LectureNotes Class Guide

Ibrahim Nasser
ibrahim.nasser@fau.de

August 15, 2025

Contents

1 Overview

The `lecturenotes` class is a custom LaTeX style designed for clear, structured, and visually clean academic notes. It preloads many packages and defines several custom macros so you can focus on writing content without repetitive boilerplate setup.

This guide demonstrates every feature provided by `lecturenotes.cls`, including:

- All preloaded packages
- Example usage of each package
- All custom macros
- How to customize each feature by editing the class file

Throughout this manual, code examples are shown in shaded `codeblock` environments, followed by their rendered output.

2 Core Document Utilities

2.1 graphicx + float

The `graphicx` [1] package provides commands for importing and scaling external images within a document, making it the standard tool for handling graphics in LaTeX. The `float` [2] package extends the default floating environment options by introducing the `[H]` specifier, which forces the element to appear exactly at the specified location rather than letting LaTeX reposition it. Together, they allow precise control over both the inclusion and placement of figures. For example, see figure 1

Figure 1: Example figure

2.2 booktabs

The `booktabs` [3] package provides commands for creating professional-quality tables by using well-spaced, stylistically consistent horizontal rules. Instead of the default LaTeX table lines, it offers `\toprule`, `\midrule`, and `\bottomrule` for cleaner design and improved readability, avoiding excessive or vertical lines for a more polished appearance. For example, see table 1

Item	Description
Apple	A fruit
Table	A piece of furniture

Table 1: Booktabs table

2.3 parskip

The `parskip` [4] package adds vertical space between paragraphs and removes first-line indentation. For example:

This is the first paragraph. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer nec odio. Praesent libero. Sed cursus ante dapibus diam. Sed nisi.

This is the second paragraph. Nulla quis sem at nibh elementum imperdiet. Duis sagittis ipsum. Praesent mauris. Fusce nec tellus sed augue semper porta.

This is the third paragraph. Mauris massa. Vestibulum lacinia arcu eget nulla. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos.

2.4 geometry

The `geometry` [5] package sets and adjusts page margins.

Default in `.cls`:

```
\RequirePackage[margin=0.5in]{geometry}
```

Change `margin` to set different margins.

2.5 array

The `array` [6] package provides advanced column formatting in tables. For example:

```
\begin{tabular}{>{\bfseries}l l}
    Header1 & Header2 \\
    Value1  & Value2
\end{tabular}
```

Header1	Header2
Value1	Value2

2.6 multicol

The `multicol` [7] package creates multi-column text layouts. For example:

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed non risus. Suspendisse lectus tortor, dignissim sit amet, adipiscing nec, ultricies sed, dolor.

Cras elementum ultrices diam. Maecenas ligula massa, varius a, semper congue, euismod non, mi. Proin porttitor, orci nec nonummy molestie.

2.7 titling

The `titling` [8] package customizes title spacing.

Default in `.cls`:

```
\setlength{\droptitle}{-1in}
```

This reduces space above the title.

3 Mathematics, Logic, and Semantics

3.1 amsmath

The `amsmath` [9] package extends LaTeX's math capabilities. For example, the `align` environment allows multiple equations to be aligned at a chosen symbol:

$$a^2 + b^2 = c^2 \tag{1}$$

$$e^{i\pi} + 1 = 0 \tag{2}$$

The `cases` environment formats systems of equations with a left brace:

$$\begin{cases} x + y = 1 \\ x - y = 3 \end{cases}$$

3.2 amssymb

The `amssymb` package [10] provides additional mathematical symbols beyond the default LaTeX set, such as blackboard-bold letters, logic symbols, and operators:

$$\mathbb{R}^n, \quad \mathbb{N}, \quad \nabla f(x), \quad \therefore x \text{ is optimal}, \quad \forall x \in X,\ \exists y \in Y$$

3.3 mathrsfs

The `mathrsfs` package [11] provides an elegant script font for mathematical expressions:

$$\mathscr{F} : \mathbb{R} \to \mathbb{R}, \quad \mathscr{L} \text{ for a Lagrangian}, \quad \mathscr{P}(S) \text{ for a power set}$$

3.4 stmaryrd

The `stmaryrd` package [12] adds symbols such as double brackets for denoting semantic evaluation:

$$[\![P]\!] = \text{true}, \quad [\![E]\!]_\rho \text{ for evaluation of } E \text{ in environment } \rho$$

3.5 mathpartir

The `mathpartir` package [13] provides a concise syntax for typesetting inference rules:

$$\frac{P \implies Q \qquad P}{Q}$$

3.6 semantic

The `semantic` package [14] supports notation for formal semantics, such as:

$$\langle E, \sigma \rangle \Downarrow v$$

for an expression E evaluating in environment σ to value v, and:

$$\langle C, \sigma \rangle \Rightarrow \sigma'$$

for a command C transforming state σ into state σ'.

