Ch. 3 — Transistor theory

3.1 - Basic theory
- NPN, PNP
- Curves
- ~~leakage, breakdown~~

Today

3.2 DC Analysis
- Common emitter
- Load line
- other circuits.

Friday

3.3 Basic transistor applications.
- Switch
- Digital logic
- Amplifier

3.4 Biasing
- single resistor
- voltage divider
- Current mirrors.

Monday (wk 8)

Wed = review
Fri = Lab

3.5 Multi-stage

Ch 4 - Transistor amplifiers

Monday (wk 9)

4.1 Analog signals
4.2 Linear amplifier
- graphical analysis
- small signal models

4.3 Basic amplifier configurations
4.4 Common emitter Amplifier — Wed.
4.5 AC load line analysis — Fri
4.6 Common collector (emitter follower) — Monday (wk 10)
4.7 Common base — Wed
4.8 Summary — Fri
4.9 Multistage — Monday wk 11
- cascade
- cascode

4.10 Power considerations. — Wed → Test Fri wk 11.

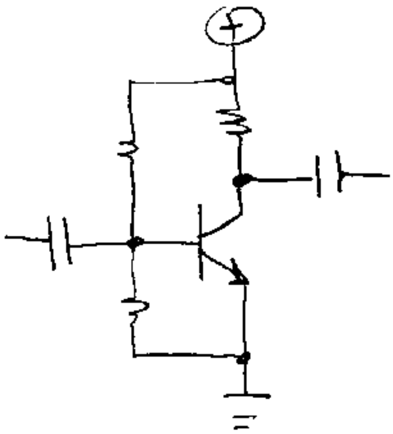
Hw — Ch. 3 —

Exercises

	p	#	p	#
Sec 3.1	104	1, 2	152	1, 4, 7, ~~10~~, 14
	107	3, 4	153	14, 16
	110	5, 6		
	~~113~~	~~7, 8~~		
	121	9, 10		

Not to hand in.

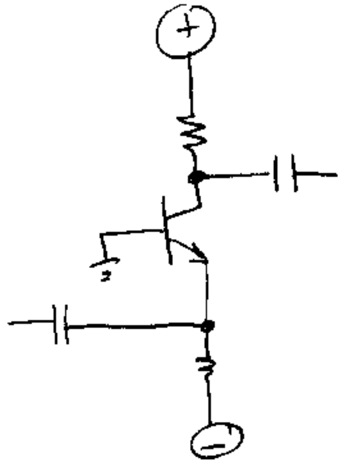
3 types of amplifiers



Common emitter

High voltage gain

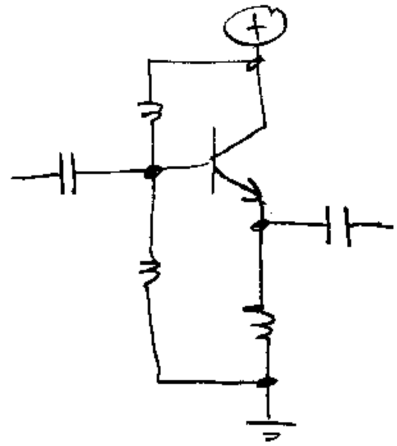
moderate current gain



Common base

High voltage gain

current gain < 1



common collector

High current gain

Voltage gain < 1

(just a preview. We need to bias them first.)

