UNIT — III: Research Tools and Techniques (07 Hours)
Literature review tools: Google Scholar, Scopus, Web of Science, ResearchGate; **Citation managers:** Zotero, Mendeley, EndNote; **Plagiarism tools:** Turnitin, Grammarly, PlagScan; **Writing tools:** LaTeX, Overleaf; Technical writing format (IEEE/ACM/Elsevier/SCI).

Literature Review Tools

A literature review tool helps find, organize, and analyze existing research articles, conference papers, theses, patents, and books relevant to a research problem.

The four main tools are Google Scholar, Scopus, Web of Science, and ResearchGate.

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1. Google Scholar

What it is:

- A free search engine by Google (scholar.google.com) that indexes scholarly articles across all disciplines.

- Covers journals, books, theses, conference papers, reports, and even patents.

How it works:

- Search using keywords, author name, or title.

- Displays citation counts and related works.

- Provides links to PDFs (if available).

Features:

- "Cited by" → shows how many times a paper has been cited.

- "Related articles" → helps discover similar studies.

- Alerts for new research (email notifications).

Example:
Suppose your research topic is "Deep Learning in Medical Imaging".

- Search: *Deep Learning Medical Imaging*.

- Google Scholar shows articles like:

    o "Deep learning in medical image analysis" (cited by 12,500).

    o "Applications of deep learning in healthcare" (cited by 4,300).

- You can quickly identify highly cited papers and see who cited them.

Best use: Quick, broad discovery of literature + citation tracking.

2. Scopus

What it is:

- A subscription-based abstract and citation database by Elsevier.

- Focus on peer-reviewed journals, books, and conference proceedings.

How it works:

- Advanced filters (author, institution, country, keyword).

- Tracks h-index, author citations, and collaboration networks.

Features:

- Citation analysis (graphs, h-index trends).

- Institution/author profiling (see which universities lead in a field).

- Integration with Mendeley/Zotero for reference management.

Example:
Topic: *Deep Learning in Medical Imaging*.

- Search in Scopus → Filter results by year (2018–2023).

- You may find:

    o "Artificial intelligence in medical imaging: opportunities, applications and risks."

    o Can check which country/university publishes most in this area.

- You can see top authors (e.g., "Dr. Litjens" with multiple citations).

Best use: In-depth, structured literature review with reliable citation metrics.

3. Web of Science (WoS)

What it is:

- A curated citation database by Clarivate Analytics.

- Focuses on high-quality, indexed journals.

How it works:

- Journals included are carefully selected (SCI, SSCI, AHCI).

- Provides Journal Impact Factor (JIF) via *Journal Citation Reports (JCR)*.

Features:

- Tracks citation history of articles over time.

- Can identify emerging research trends.

- Author and institution profiles (similar to Scopus).

Example:
Topic: *Deep Learning in Medical Imaging*.

- Search → Find papers published in Nature Medicine or IEEE Transactions on Medical Imaging.

- Example: "Clinically applicable deep learning for diagnosis of diseases from medical imaging."

- WoS shows the impact factor of the journal (e.g., *Nature Medicine IF ≈ 87*).

Best use: When you need highly reliable, curated research + journal quality metrics.

4. ResearchGate

What it is:

- An academic social networking site where researchers upload their work, follow topics, and connect with peers.

How it works:

- Researchers create profiles and share PDFs of their papers.

- You can directly contact authors to request papers not publicly available.

- Community Q&A for academic discussions.

Features:

- Download articles uploaded by authors.

- Follow research topics or experts.

- Request full-text copies from authors (if not freely available).

Example:
Topic: *Deep Learning in Medical Imaging*.

- Search → Find an author who uploaded their paper *"Deep learning approaches for tumor detection in MRI."*

- If the PDF is not available, you can click "Request Full Text" → author may send it to you.

Best use: Networking, collaboration, and accessing papers otherwise behind paywalls.

Comparison Table

Tool	Cost	Coverage	Best for
Google Scholar	Free	Broad (all disciplines, grey literature too)	Quick discovery, citations overview
Scopus	Paid	Peer-reviewed journals, conferences, books	Advanced analytics, h-index, trends
Web of Science	Paid	Curated, high-impact journals	Reliable, citation reports, impact factor
ResearchGate	Free	Author-uploaded works	Networking, requesting full-texts

✅ **Key Tip for Students/Researchers:**

- **Start broad with Google Scholar → Identify highly cited papers.**

- **Use Scopus/Web of Science → Perform structured review and citation analysis.**

- **Use ResearchGate → Network + get access to full-texts and ongoing discussions.**

Citation Managers (Zotero, Mendeley, EndNote)

1. Introduction to Citation Managers

- Definition: Software tools that help collect, organize, and format bibliographic references and citations.

- Purpose:

  o Save time in research writing.

  o Ensure consistency and accuracy in citations.

  o Facilitate collaboration in academic projects.

