GHOUSIA INSTITUTE OF TECHNOLOGY FOR WOMEN

NEAR DAIRY CIRCLE, HOSUR ROAD, BENGALURU-560029, KARNATAKA

AFFILIATED TO VTU., BELAGAVI, RECOGNIZED BY GOVERNMENT OF KARNATAKA & A.I.C.T.E., NEW DELHI

TECHNICAL WRITING USING LATEX BCSL456D

MiKTEX

Overleaf by writeLaTeX

Free online collaborative LaTeX editor and template gallery

www.overleaf.com

TEXMAKER

AS PER VTU 2022 SCHEME SYLLABUS

4th SEMESTER
COMPUTER SCIENCE
INFORMATION SCIENCE
B.E. DEGREE

Dr. NAVEED

ASSISTANT PROFESSOR

GHOUSIA INSTITUTE OF TECHNOLOGY FOR WOMEN

Near Dairy Circle, Hosur Road, Bengaluru , Karnataka 560029

Affiliated to VTU., Belagavi, Recognized by Government of Karnataka & A.I.C.T.E., New Delhi

TECHNICAL WRITING USING LaTeX

(BCSL456D)

As per 2022 Scheme Syllabus Prescribed by V.T.U.

For

FOURTH SEMESTER

COMPUTER SCIENCE & ENGINEERING / INFORMATION SCIENCE & ENGINEERING

(Bachelor of Engineering)

Dr.NAVEED M.Tech., PhD.

Assistant Professor

Department of Computer Science & Engineering

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TECHNICAL WRITING USING LaTeX / BCSL456D / FOURTH SEMESTER / B.E DEGREE / 2024-25

CERTIFICATE

This is to certify that Miss._____bearing USN_____of _____ Branch completed the academic requirements for the practical course work titled **"TECHNICAL WRITING USING LaTeX/ BCSL456D"** of FOURTH SEMESTER B.E, prescribed by Visvesvaraya Technological University , Belagavi, for the academic year **2024-25**. The details of Mark's obtained by the candidate is given below.

Sl.No	Particulars		Max.Marks (Execution+Record)	Marks Obtained		Page No	Staff Sign
1	Expt-01	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]	5+5 = 10			14	
2	Expt-02	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]				16	
3	Expt-03	Develop a LaTeX script to create a document that displays the sample Abstract/Summary and Acknowledgement				18	
4	Expt-04	Develop a LaTeX script to create a simple document that consists of sections, sub-sections, and a paragraph with dummy text in each section followed with table of contents. And also include header [title of document] and footer [institute name, page number] in the document.				20	
5	Expt-05	Develop a LaTeX script to include the simple as well side-by-side graphics/pictures/figures in the document by using the subgraph concept				22	
6	Expt-06	Develop a LaTeX script in two columns format consisting of sections, sub-sections, figures.				24	
7	Expt-07	Develop a LaTeX script to create a document that contains table with proper labels.				26	
8	Expt-08	Develop a LaTeX script to create a document that consists of paragraphs with a minimum of 10 citations in it and display the reference in the section.				28	
9	Expt-09	Develop a LaTeX script to create a document that consists of two mathematical equations				35	

10	Expt-10	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document				38	
11	Expt-11	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library.				40	
12	Expt-12	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library				42	
13	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.		15+15 = 30			48	
Total Marks-A			150				
Test Marks-B			100				
Final Internal Assessment Mark's.			[(A*30)/150] + (B*20%) = **50**				

Internal Assessment Marks Awarded in Words: _____

Signature of Staff Incharge with Date: (Dr.NAVEED)

Technical Writing using LaTeX		Semester	4
Course Code	**BCSL456D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	02
Examination type (SEE)	**Practical**		

Course objectives:

- To introduce the basic syntax and semantics of the LaTeX scripting language
- To understand the presentation of tables and figures in the document
- To illustrate the LaTeX syntax to represent the theorems and mathematical equations
- To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document

