

**A: Tunnel Diodes**

ECSE-573 September 2006

- [1] Introduction
- [2] Qualitative description of tunnel diode  
  - Cross- section, doping distribution, electric field distribution
- [3] Qualitative description of current- voltage characteristics
- [4] Degenerate semiconductors and Fermi levels
- [5] Tunneling probability
- [6] Current-voltage characteristics and negative differential resistivity
- [7] Oscillators utilizing tunnel diodes
- [8] Small signal equivalent circuits
- [9] Fabrication techniques
- [10] A survey of manufacturers of the tunnel diodes and a summary on the evolution of development of tunnel diodes for microwave and millimeter-wave applications
- [11] Examples of commercial products involving the tunnel diodes at microwave frequencies

Presentation package A-1: items [1] to [6] (Hadley, 09/21)

Presentation package A-2: items [7] to [11] (Qing, 09/26)



Scheduled Date

- Every presentation is scheduled to be **45 minutes**, followed by a discussion period. (Students are encouraged to participate in the discussion period)
- Each class will have **one** presentations.
- Deadline to hand in presentation slides for A-1: **Sept. 20<sup>th</sup>**
- Deadline to hand in presentation slides for A-2: **Sept. 25<sup>th</sup>**

**B: IMPATT devices**

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- [1] Introduction
- [2] Qualitative description of IMPATT  
Cross- section, doping distribution, electric field distribution
- [3] Impact ionization
- [4] Conditions for impact ionization
- [5] Width of impact ionization region
- [6] Small signal analysis of IMPATT diodes
- [7] Current voltage characteristics, Impact ionization region, drift region
- [8] Small signal equivalent circuits
- [9] A survey of the development of the IMPATTs
- [10] A survey of manufacturers of microwave circuits and components involving IMPATT devices
- [11] A survey and summary on the commercial products involving IMPATTs

Presentation package B-1: items [1] to [6] (Guillaume, 09/28)

Presentation package B-2: items [7] to [11] (Li, 10/03)



Scheduled Date

- Every presentation is scheduled to be **45 minutes**, followed by a discussion period. (Students are encouraged to participate in the discussion period)
- Each class will have **one** presentations.
- Deadline to hand in presentation slides for B-1: **Sept. 27<sup>th</sup>**
- Deadline to hand in presentation slides for B-2: **Oct. 2<sup>nd</sup>**

**C: Transferred electron devices ECSE-573 September 2006**

- [1] Introduction
- [2] Qualitative description of transferred electron devices  
Cross- section, doping distribution, electric field distribution
- [3] Bulk negative differential resistivity, spacial response, temporal response
- [4] N-shaped and S-shaped bulk negative differential resistivity
- [5] Formation of high field domain
- [6] Dipole layer for N-shaped devices
- [7] Current-controlled negative differential resistivity devices
- [8] Energy required for transferred electron effects
- [9] Modes of operation (Ideal uniform-field mode, Accumulation-layer mode, Transit-time dipole-layer mode)
- [10] Excess voltage and load line (device line)
- [11] Triangular domain formation and fundamental frequency
- [12] Comparison of different operation modes
- [13] Equivalent circuits (Bosch, Gunn effect electronics)

**C: Transferred electron devices (continue)**

- [14] Impedance for low field region
- [15] Impedance for high field region
- [16] Power-frequency performance
- [17] Some examples of Gunn device applications
- [18] A comprehensive survey on the development of TEDs
- [19] A survey on the manufacturers of microwave and millimeter wave circuits involving TEDs
- [20] Evolution of the microwave and millimeter wave markets involving TEDs

Presentation package C-1: items [1] to [5]	(Hadley,	10/05)
Presentation package C-2: items [6] to [10]	(Qing,	10/12)
Presentation package C-3: items [11] to [15]	(Guillaume,	10/17)
Presentation package C-4: items [16] to [20]	(Li,	10/19)



Scheduled Date

- Every presentation is scheduled to be **45 minutes**, followed by a discussion period. (Students are encouraged to participate in the discussion period)
- Each class will have **one** presentations.
- Deadline to hand in presentation slides for C-1: **Oct. 4<sup>th</sup>**
- Deadline to hand in presentation slides for C-2: **Oct. 11<sup>th</sup>**
- Deadline to hand in presentation slides for C-3: **Oct. 16<sup>th</sup>**
- Deadline to hand in presentation slides for C-4: **Oct. 18<sup>th</sup>**