2. Why Use Citation Managers?

- Efficiency: Import references directly from databases (Google Scholar, PubMed, JSTOR).

- Organization: Store, tag, and categorize references.

- Automation: Generate bibliographies in styles like APA, MLA, Chicago.

- Collaboration: Share libraries with peers.

- Integration: Work with word processors (Word, LibreOffice, Google Docs, LaTeX).

3. Overview of Popular Tools

◆ **Zotero**

- Open-source, free.

- Browser extension for one-click reference saving.

- Strong web integration (captures metadata from websites, PDFs, catalogs).

- Cloud syncing (free storage up to 300 MB, paid for more).

- Plugins for Word, LibreOffice, Google Docs.

- Good for humanities & social sciences.

- Strengths: Easy, free, flexible.

- Limitations: Limited free storage for PDFs.

◆ **Mendeley**

- Owned by Elsevier.

- Desktop + web version.

- Strong in PDF annotation & management.

- 2 GB free storage in cloud.

- Social network features: researchers can connect and share work.

- Plugins for Word, LibreOffice, BibTeX export for LaTeX.

- Strengths: Great for collaboration, PDF handling.

- Limitations: Closed-source, dependence on Elsevier ecosystem.

◆ **EndNote**

- Developed by Clarivate (paid, subscription/license-based).

- Powerful for large-scale reference management (thousands of entries).

- Advanced citation style customization.

- Integration with Web of Science.

- Plugins for Word (Cite While You Write).

- Strengths: Very comprehensive, widely used in sciences/medicine.

- Limitations: Expensive, steeper learning curve.

4. Key Features Compared

Feature	Zotero	Mendeley	EndNote
Cost	Free (open-source)	Free + premium	Paid
Storage	300 MB free	2 GB free	Large (paid)
PDF Annotation	Basic	Strong	Strong
Word Processor Plug-in	Yes	Yes	Yes
Collaboration	Groups (free)	Groups (free)	Shared libraries
Platforms	Win/Mac/Linux	Win/Mac/Linux	Win/Mac
Best for	Humanities, students	STEM, collaboration	Professional research, large projects

5. Best Practices for Using Citation Managers

- Always check imported references (metadata errors are common).

- Back up your library regularly.

- Learn how to switch citation styles quickly (APA ↔ MLA ↔ Chicago).

- Use tags, folders, and notes to stay organized.

- If collaborating: agree on one citation manager beforehand.

Plagiarism Detection Tools

(Turnitin, Grammarly, PlagScan)

1. Introduction to Plagiarism Detection

- **Plagiarism Definition**: Presenting someone else's ideas, words, or data as one's own without proper acknowledgment.

- **Forms of Plagiarism**:

    o **Direct Copying** (word-for-word).

    o **Paraphrasing without citation**.

    o **Self-plagiarism** (reusing one's past work without disclosure).

    o **Patchwriting** (mixing copied phrases with slight modifications).

- **Need for Detection Tools**:

    o Rising digital resources make it easier to copy text.

    o Academic institutions require integrity checks.

    o Publishers need to ensure originality of submitted research.

- **How Detection Tools Work**:

    o Convert submitted text into searchable units (fingerprints).

    o Compare against:

        ▪ **Web content** (millions/billions of pages).

        ▪ **Academic sources** (journals, books, conference proceedings).

        ▪ **Student paper repositories** (past submissions).

    o Produce **similarity reports** (highlighted text, percentage match, source list).

2. Turnitin

- **Overview**:
    - Founded in 1998, headquartered in the U.S.
    - Used by >15,000 institutions in 140+ countries.
    - Deeply integrated in higher education workflows.

- **Core Databases**:

1. **Student Paper Repository** (unique to Turnitin).

2. **Academic Content** (journals, books, databases).

3. **Internet Sources** (websites, blogs, online content).

- **Key Features**:
    - **Similarity Report**: Generates a color-coded percentage similarity score.
    - **Source Matching**: Links flagged text to the original source.
    - **Feedback Studio**:
        - Instructors add comments, highlight issues.
        - Grading rubrics available.
    - **Authorship Investigate**: Helps detect contract cheating (outsourced work).

- **Strengths**:
    - Largest academic database.
    - Institutional adoption ensures consistency.
    - Reliable integration with LMS (Canvas, Moodle, Blackboard).

- **Limitations**:
    - Expensive, subscription-based.
    - High similarity % may include correctly cited references.
    - Not designed for casual/individual users.

- **Example**:
  A student submits an essay → Turnitin compares it against millions of papers → produces a report showing that **25%** matches Wikipedia and **10%** matches a past student paper.

3. Grammarly

- **Overview**:

  - Founded in 2009, primarily a **writing enhancement tool**.

  - Available as browser extension, MS Word/Google Docs add-on, desktop/mobile apps.