<table>
<tr><th>Sl.NO</th><th>Experiments</th></tr>
<tr><td>1</td><td>Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.</td></tr>
<tr><td>2</td><td>Develop a LaTeX script to create a document that displays the sample Abstract/Summary</td></tr>
<tr><td>3</td><td>Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]</td></tr>
<tr><td>4</td><td>Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]</td></tr>
<tr><td>5</td><td>Develop a LaTeX script to create a document that contains the following table with proper labels.
<table>
<tr><th rowspan="2">S.No</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr>
<tr><th>Subject1</th><th>Subject2</th><th>Subject3</th></tr>
<tr><td>1</td><td>4XX22XX001</td><td>Name 1</td><td>89</td><td>60</td><td>90</td></tr>
<tr><td>2</td><td>4XX22XX002</td><td>Name 2</td><td>78</td><td>45</td><td>98</td></tr>
<tr><td>3</td><td>4XX22XX003</td><td>Name 3</td><td>67</td><td>55</td><td>59</td></tr>
</table></td></tr>
<tr><td>6</td><td>Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept</td></tr>
<tr><td>7</td><td>Develop a LaTeX script to create a document that consists of the following two mathematical equations
$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$
$$= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$$
$$= \frac{-2 \pm \sqrt{4+32}}{2}$$
$$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda$$
$$= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$$
$$= A_{\sigma t} \varphi_\sigma^\lambda$$</td></tr>
</table>

8	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document
9	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section
10	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
11	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library
12	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Apply basic LaTeX command to develop simple document
- Develop LaTeX script to present the tables and figures in the document
- Illustrate LaTeX script to present theorems and mathematical equations in the document
- Develop programs to generate the complete report with citations and a bibliography
- Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the document

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners

jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK:** A Short Introduction to LaTeX BY FIRUZA KARMALI (AIBARA), A book for beginners, 2019
- **BOOK:** Formatting Information: A Beginner's Introduction to Typesetting with LaTeX, BY PETER FLYNN, Comprehensive TeX Archive Network (2005)
- LaTeX TUTORIAL: [https://latex-tutorial.com/tutorials/]
- LaTeX TUTORIAL: [https://www.javatpoint.com/latex]

INTRODUCTION

What is LaTeX?

LaTeX is a high-quality typesetting system commonly used for the production of technical and scientific documents. It is built on top of the **TeX** typesetting system, developed by Donald Knuth in 1978. LaTeX was developed by Leslie Lamport in the early 1980s to make TeX more accessible to general users. LaTeX automates many aspects of document formatting, allowing authors to focus on content rather than layout.

Key Features of LaTeX

1. **Professional Typesetting**:
   - Produces documents with excellent typographic quality.
   - Handles mathematical and scientific notation effectively.
2. **Consistency**:
   - Ensures uniform formatting across documents.
   - Automatic numbering of sections, figures, tables, and equations.
3. **Customizability**:
   - Flexible to create custom document styles and layouts.
4. **Cross-Platform**:
   - Available for Windows, macOS, Linux, and online platforms.
5. **Open-Source**:
   - Freely available for everyone to use and modify.

Types of LaTeX Editors

There are two main types of LaTeX editors: **desktop-based** and **online-based**.

Desktop-Based Editors

1. **TeXworks**:
   - Lightweight and user-friendly.
   - Ideal for beginners.
2. **Overleaf (Desktop App)**:
   - Supports real-time collaboration.
   - Integrated with cloud storage.
3. **MikTeX**:
   - A comprehensive LaTeX distribution for Windows.
   - Includes a package manager for additional functionality.
4. **Texmaker**:
   - Cross-platform with built-in PDF viewer.
   - Syntax highlighting and auto-completion features.
5. **Kile**:
   - Linux-specific editor with advanced customization options.

Online-Based Editors

1. **Overleaf**:
    - Most popular cloud-based LaTeX editor.
    - Facilitates collaborative editing and sharing.
    - Integrated with GitHub and version control.
2. **Papeeria**:
    - Online editor with simple UI.
    - Supports collaboration and integration with cloud storage.
3. **Authorea**:
    - Tailored for scientific documents.
    - Includes features like collaborative writing and publishing tools.
4. **ShareLaTeX** (merged with Overleaf):
    - Focused on real-time collaborative writing.

Merits of LaTeX

1. **High-Quality Output**:
    - Produces professional-quality documents suitable for publications.
2. **Mathematical Typesetting**:
    - Handles complex equations and symbols with ease.
3. **Automation**:
    - Automatically generates table of contents, bibliographies, and cross-references.
4. **Free and Open-Source**:
    - No licensing cost.
5. **Cross-Platform**:
    - Works on multiple operating systems.
6. **Customizability**:
    - Highly flexible for creating custom styles, templates, and commands.
7. **Scalable**:
    - Suitable for both small documents and large, multi-chapter books.

Scope and Significance of LaTeX

1. **Academics and Research**:
    - Widely used for writing theses, dissertations, and academic papers.
    - Preferred by journals and publishers for its professional formatting.
2. **Publishing Industry**:
    - Essential for creating books, journals, and newsletters.
3. **Mathematics, Physics, and Engineering**:

   - Handles complex mathematical formulas and technical notations efficiently.
4. **Data Science and Programming**:
   - Used to create well-documented project reports and manuals.
5. **Corporate and Government**:
   - Used for creating official documents like reports, proposals, and presentations.

