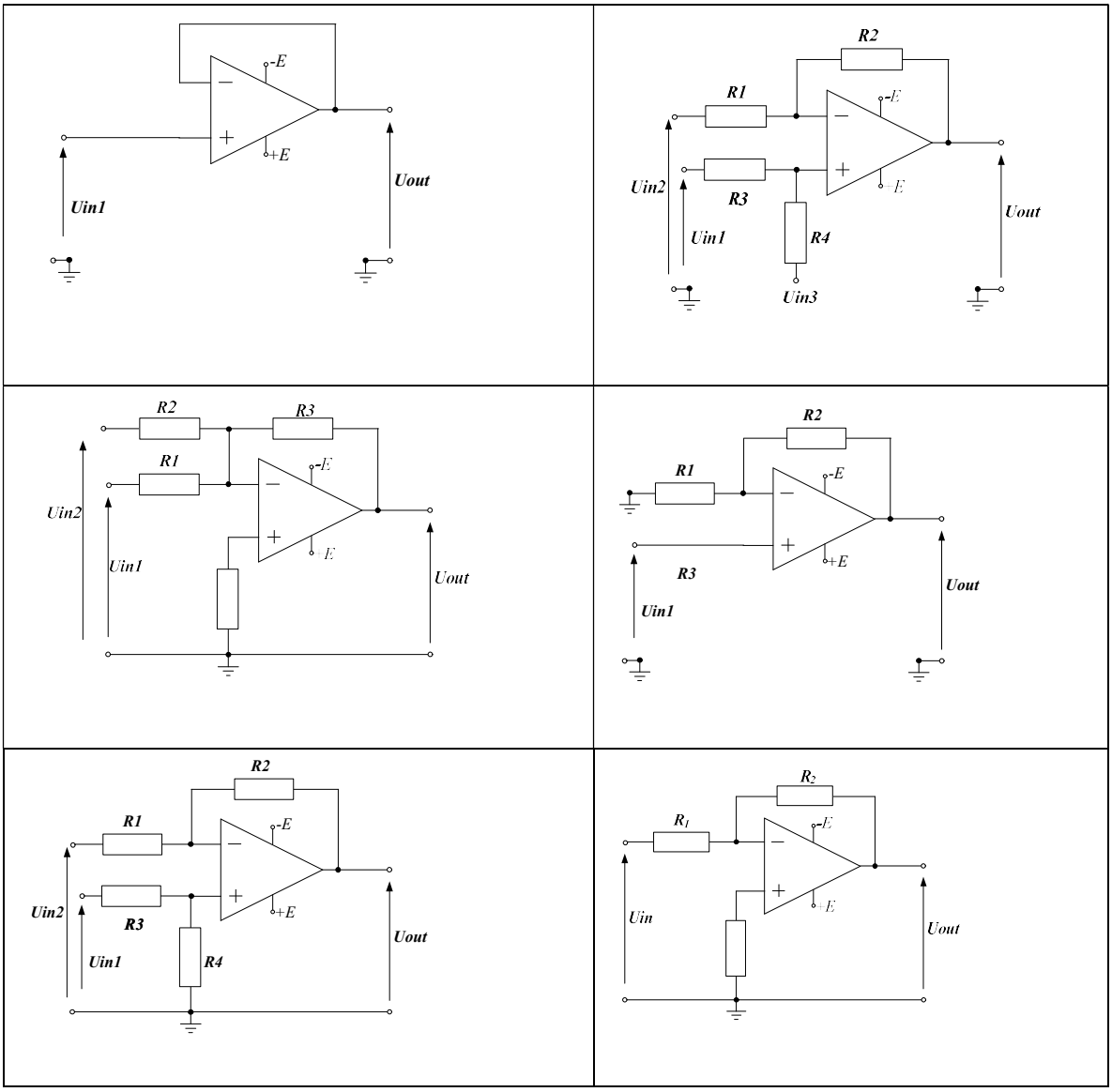
Electronic Circuits

1. *Amplifiers - basics:*
    a. *Lower and upper frequency limit?*
    b. *Amplitude and phase characteristics of first order RC circuits.*
    c. *Compensated divider ?*
    d. *Bode plots ? (example: - Amplifier of the gain of 10V/V has lower and upper frequency limits of 100Hz and 100kHz respectively. Draw Bode plots for this amp.).*
    e. *Convert units dB to V/V or W/W (±3dB, ±6dB, ±10dB, ±20dB, ±40dB and other as e.g.. 13=10+3dB).*
    f. *Explain units: dBu, dBm, dBV (be ready to convert units).*
2. *Operating amplifiers:*
    a. *What is a differential amplifier ?*
    b. *Compare a perfect and a real OpAmp (give an order of magnitude of real parameters).*
    c. *Explain notion of a "offset voltage" ?*
    d. *Explain notion of CMRR (Common Mode Rejection Ratio) ?*
    e. *For a given schematic diagram calculate unknown voltage (Ri and other voltages are given, assume perfect OpAmp).*