  - Popular with students, professionals, and writers.

- **Plagiarism Detection**:

  - Compares against **billions of websites** (but not academic databases).

  - Uses AI/NLP to flag copied or paraphrased text.

- **Key Features**:

  - **Grammar & Spell Check** (advanced AI-based).

  - **Style & Tone Suggestions** (formal, casual, academic).

  - **Plagiarism Checker** (highlights copied text, links to original source).

  - **Citation Help**: Suggests correct citation formats.

- **Strengths**:

  - Easy to use; works in real-time as you type.

  - Affordable compared to institutional tools.

  - Useful for avoiding **accidental plagiarism**.

- **Limitations**:

  - Does not access Turnitin's academic/student paper repositories.

  - Less reliable for **academic plagiarism detection**.

  - More of a **preventive tool** than a forensic one.

- **Example**:
  A student writing a research paper uses Grammarly → it flags a sentence copied from a blog without citation → provides the source link → student corrects it before submission.

4. PlagScan

- **Overview**:
  - Founded in Germany, widely used in **Europe** and research institutions.
  - Known for **GDPR compliance** (strong data protection).

- **Database Coverage**:

1. **Internet sources**.

2. **Scientific Journals and Publications** (via partnerships).

3. **Internal Repositories** (upload institutional documents for cross-checking).

- **Key Features**:
  - **Similarity Reports**: Detailed, with side-by-side view of submitted vs. source text.
  - **Customizable Settings**: Institutions can decide which sources to include.
  - **Integration**: Works with LMS like Moodle, and supports APIs for custom use.
  - **Institutional Archiving**: Universities can build their own repositories.

- **Strengths**:
  - Transparent reporting with **adjustable thresholds**.
  - Strong focus on **data privacy**.
  - Good balance for universities and publishers.

- **Limitations**:
  - Smaller global database than Turnitin.
  - Less known outside Europe.

- **Example**:
  A research article is uploaded to PlagScan → system highlights 15% overlap with a published journal → editor checks and verifies if citations are properly given.

5. Comparison Summary

Feature	Turnitin	Grammarly	PlagScan
Founded	1998 (US)	2009 (US)	2009 (Germany)
Primary Use	Academic plagiarism detection	Writing improvement + plagiarism	Academic/research integrity
Database	Student papers, journals, internet	Billions of websites only	Journals, internet, repositories
Users	Universities, instructors	Students, professionals, writers	Universities, publishers, EU
Integration	LMS (Canvas, Moodle, Blackboard)	Word, Google Docs, browser extension	LMS, institutional repositories
Extra Features	Grading, feedback, authorship checks	Grammar, style, tone, citations	GDPR compliance, transparency
Best For	Formal academic institutions	Students avoiding mistakes	EU institutions, researchers
Cost	Institutional subscription	Freemium + Premium (monthly/annual)	Institutional subscription

6. Conclusion

- **Turnitin** → Best for **universities** with large student populations and strict integrity standards.

- **Grammarly** → Best for **individuals** (students, professionals, writers) to pre-check their work.

- **PlagScan** → Good for **research institutions and publishers**, especially in GDPR-sensitive regions.

- Many students use **Grammarly before submission** → then universities use **Turnitin or PlagScan** as the final check.

Writing tools: LaTeX, Overleaf;

A LaTeX editor is a tool used for creating high-quality documents by writing text in a plain text file interspersed with commands, which are then processed by a TeX engine to produce a typeset PDF. Unlike WYSIWYG (What You See Is What You Get) word processors, authors focus on content and structure through these commands, allowing the software to handle professional-level formatting, especially for scientific and mathematical content. This approach provides professional, consistent, and highly customizable results without the author needing to be a typographer.

How it works

Code-based system:

You write a plain text file containing your document's content and LaTeX commands (e.g., \section{Introduction}, \textbf{bold text}) to define its structure and formatting.

Compilation:

A TeX engine processes this .tex file to interpret the commands and compile it into a professional-looking output, most often a PDF.

Focus on content:

The system separates the content from the presentation, so you can concentrate on writing while the software automatically handles the layout, spacing, and numbering of elements.

Key features and advantages

- **High-quality output**:

LaTeX excels at producing documents with professional-level typesetting, especially complex mathematical equations and scientific notation.

- **Professional appearance**:

It handles complex formatting such as page layout, spacing, and cross-referencing automatically, ensuring consistency.

- **Customization**:

It is highly customizable, with many packages available to extend its functionality.

- **Efficiency**:

Commands like \section and \tableofcontents automatically create document structures, and labels can be automatically numbered and cross-referenced.

- **Portability**:

The PDF output is a universal format that can be opened on any device and is often smaller than other file types.

- **Collaboration**:

Online editors often include features like real-time collaboration and version history, similar to modern word processors.