Lab reports –

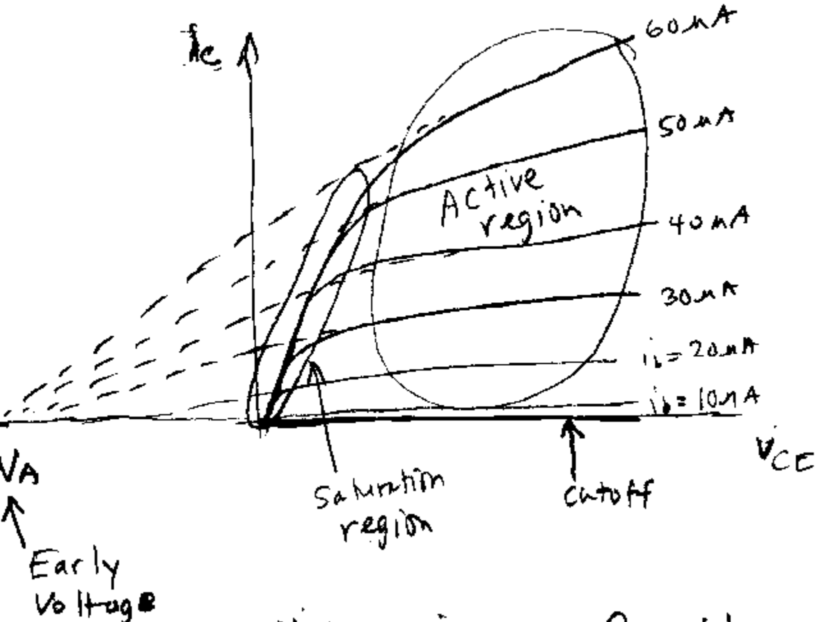
general comments – All are OK.

Label the plots –
I could not tell what they mean

Mix text and figures –
(as opposed to Fig 1, Fig 2, etc)
Write the notes on the same page as the scope picture.

Procedure needs more detail –
Someone else should be able to repeat the experiment, <u>with all the mistakes</u>.

Transistor characteristic curves.

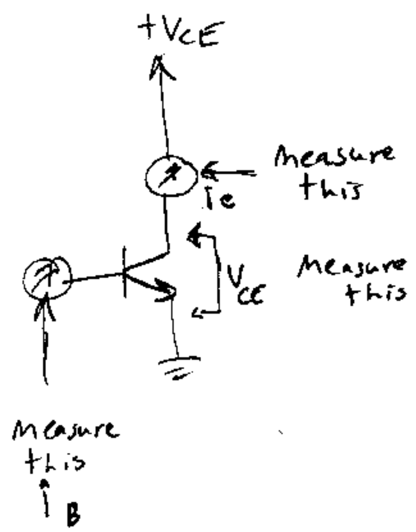


3 regions – Active
Saturation
cutoff.

This is a family of curves.

"Common emitter characteristics" –

One curve for each sample V_{BE}.



Hold i_B constant –

Sweep V_C

Measure i_C

Breakdown – (3.1.6)

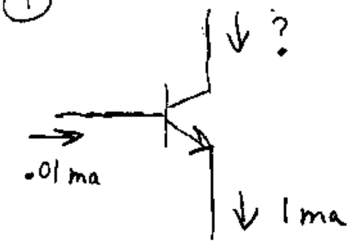
Like a zener diode –

When the voltage is too high, it breaks down –

non-destructive, but current can be destructive.

Examples

(1)

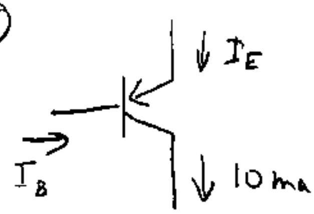


What is β ?

α ?

I_C ?

(2)



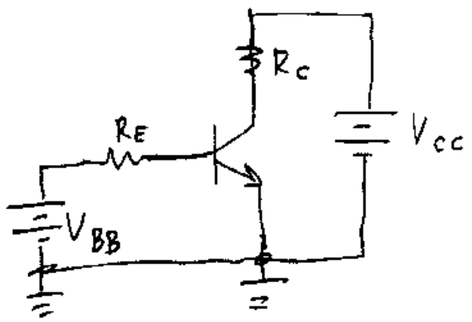
$\beta = 100$

What is I_B ?

I_E ?

