



# Electronics II

Lecture 05  
re Equivalent Model  
&  
BJT Small Signal Analysis

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## Previous Lecture

- Important Amplifier Parameters using Two Port System
  - Voltage Gain.
  - Current Gain.
- re Equivalent Model for
  - Common Base Configuration.
  - Common Emitter Configuration.



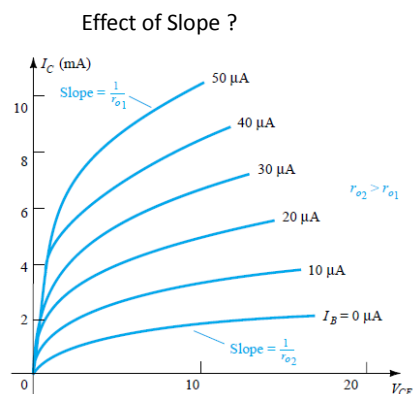
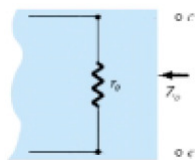
## Session Overview

<b>Topic</b>	re Model for Common Base, Common Emitter & Common Collector Configurations. BJT Small Signal Analysis (Common Emitter Configuration)
<b>Concepts</b>	BJT Small Signal Analysis of Common Emitter <ul style="list-style-type: none"> <li>▪ Fixed Bias Configuration.</li> <li>▪ Voltage Divider Bias.</li> </ul>
<b>Recommended Reading</b>	Section 7.5 of [1] Sections 8.1, 8.2 of [1]
<b>Keywords</b>	re Model, Common Emitter, Fixed Bias, Voltage Divider, Small Signal, BJT.



## Common Emitter Configuration

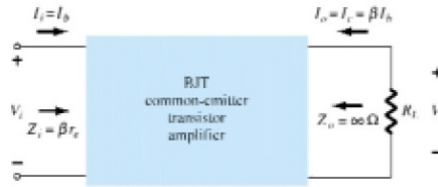
- Output Impedance
  - $Z_o = r_o \Omega$ .
  - If  $r_o$  is ignored, then
  - $Z_o = \infty \Omega$ .



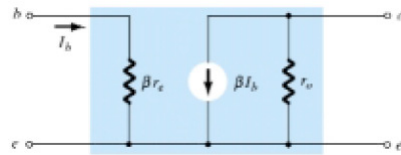


# Common Emitter Configuration

- Voltage Gain,  $A_v$ 
  - $A_v = -R_L/r_e$



- Current Gain,  $A_i$ 
  - $A_i = \beta$

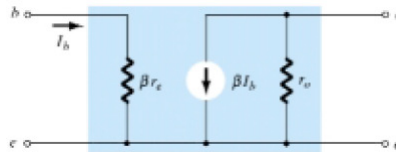


Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8<sup>th</sup> Edition, Pearson Education Inc, ISBN: 81-7808-590-9.



# Common Emitter Configuration

- *Example 7.5(Boylestad):* For a common emitter configuration with  $r_o = \infty \Omega$ ,  $\beta = 120$ ,  $I_E = 3.2\text{mA}$ , calculate
  - $Z_i$
  - $A_v$  with  $R_L = 2\text{k}\Omega$
  - $A_i$  with  $R_L = 2\text{k}\Omega$ .



Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8<sup>th</sup> Edition, Pearson Education Inc, ISBN: 81-7808-590-9.



## Common Collector Configuration

- For common collector configuration, the re equivalent model of common emitter configuration is used.

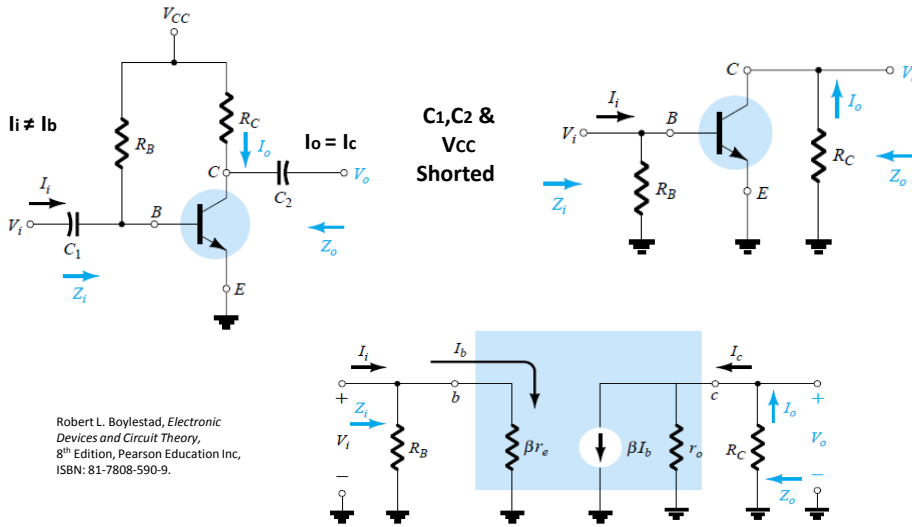


## BJT Small Signal Analysis Common Emitter Configuration

- The  $r_e$  model developed previously accounted only for the BJT equivalent model and related parameters.
- Small signal analysis will cover the detailed analysis of BJT along with its biasing circuit.
- Common Emitter  $r_e$  model will be considered with different DC bias configuration. The DC bias configuration under consideration are
  - Fixed Bias Configuration.
  - Voltage Divider Bias.
  - Emitter Bias Configuration.
  - Collector Feed Back Configuration.

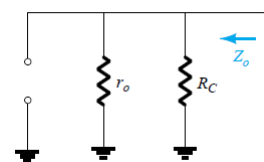


# CE Fixed Bias Configuration

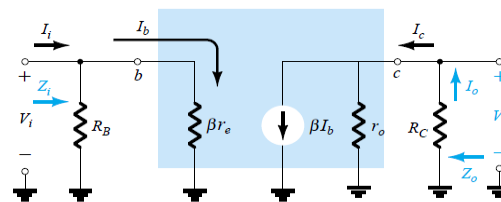


# CE Fixed Bias Configuration

- Input Impedance,  $Z_i$



- Output Impedance,  $Z_o$

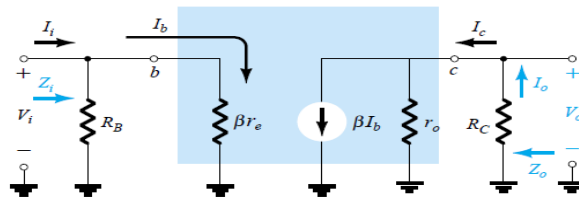


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## CE Fixed Bias Configuration

- Voltage Gain,  $A_v$   
 $A_v = -R_c/r_e$
- Derivation:



Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8<sup>th</sup> Edition, Pearson Education Inc, ISBN: 81-7808-590-9.



## References

- [1] Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8<sup>th</sup> Edition, Pearson Education Inc, ISBN: 81-7808-590-9.