RIP protocol the second version (RIPv2) allows to:
- a) use higher bandwidth connection.
- 147.** Mark the correct sentences (About OSPF)
- a) OSPF is classless protocol.
- 148.** Mark the correct sentences (About DHCP ACK)
- a) DHCPACK is sent to the DHCP client.
- 149.** DHCP protocol allows to (mark the correct sentence)
- a) obtain IP address.
- 150.** Mark the correct sentences . (About ACL)
- a) ACL Are checked sequentially.
- 151.** The network computer - router - computer has been built. The connection was realised with the use of Ethernet. Knowledge of which parameters is needed so that the exchange of echo-request and echo-replay communications is possible?
- a) Destination IP Address and mask.
- 152.** Translation of addresses (NAT or PAT) allows:
- a) translation of private IP address to public IP address.
- 153.** Mark the correct sentences (NAT – Network Address Translation, PAT – Port Address Translation, ACL – Access Control List):
- a) it is possible to simultaneously use PAT and ACL.
- 154.** The frequency of the second harmonic of 5 MHz is:
- a) 12.5 MHz.
- 155.** Examining the modulation depth on the oscilloscope screen a picture like below has been obtained



Magnitude of the carrier is equal to:

- a) 4 V.
- 156.** Change of carrier frequency in radio relay link from 11 to 6 GHz will cause that radii of first Fresnel zone at obstacles within direct propagation path:
- a) Increase.
- 157.** When mobile terminal departs from GSM 900 cellular phone base station with the speed of 60 km/h, it causes that carrier frequency:
- a) in downlink will go up.
- 158.** The transmitter's intermediate frequency device group comprises:
- a) channel filter.
- 159.** What are the characteristics of a coaxial cable?
- a) It has twisted pairs with a shield.
- 160.** To transmit the signal with 100 mW power a coaxial cable with attenuation coefficient of 0.5 dB/m has been used. Which of enlisted cable lengths ensure -50 dBm or higher output power?
- a) 50 m.
- 161.** Transmission line ($Z_0=50 \Omega$) is loaded with resistor of unknown value R . It resulted with standing wave with $SWR=2$. What are possible values of R ?
- a) 60Ω or 40Ω .
- 162.** Antenna efficiency is:
- a) ratio of total radiated power to power supplied to input.
- 163.** Connecting transmission lines filed with lossless dielectrics with different permittivity leads to

- a) reflection and transmission.
- 164.** Multipath fading is an important problem for radio transmission in
- a) satellite television broadcasting.
- 165.** Reflection coefficient is defined as ratio of
- a) transmitted wave to the reflected wave a/b .
- 166.** In a transmission line, shorted at the end, the voltage standing wave
- a) equals to zero at distances being equal multiple of $\lambda/2$ from the short.
- 167.** In a transmission line terminated with matched load the voltage standing wave
- a) has constant amplitude along the transmission line.
- 168.** The scattering parameters
- a) describe the linear distributed networks.
- 169.** When S parameters of a 4-port network are measured using 2-port vector network analyzer, the two ports not currently connected to the analyzer need to be
- a) shorted.
- 170.** Branch-line directional coupler
- a) splits the power delivered to one of the ports between transmission and coupling ports.
- 171.** Characteristic impedance of the microstrip line
- a) depends on the dielectric constant of the laminate at which the line is printed.
- 172.** Length of TEM wave with frequency of 300 MHz in lossless dielectric having relative permittivity of 2 and relative permeability of 2 is approximately:
- a) 0.705 m.
- 173.** Antenna gain is:
- a) For lossless antennas is always less than 1.
- 174.** Transmission line with characteristic impedance $Z_0 = 50\Omega$ was loaded with a resistor with such value, that standing wave with $SWR = 2$ occurred. What are possible values of

that resistor?

a) 75Ω and 25Ω .

175. If the constant connectivity radio communication system works on a wave with a frequency of 5 GHz and polarization V, it is possible that in the immediate vicinity, without disturbing the first one, another constant connectivity radio system is able to operate on a wave with the same frequency and polarization:

a) 6 GHz and vertical.

176. Signal transmission was performed with coaxial cable which damping factor was equal 0.5dB/m. Which cable length ensure -50dB or better power at the end of cable?

a) 100 m.

177. At the input of $F=3$ dB amplifier an $A=6$ dB muffler was connected. What is new value of noise figure?

a) $F=9$ dB.

178. Fading of the mobile station from the base station in GSM900 standard with $v=60$ km/h will affect frequency of the carrier signal in such a way that it will:

a) increase in the uplink.

179. Usage of the differential encoding in wireless radio systems with coherent detection results with:

a) worse efficiency with given BER.