Applications of LaTeX

1. **Scientific Publishing**:
   - Commonly used by journals like IEEE, ACM, and Elsevier.
2. **Book Writing**:
   - Ideal for creating structured and well-formatted books.
3. **Presentations**:
   - Beamer package allows users to create professional slides.
4. **Technical Documentation**:
   - Used for software manuals and user guides.
5. **Resumes and CVs**:
   - Offers templates for creating elegant resumes.
6. **Lecture Notes and Handouts**:
   - Professors and teachers use LaTeX for class materials.

Significance in Modern Context

- LaTeX's ability to create structured, professional documents makes it irreplaceable in technical fields.
- With the rise of online editors like Overleaf, LaTeX is becoming more accessible to users unfamiliar with coding.
- Its collaborative features are crucial for modern research teams working across geographical boundaries.

Challenges and Limitations

1. **Steep Learning Curve**:
   - Requires users to learn syntax and commands.
2. **Limited WYSIWYG Interface**:
   - Editing is code-based, which may be difficult for beginners.
3. **Dependency on Packages**:
   - Requires additional packages for extended functionality.
4. **Time-Consuming**:
   - Initial setup and debugging can be time-intensive.

Despite these challenges, the benefits of LaTeX far outweigh its limitations, especially in technical and academic fields.

What is TeXmaker?

TeXmaker is a popular cross-platform LaTeX editor used to create, edit, and compile LaTeX documents. It provides an integrated environment with all the essential tools for LaTeX users, combining simplicity with powerful features. TeXmaker is compatible with Windows, macOS, and Linux, and it is widely favored for its clean user interface, built-in PDF viewer, and advanced functionality like syntax highlighting and auto-completion.

TeXmaker was developed by **Pascal Brachet** and is an open-source project available under the GPL license.

Key Features of TeXmaker

1. **Cross-Platform Compatibility**:
   - Available for Windows, macOS, and Linux.
2. **All-in-One Interface**:
   - Combines an editor, LaTeX compiler, and PDF viewer in a single interface.
3. **Syntax Highlighting**:
   - Highlights LaTeX commands and text for better readability.
4. **Auto-Completion**:
   - Suggests commands and environments as you type, speeding up the writing process.
5. **Integrated PDF Viewer**:
   - Supports forward and inverse search (synchronizing the LaTeX source with the compiled PDF).
6. **Error Detection**:
   - Automatically checks for errors during compilation and provides helpful messages for debugging.
7. **Code Folding**:
   - Collapsible sections improve navigation in large documents.
8. **Template Support**:
   - Includes preloaded templates for various document types (e.g., articles, reports, CVs).
9. **Customizable Shortcuts**:
   - Allows users to define keyboard shortcuts for frequently used commands.
10. **Built-in Tools**:
    - Includes spell checker, word counter, and mathematical symbol table.
11. **Support for Multiple Encodings**:
    - Compatible with UTF-8 and other encoding formats.

Merits of TeXmaker

1. **User-Friendly Interface**:
   - The intuitive layout makes it suitable for both beginners and advanced users.
2. **Cross-Platform**:
   - Consistent experience across different operating systems.
3. **Free and Open Source**:
   - No licensing costs and freely available for everyone.
4. **Integrated Workflow**:
   - Combines editing, compiling, and viewing into one streamlined interface.
5. **Customizability**:
   - Offers flexible configurations for shortcuts, syntax highlighting, and more.
6. **Error Feedback**:
   - Detects and displays compilation errors, simplifying the debugging process.
7. **Multi-Language Support**:
   - Available in multiple languages, broadening its accessibility.
8. **Lightweight**:
   - Does not require heavy system resources to run efficiently.

Scope of TeXmaker

1. **Educational Institutions**:
   - Ideal for students and researchers writing theses, assignments, and academic papers.
2. **Publishing Industry**:
   - Suitable for creating structured and polished documents for publication.
3. **Scientific and Technical Fields**:
   - Provides excellent support for mathematical equations and technical notations.
4. **Global User Base**:
   - Widely adopted across academia, industries, and freelance writers.
5. **Cross-Platform Use**:
   - Ensures that users on different systems can collaborate without compatibility issues.

Applications of TeXmaker

1. **Academic Research**:
   - Writing and formatting research papers, articles, and dissertations.
2. **Book Writing**:
   - Creating professionally typeset books with chapters, indexing, and references.
3. **Technical Documentation**:
   - Writing manuals, guides, and system documentation.