4 Code, Algorithms, and Styling

4.1 tcolorbox + listingsutf8

The `tcolorbox` package [15] creates colored and framed content boxes, while `listingsutf8` [16] enables UTF-8 input in source code listings. These packages power the defined `commandnote` (6.6), `hltext` (6.7), `inlinecode` (6.9), and `codeblock` (6.8).

4.2 algorithm + algorithmicx + algpseudocode

The `algorithm` package [17] provides a floating environment for algorithms. The `algorithmicx` [18] and `algpseudocode` [19] packages offer structured pseudocode syntax with features such as line numbering and control structures.

Algorithm 1 Example

1: $x \leftarrow 0$
2: **for** $i = 1$ to 10 **do**
3: $\quad x \leftarrow x + i$
4: **end for**

4.3 xcolor + soul

The `xcolor` package [20] provides advanced color management, and the `soul` package [21] adds text highlighting, underlining, and letter spacing. These packages power the `hltext` macro (6.7).

4.4 enumitem

The `enumitem` package [22] extends LaTeX's list environments, allowing customization of numbering, labels, spacing, indentation, and inline formatting. Examples:

Inline enumerated list with roman numerals: (i) First (ii) Second (iii) Third

Block-style list with custom labels:

Step 1: Gather materials

Step 2: Assemble components

Step 3: Test the result

4.5 gensymb

The `gensymb` package [23] provides symbols not included in core LaTeX, such as `degree` (°), `celsius` (°C), and `ohm` (Ω).

5 Bibliography and Hyperlinks

Hyperlinks and citations are fully supported through `hyperref` [24] and `natbib` [25].

Examples

- URLs: https://www.example.com
- Email: Email me
- In-text citation: Goodfellow et al. [26]
- Parenthetical citation: [26]
- Reference to a definition: see Def 6.1.1
- Reference to a section: see Section 1

Customization

To change link colors, edit in `lecturenotes.cls`:

```
\hypersetup{
    colorlinks,
    citecolor=teal,     % Color for citations
    linkcolor=blue,     % Color for internal references
    urlcolor=magenta    % Color for URLs
}
```

6 Custom Environments and Commands

Each macro is shown with example, output, and customization notes.

6.1 \definition

```
\definition{Sample concept}{This is the definition body}{def:sample}
```

Def 6.1.1. Sample concept: This is the definition body.

Customization:

```
\newcounter{definition}[subsection]
\renewcommand{\thedefinition}{\thesubsection.\arabic{definition}}
```

Change to:

- Global: `\newcounter{definition}`
- Section: `\newcounter{definition}[section]`

6.2 \refterm and \linkterm

```
\refterm{Important Term}{term:key}
See \linkterm{this reference}{term:key}.
```

Important Term See this reference.

6.3 \set

```
$S = \set{a, b, c}$
```

$S = \{a, b, c\}$

6.4 \sint

```
$\sint{E}$
```

$[\![E]\!]$

6.5 \minititle

```
\minititle{Key idea}
```

Key idea

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed non risus. Suspendisse lectus tortor, dignissim sit amet, adipiscing nec, ultricies sed, dolor.

6.6 \commandnote

```
\commandnote{This is a note.}
```

Note

This is a note.

Customization The appearance of `commandnote` is defined in the `tcolorbox` options inside the class file. You can customize:

- **Title text:** Change `title=Note` to another string.
- **Colors:** Add `colback={color}` for background and `colframe={color}` for border.
- **Style:** Modify options such as `arc` (corner roundness) or `boxrule` (border thickness).

6.7 \hltext

```
This is \hltext{highlighted}.
```

This is highlighted.

Customization The `hltext` macro uses the `soul` package for highlighting and sets its background with:

```
\sethlcolor{gray!10}
```

To customize: Change the color name (e.g., `yellow`, `cyan`) or use xcolor mixes (e.g., `blue!20`).

6.8 codeblock environment

```
\begin{codeblock}
print("Hello World")
\end{codeblock}
```

```
print("Hello World")
```

Customization The `codeblock` environment is defined with `tcolorbox` (using the `listingsutf8` library) in the class file. You can customize:

- **Background and border colors:** Change `colback` and `colframe`.
- **Border style:** Modify `boxrule` (thickness) and `arc` (corner roundness).
- **Font style:** Adjust `basicstyle` (e.g., `\ttfamily`, `\small\ttfamily`).
- **Line wrapping:** Toggle `breaklines` to enable or disable automatic wrapping.
- **Listings options:** Add syntax highlighting rules or custom keyword styles in `listing options`.

6.9 \inlinecode

```
Use \inlinecode{pip install package}
```

Use `pip install package`

Customization The `inlinecode` macro wraps its content in `\texttt` for a monospaced font and uses `colorbox` from the `xcolor` package for a background. You can customize:

- **Background color:** Change the color in `\colorbox{gray!10}{...}` to any `xcolor` value (e.g., `yellow!20`).
- **Font style:** Replace `\texttt` with `\ttfamily\small` or another font family/size.

