1. Shown below is a single stage common emitter amplifier using a NPN BJT as the active device. Design the circuit so that it clips symmetrically, viz., pick $R_{B1}$ and $R_{B2}$ so that the collector current is that which yields symmetric clipping. The design specification for the magnitude of the small signal midband voltage gain is 11.2. For the design calculations assume the the base-to-emitter dc voltage drop is 0.65 V, that the current in $R_{B1}$ is $12I_B$, $\beta = 112$, the base spreading resistance is 0Ω, and the Early voltage is infinity. The dc power supply voltage is $V^+ = 15$ V. It is given that $C_1 = 10 \mu F$, $C_2 = 22 \mu F$, $C_E = 330 \mu F$, $R_{E1} = 2 k\Omega$, $R_L = 13 k\Omega$, and $R_C = 6.8 k\Omega$.

2. For the circuit parameters indicated in the diagram, use SPICE to determine:
   - the dc operating point of the circuit, viz. the dc voltage at each terminal of the transistor and the current flowing into the collector and base leads and out of the emitter. (DC Operating Point or OP analysis)
   - the small signal ac voltage gain, viz. a plot of the gain, $A_v$ versus frequency where the frequency range is from 10 Hz to 100 MHz. (AC Analysis)
   - plot of the output voltage versus time for 2 cycles of the input for an input signal a sine wave with a frequency of 1 kHz and a peak values for which the output is not clipped, is on the verge of clipping, and significantly clipped (hard clipping). (Transient Analysis)
   - plot of the output voltage versus frequency for a frequency span from dc to 10 kHz, viz. the spectra of the output with an input signal a sine wave with a frequency of 1 kHz and a peak value which causes the output to clip. Plot the output voltage on a log scale. Determine the THD (Fourier Analysis).
   - plot the noise spectral density at the output (noise analysis). Also determine the total noise at the output.

Assume that the SPICE parameters for the NPN BJT are: saturation current the value that makes the base-to-emitter voltage 0.65 V when the emitter current is the value that produces symmetric clipping; forward beta, 112; Early voltage, 74.03 V, zero-bias base collector capacitance, 3.638 pF; forward transit time, 301.2 ps, and base spreading resistance, 10 Ω.

Verify the SPICE solution for the above with a hand calculation using the parameters given for the SPICE simulation. Calculate the dc operating point, mid-band small signal voltage gain, and positive and negative clipping levels.
2. For the circuit shown below bias it at the same collector current and select the components so that the midband gains are the same as in problem 1. Perform the same analyses as in Problem 1. Use the same parameters for the transistors.