Overleaf is a popular online platform and LaTeX editor that allows users to write, edit, and collaborate on professional, high-quality typeset documents, such as scientific papers, theses, and reports. It eliminates the need to install LaTeX compilers by providing a web-based interface with a code editor for writing LaTeX commands and a real-time preview of the compiled PDF document.

LaTeX: is a document preparation system and typesetting language that uses plain text and commands to create beautifully formatted documents.

- It is especially popular in academia and science for producing complex, technical, and scientific documents with high-quality typesetting.

Technical writing format (IEEE/ACM/Elsevier/SCI).

📑 **1. IEEE Format (Institute of Electrical and Electronics Engineers)**

Common in: Engineering, computer science, electronics, telecommunications. Template: IEEE Manuscript Template

General Structure

1. Title
2. Author(s) and affiliation(s)
3. Abstract (≤ 250 words)
4. Keywords
5. Introduction
6. Related Work / Literature Review
7. Methodology
8. Results and Discussion
9. Conclusion and Future Work
10. Acknowledgment (optional)
11. References

Formatting Details

- Font: Times New Roman, 10 pt (two-column format)
- Page size: Letter (8.5" × 11")
- Margins: 0.75" top/bottom/left/right
- Figures & Tables: Centered, labeled (e.g., *Fig. 1. Block diagram of the system*)
- Reference style: Numbered, in-text citations as [1], [2]
    - Example: "As shown in [3], the performance improves with..."
- References list: Numbered in order of appearance

📘 2. ACM Format (Association for Computing Machinery)

Common in: Computer science, software engineering, HCI, AI.
Template: ACM Primary Article Template (Word & LaTeX)

General Structure

1. Title

2. Author(s), Affiliation(s), Email(s)

3. Abstract

4. CCS Concepts (ACM Classification)

5. Keywords

6. Introduction

7. Related Work

8. Methodology / Experiments

9. Results

10. Discussion / Limitations

11. Conclusion / Future Work

12. Acknowledgments

13. References

Formatting Details

- Font: 9 pt Times New Roman, two columns

- Page size: Letter

- Citation style: Author-year or numeric (depends on venue)

    o Example (numeric): [1]

    o Example (author-year): (Smith et al., 2023)

- References: Follow ACM Digital Library style

📖 3. Elsevier Format

Common in: Science, technology, medicine, social sciences.
Template: Elsevier Journal Article Template

General Structure

1. Title

2. Author(s), Affiliation(s)

3. Abstract (≤ 250 words)

4. Keywords

5. Introduction

6. Background / Related Work

7. Materials and Methods

8. Results

9. Discussion

10. Conclusion

11. Acknowledgments

12. References

13. Appendices (if any)

Formatting Details

- Font: Times New Roman, 12 pt, single column (double spacing)

- Page size: A4

- Figures/Tables: Placed after references or inline

- Reference style: Harvard (Author–date) or numbered (Vancouver) — depends on journal

    o Example (Harvard): (Smith, 2023)

    o Example (Vancouver): [1]

- References: APA or Harvard, depending on journal

🔬 4. SCI / SCIE Journals (Science Citation Index)

Common in: High-impact scientific and engineering journals.
SCI is not a format but an indexing standard (Clarivate Analytics).
Each SCI journal uses its own format, often aligned with Elsevier, Springer, Wiley, or IEEE.

Typical Structure

1. Abstract

2. Introduction

3. Methods / Experimental Setup

4. Results

5. Discussion

6. Conclusion

7. References

Formatting

- Style follows the publisher's guidelines.

- Common features:

    o Double-column or single-column, depending on the publisher

    o High-quality figures/tables

    o Strict reference formatting

    o Word limit usually 5,000–8,000 words

⚖️ Comparison Table

Feature	IEEE	ACM	Elsevier	SCI (varies)
Column Layout	Two-column	Two-column	Single-column	Depends on publisher
Font	10 pt Times New Roman	9 pt Times New Roman	12 pt Times New Roman	Varies
Reference Style	Numeric [1]	Numeric or Author-Year	Harvard/Vancouver	Depends on journal
Abstract Length	≤250 words	≤150–250 words	≤250 words	≤250 words
Keywords	3–5	3–5	3–6	3–6
Figures/Tables	Centered, numbered	Centered, captioned	Captioned below	Captioned below
Submission Format	PDF (LaTeX/Word)	PDF (LaTeX)	Word/LaTeX	As per journal

Choosing the Right Format

Field / Goal	Recommended Format
Electrical / Electronics / CS (Engineering)	IEEE
Pure Computer Science / HCI / Software	ACM
Multidisciplinary / Applied Science	Elsevier
High-impact publication target	SCI-indexed (Elsevier/Springer/Wiley)

Field / Goal	Recommended Format
Electrical / Electronics / CS (Engineering)	IEEE
Pure Computer Science / HCI / Software	ACM