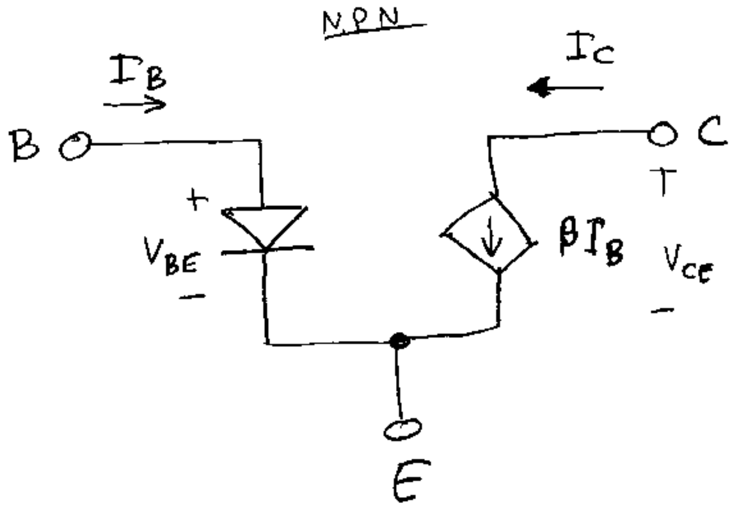
3.2 DC Analysis of Transistor Circuits

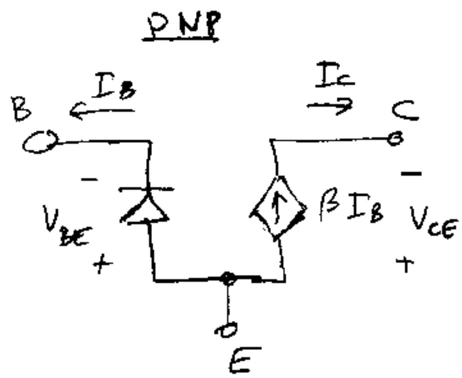
3.2.1 Common Emitter Circuit.



What are voltages and currents?

Equivalent circuit of transistor: (Model)





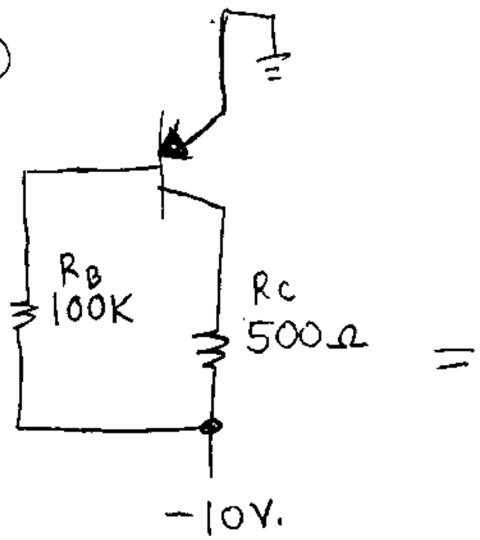
Substitute the model for the transistor, and analyze.

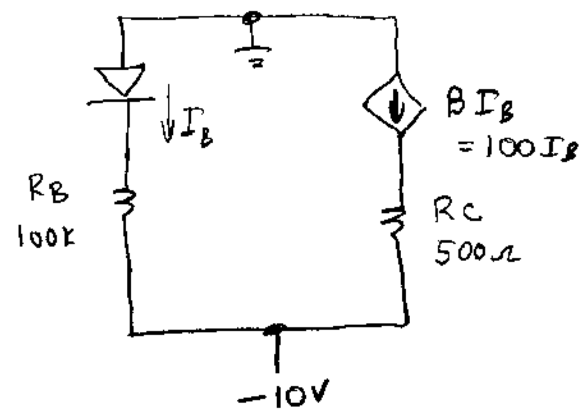
Example:

Transistor parameters:

$V_{BE} = .6 \qquad \beta = 100$

(1)





$V_{RB} = 9.4 \qquad I_B = \frac{9.4}{100k} = .094\,ma$

$I_C = \beta I_B = 9.4\,ma$

$V_{RC} = I_C R = (9.4\,ma)(500) = 4.7$

$V_{CE} = (-10) - (-4.7) = -5.3\,V$

HW: Do again for $\beta = 50, 200, 500$

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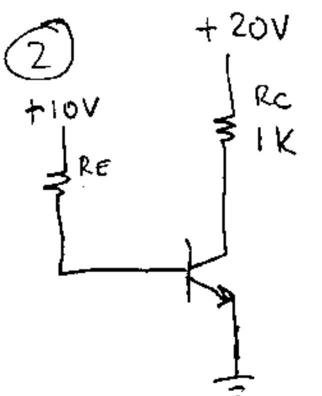
(2)



$V_{BE} = .6 \qquad \beta = 100$

What is R_E for $V_{CE} = 10$?