#### Dept EE, National Tsing Hua University EE2255 Electronics HW 2 (chapter 4, 5)

#### Student ID:

Name:

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- (1) Delay is not allowed. (-100pt)
- (2) We use LTspice transient analysis to simulate both cases. You must set stop time = 200u and maximum timestep = 1n. (-5pt)
- (3) The BJT model is set by the directive: .model NPN NPN(Is=2e-16 Bf=80). (-10pt)
- (4) You must attach screenshots of circuit and output waveform. (-10pt)
- (5) You must extract the output amplitude by cursor. (-10pt)
- (6) Please check the hand-writing result in your photo is clear. (-5pt or -10pt)
- 1. Fig. 1 shows the common-emitter amplifier with  $V_{CC}$  as 2.5 V.  $V_{in}$  is a 10 KHz sinusoidal waveform with amplitude equal to 0.5 mV ( $V_{p-p} = 1$  mV).
  - (a) Please design your  $V_B$  and  $R_C$  to make the voltage gain larger than 10 V/V. Note that voltage gain is the ratio of output amplitude to input amplitude.
  - (b) Please check the BJT operates in "active mode," and display it ( $V_{CE} > V_{BE} > 0$ ).
  - (c) Please use small signal model to calculate its small signal gain.
  - (d) Compare (a) and (c) results.



Fig. 1

- 2. Fig. 2 shows the common-collector amplifier (emitter follower) with  $V_{CC}$  as 2.5 V.  $V_{in}$  is a 10 KHz sinusoidal waveform with amplitude equal to 0.5 mV ( $V_{p-p} = 1$  mV).
  - (a) Please design your  $V_B$  and  $R_E$  to make the voltage gain larger than 0.8 V/V. Note that voltage gain is the ratio of output amplitude to input amplitude.
  - (b) Please check the BJT operates in "active mode," and display it ( $V_{CE} > V_{BE} > 0$ ).
  - (c) Please use small signal model to calculate its small signal gain.
  - (d) Compare (a) and (c) results.



### Appendix

(1) Setup of Transient Analysis

😕 Edit Simulation Command						
Transient AC Analysis DC sweep Noise DC Transfer DC op pnt						
Perform a non-linear, time-domain simulation.						
Stop time:	200u					
Time to start saving data: 0						
Maximum Timestep:	1n					
Start external DC supply voltages at 0V:						
Stop simulating if steady state is detected:						
Don't reset T=0 when steady state is detected:						
Step the load current source:						
Skip initial operating point solution:						
Syntax: .tran <tprint> <tstop> [<tstart> [<tmaxstep>]] [<option> [<option>]]</option></option></tmaxstep></tstart></tstop></tprint>						
.tran 0 200u 0 1n						
Cancel	ОК					

## (2) Waveform of Sinusoidal Input



# (3) Setup of BJT Model

Top Directory: C	:\Users\ChungYua	n\Dropbox\我的電	腦 (LAPTOP-83B4F3A9) >
G_		Bipolar NPN tra	ansistor
			macromodel's test fixture
Crossers(chung) [SpecialFunctions] [Switches] bi bi2 bv cap csw current diode e e2 <	f FerriteBead FerriteBead2 g g2 h ind ind2 ISO16750-2 ISO7637-2 LED	電腦 (LAPTOP-83) load load2 lpnp ltline mesfet njf nmos nmos4 npn npn2 npn3	npn4 pjf pmos pmos4 pnp pnp2 pnp4 polcap res res2 schottky
Car	icel		ОК
Fext on the Sch	ematic:		

😕 Edit Text on the Scheme	$\times$				
How to netlist this text Comment SPICE directive	Justification Left ~ Vertical Text	Font Size 1.5(default)	OK Cancel		
.model NPN NPN(Is=2e-16 Bf=80)					
Type Ctrl-M to start a new line.					