    f. *What is an "instrumentation amp" ?*
    g. *Schematic diagram of differentiator and integrator.*

h. *Explain way of operation of auto-zeroing amplifier ?*

3. *Active filters.*
   a. *Name the types of active filters due to the type of frequency response.*
   b. *List the types of active filters due to the method of approximation of the frequency response. Characterize their basic properties in time and frequency domains.*
   c. *What is a biquadratic section of a filter ?*
   d. *How can be realized an active filter of the order higher than 2 ?*
   e. *What is the basic principle of an active filter with switching capacitor ?*
4. *Amplifier with BJT – operating point:*
   a. *Small signal model of BJT.*
   b. *List types of polarization schemes of BJT (draw schematics) ?*
   c. *Estimate operating point of BJT (assume all values of resistors , supply voltages, transistor parameters)).*
   d. *What is a load line (How to draw it ?) ?*
   e. *What are the effects of changes in the parameters of the polarization (resistors, supply voltage, transistor parameters) on collector current potential of emitter, collector, collector-emitter voltage?*
5. *Amplifier with BJT – gain:*
   a. *Estimate gain (and effective gain)of BJT amp for given: R_G, R_{B1},R_{B2}, R_C, R_L, β, φ_T, I_{CQ}, U_{CEQ}.*
   b. *Compare BJT amp in CE, CB, CC configurations.*
   c. *What is emitter follower, what are specific parameter of it ?*
6. *Amplifier with BJT – frequency limits:*
   a. *What determines the lower and upper frequency of the amplifier with the BJT?*
   b. *Compare upper frequency limits of CE, CB, CC configurations.*
   c. *Explain Miller effect ?*
7. *Linear voltage controllers:*
   a. *What is a serial and parallel voltage regulator - main features ?*
   b. *What is the principle of operation of a simple current limiter (with transistor)?*
   c. *What is a "fold-back" current limiter??*
   d. *Draw a load and line regulation curves of a voltage stabilizer. What parameters of the stabilizer can be read from these curves ?*
8. *Oscillators:*
   a. *What are the condition of amplitude and the condition of phase of wave generation?*
   b. *Name and draw main LC oscillators.*
   c. *Name and draw basic RC oscillator.*
   d. *Draw the electronic model of a crystal resonator. Draw an absolute value of the impedance of a crystal resonator vs. frequency. What are series and parallel resonance of the resonator?*
   e. *What are the basic (essential) parameters of oscillators ?*
   f. *What is a monostable and astable flip-flop?*
   g. *What is a function generator ?; What is the principle of operation of the DDS generator (Direct Digital Synthesis)?*
9. *DC-DC converters:*
   a. *Draw a basic (simplified) schematic diagram of DCDC converter (step up, step down, inverter). Derive the formula for the output voltage; Sketch basic voltage and current waveforms.*
10. *Multipliers and PLL.*
   a. *List the basic types of analog multipliers - compare their accuracy with the speed of operation.*
   b. *What is the principle of synchronous detection ?*
   c. *What is the I&Q detector ?*
   d. *Draw block diagram of a PLL and explain its operation principle.*
   e. *Draw the examples of functional blocks of PLL (VCO, Filter, phase detector).*
   f. *What is the capture frequency range and the lock frequency range of a PLL ?*

g. *Draw the block diagram and explain principle of operation of AM detector, FM detector, frequency synthesizer with a PLL.*

11. *AD and DA converters*
    a. *What is the quantization noise? How can be estimated the signal-to-noise ratio for the n-bit converter?*
    b. *List several types of AC converters and arrange them in order from the largest to the smallest resolution and speed.*
    c. *What is the difference between " sample and hold" and "track and hold" systems ?*
12. *Rectifiers:*
    a. *Draw schematic diagram of half-wave, center-tap and bridge rectifier with capacitive filter.*
    b. *Draw the currents and voltages wave forms in rectifier (HW, CT, Bridge).*
    c. *What is the PF (Power Factor) ?*
    d. *What is the voltage ripples and what the ripples depends on ?*
    e. *Draw a simplified model of real transformer. Describe the components of the model.*
13. *Noise.*
    a. *List the basic types of noise found in electronic circuits.*
    b. *Briefly describe Johnson (Nyquist) noise,*
    c. *briefly describe shot noise,*
    d. *briefly describe flicker (1/f) noise,*
    e. *Define noise factor,*
    f. *What is the SNR(out) on the output of the system composed of amplifier of gain G and noise factor F connected in series with attenuator of attenuation A? Assume SNR(0=input) = 20dB, G=30dB, F=7dB and A=4dB)*