7 Customizing Referencing and Citation Style

This document class uses the `natbib` package for citations. The current configuration in `main.tex` is:

```
\setcitestyle{numbers,square}
\bibliographystyle{IEEEtranN}
\bibliography{refs}
```

7.1 Citation Styles

There are two main styles in `natbib`:

- **Numeric styles**: Citations appear as numbers, e.g., `[1]`, `[2]`, matching the numbered list in the bibliography. Natbib-aware examples: `IEEEtranN`, `unsrtnat`.
- **Author–year styles**: Citations show author name(s) and publication year, e.g., `(Goodfellow et al., 2016)`. Examples: `apalike`, `plainnat`.

7.2 Changing the Style

1. Replace `IEEEtranN` with another supported `.bst` file name. Examples:
   - `unsrtnat`: Numeric style in the order cited in the text.
   - `apalike`: APA-like author–year style.
   - `plainnat`: Author–year with natbib extensions.
2. To switch between styles, adjust the `\setcitestyle` line:
   - Numeric with square brackets: `\setcitestyle{numbers,square}`
   - Author–year: remove the `\setcitestyle` line or set `\setcitestyle{authoryear}`
3. Keep the bibliography file reference as:

   ```
   \bibliography{refs}
   ```

4. Compile using **BibTeX**:

   ```
   pdflatex main
   bibtex main
   pdflatex main
   pdflatex main
   ```

7.3 Citation Commands in `natbib`

- `\cite{key}`: Parenthetical citation. Author–year: `(Author, Year)`. Numeric: `[n]`.
- `\citep{key}`: Parenthetical citation. Author–year: `(Author, Year)`. Numeric: `[n]`.
- `\citet{key}`: Textual citation. Author–year: `Author (Year)`. Numeric: `Author [n]`.

Note: Use `IEEEtranN` (not `ieeetr`) if you want natbib commands like `\citet` to work correctly in numeric IEEE style. The plain `ieeetr` style is not natbib-aware and will produce `author?` placeholders.

Customization Examples:

- IEEE numeric with natbib (current):

  ```
  \documentclass{lecturenotes}
  \setcitestyle{numbers,square}
  ...
  \bibliographystyle{IEEEtranN}
  \bibliography{refs}
  ```

- Numeric in citation order:

  ```
  \documentclass{lecturenotes}
  \setcitestyle{numbers,square}
  ...
  \bibliographystyle{unsrtnat}
  \bibliography{refs}
  ```

- APA-like author–year:

  ```
  \documentclass{lecturenotes}
  ...
  \bibliographystyle{apalike}
  \bibliography{refs}
  ```

References

[1] "graphicx," https://ctan.org/pkg/graphicx, accessed 2025-08-15.

[2] "float," https://ctan.org/pkg/float, accessed 2025-08-15.

[3] "booktabs," https://ctan.org/pkg/booktabs, accessed 2025-08-15.

[4] "parskip," https://ctan.org/pkg/parskip, accessed 2025-08-15.

[5] "geometry," https://ctan.org/pkg/geometry, accessed 2025-08-15.

[6] "array," https://ctan.org/pkg/array, accessed 2025-08-15.

[7] "multicol," https://ctan.org/pkg/multicol, accessed 2025-08-15.

[8] "titling," https://ctan.org/pkg/titling, accessed 2025-08-15.

[9] "amsmath," https://ctan.org/pkg/amsmath, accessed 2025-08-15.

[10] "amsfonts (includes amssymb)," https://ctan.org/pkg/amsfonts, accessed 2025-08-15.

[11] "mathrsfs," https://ctan.org/pkg/mathrsfs, accessed 2025-08-15.

[12] "stmaryrd," https://ctan.org/pkg/stmaryrd, accessed 2025-08-15.

[13] "mathpartir," https://ctan.org/pkg/mathpartir, accessed 2025-08-15.

[14] "semantic," https://ctan.org/pkg/semantic, accessed 2025-08-15.

[15] "tcolorbox," https://ctan.org/pkg/tcolorbox, accessed 2025-08-15.

[16] "listingsutf8," https://ctan.org/pkg/listingsutf8, accessed 2025-08-15.

[17] "algorithms," https://ctan.org/pkg/algorithms, accessed 2025-08-15.

[18] "algorithmicx," https://ctan.org/pkg/algorithmicx, accessed 2025-08-15.

[19] "algpseudocodex," https://ctan.org/pkg/algpseudocodex, accessed 2025-08-15.

[20] "xcolor," https://ctan.org/pkg/xcolor, accessed 2025-08-15.

[21] "soul," https://ctan.org/pkg/soul, accessed 2025-08-15.

[22] "enumitem," https://ctan.org/pkg/enumitem, accessed 2025-08-15.

[23] "gensymb," https://ctan.org/pkg/gensymb, accessed 2025-08-15.

[24] "hyperref," https://ctan.org/pkg/hyperref, accessed 2025-08-15.

[25] "natbib," https://ctan.org/pkg/natbib, accessed 2025-08-15.

[26] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. MIT Press, 2016, accessed 2025-08-15. [Online]. Available: https://www.deeplearningbook.org/