Try to simulate circuits using SPICE (if possible) and compare the results with your answers. The extra problems are stared (*) and need not to be handed in.

1. In the following circuit, it is desired to transmit maximum output power $P_{\text{omax}} = 1\, \text{W}$ to the load $R_L = 8\, \Omega$. If we want efficiency ($\eta$) to be maximized:
   a) Determine the following parameters of the circuit: $\pm Vcc, R1, \eta_{\text{max}}$
   b) Calculate $R_{\text{in}}, R_{\text{out}}, A_v$ of the circuit in its bias point.

```
+Vcc
   |
   V
   |
  +Vcc
```

$V_{\text{in}}$ $V_{\text{out}}$

$R1$ $R_{\text{out}}$

$-Vcc$

2. In the following circuit, output swing is 4V. Assume efficiency is maximum. Calculate the values of $R_1$ and $R_3$.

```
+Vcc 12V

+Vcc
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
```

$V_{\text{in}}$

$R1$

$R3$

$R2$

$Q1$

$Q2$

$R_{\text{out}}$

$50$

3. Calculate the specifications ($R_{\text{in}}, R_{\text{out}}, A_v, P_{\text{omax}}, \eta$) of the following circuit. Assume $V_{\text{BE}} = 0.7$ and $\beta = 100$.

```
+Vcc 24V

+Vcc
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
   |
```

$V_{\text{in}}$

$R1$

$R2$

$R3$

$R4$

$Q1$

$Q2$

$Q3$

$Q3$

$R7$

$R_{\text{out}}$

$200$

$R_{\text{out}}$

$180k$

$100k$

$1k$

$6.8$

$10k$

$10k$

$100$

$1k$
(*) 4) Find the values of R5 and R6 in order $P_{\text{omax}}$ and $\eta$ to be maximized.

$\beta_1 = 200$, $\beta_2 = \beta_3 = 50$

$V_D = 0.7$