BIASING

- To find the ***DC operating point*** (***bias point***, ***Q-point***)
- Has to ***precede ac analysis***, since ***small-signal parameters depend on the bias point***
- For ***diodes***: (I_D, V_D)
- For ***BJTs***: (I_C, V_{CE})
- For ***MOSFETs***: (I_D, V_{DS})
- Also, $P_D = V_D \times I_D$ (***Diodes***), $V_{CE} \times I_C$ (***BJTs***), and $V_{DS} \times I_D$ (***MOSFETs***)

- ***DC power dissipated in a circuit*** = (***Supply Voltage***) × (***Supply Current***)
- Circuits may be ***biased*** by ***single supply*** (***positive/negative and ground***) or ***dual supply*** (***positive and negative***)
- Devices should be ***properly biased*** and ***ideally*** should be under the ***best biasing*** (BB)
- Also, need ***voltage references*** to provide ***fixed DC voltages*** at some ***circuit nodes***

- ***Two types***:
  - ***Discrete Stage Biasing***:
    - Uses ***power supplies*** and ***resistors*** along with the ***active devices***
    - Used for ***discrete circuits*** assembled in ***breadboards***
    - Also known as ***passive biasing***
  - ***IC (Integrated Circuit) Stage Biasing***:
    - ***Avoids resistors*** as much as possible and ***uses transistors*** as ***biasing elements***
    - Used for ***IC stages***
    - Also known as ***active biasing***

Discrete Stage Biasing: BJT

- Will be using ***quick estimate*** (V_{BE} = 0.7 V)
- ***FA mode of operation*** with $V_{CE} \geq 0.2$ V
- ***Error of ±5-10% perfectly acceptable***
- ***Common Schemes***:
  - ***Fixed Resistor Bias***
  - ***Emitter Feedback Bias***
  - ***Collector Feedback Bias***
  - ***Voltage Divider (or 4-Resistor) Bias***

- ***Fixed Resistor Bias***:
  - $I_B = (V_{CC} - V_{BE})/R_B$
  - $I_C = \beta I_B$
  - $I_E = (\beta + 1)I_B \approx I_C$
  - $V_{CE} = V_{CC} - I_C R_C$
    - For BB, $V_{CE} = V_{CC}/2$
  - P_D (***circuit***) $= V_{CC} \times I_E$
  - ***Note***: ***Need β to find the operating point***
  - The ***simplest biasing circuit***, but has ***severe β dependence***