4. **Presentations**:
    - Using the Beamer class to create elegant and dynamic slide presentations.
5. **Resumes and CVs**:
    - Designing professional and aesthetically pleasing resumes using LaTeX templates.
6. **Reports and Proposals**:
    - Preparing technical and business reports with complex layouts.
7. **Collaborative Projects**:
    - Sharing .tex files among team members for efficient collaboration.

Significance of TeXmaker

1. **Integration and Efficiency**:
    - The all-in-one interface minimizes the need to switch between tools, increasing productivity.
2. **Open Source and Free**:
    - Makes LaTeX accessible to everyone, regardless of budget constraints.
3. **Professional Output**:
    - Enables users to create high-quality documents suitable for professional and academic purposes.
4. **Error Management**:
    - Simplifies the debugging process, particularly for complex documents with many packages and customizations.
5. **Wide Adoption**:
    - Trusted by researchers, educators, and industry professionals worldwide.

Limitations of TeXmaker

1. **No Real-Time Collaboration**:
    - Unlike Overleaf, TeXmaker does not support real-time collaborative editing.
2. **Learning Curve**:
    - Beginners may find LaTeX commands and syntax challenging to learn.
3. **Limited Modern Features**:
    - Lacks advanced features like cloud integration or GitHub support that some modern editors provide.
4. **Dependence on External Tools**:
    - Requires LaTeX distributions like MiKTeX or TeX Live to compile documents.

Comparison with Other LaTeX Editors

Feature	TeXmaker	Overleaf	TexStudio
Platform	Windows, macOS, Linux	Cloud-based	Windows, macOS, Linux
Collaboration	No	Real-time	No
Ease of Use	Beginner-friendly	Simplest	Similar to TeXmaker
Integration	Editor + PDF viewer	Online editor + cloud storage	Editor + viewer
Cost	Free	Free (with premium options)	Free

Conclusion

TeXmaker is a versatile and user-friendly LaTeX editor suitable for both beginners and experienced users. Its all-in-one design, cross-platform compatibility, and powerful features make it a preferred choice for writing professional documents. While it lacks real-time collaboration and cloud integration, its lightweight nature and simplicity ensure efficient LaTeX document preparation. TeXmaker remains a reliable tool for academic, professional, and technical users worldwide.

What is MiKTeX?

MiKTeX is a popular LaTeX distribution designed primarily for Microsoft Windows, though it is also available for macOS and Linux. It provides all the essential tools and packages needed to create documents using LaTeX. MiKTeX simplifies the process of installing and managing LaTeX packages, making it beginner-friendly while retaining the powerful features LaTeX users require. MiKTeX includes:

1. A **LaTeX compiler** to process .tex files.
2. A **package manager** to download additional packages as needed.
3. An integrated PDF viewer and basic editor.

Developed by **Christian Schenk**, MiKTeX is one of the most widely used LaTeX distributions because of its ease of use, regular updates, and comprehensive support for LaTeX packages.

Key Features of MiKTeX

1. **Automatic Package Installation**:
    - MiKTeX can automatically download and install required packages during document compilation.
2. **Comprehensive LaTeX Distribution**:
    - Includes all essential tools like pdflatex, xelatex, lualatex, and auxiliary utilities for creating documents.
3. **Built-in Package Manager**:

   - Easy to install, update, and manage LaTeX packages using a graphical user interface (GUI).
4. **Cross-Platform**:
   - Available for Windows, macOS, and Linux.
5. **Integrated PDF Viewer**:
   - Comes with a built-in viewer to preview compiled documents.
6. **Regular Updates**:
   - Frequently updated to include the latest packages and improvements.
7. **User-Friendly Installer**:
   - Provides a clean and simple installation process suitable for beginners.
8. **Portable Version**:
   - A portable edition of MiKTeX allows users to run it from a USB drive without installation.

Merits of MiKTeX

1. **Beginner-Friendly**:
   - Easy to set up and use, especially for users new to LaTeX.
2. **Automatic Package Management**:
   - Automatically downloads missing packages, saving users from manual searches.
3. **Lightweight**:
   - Relatively smaller download size compared to other distributions like TeX Live.
4. **Customizable**:
   - Allows users to configure settings and manage packages according to their needs.
5. **Cross-Platform Support**:
   - Compatible with major operating systems.
6. **Active Development**:
   - Regular updates ensure compatibility with the latest LaTeX features and packages.
7. **Comprehensive Documentation**:
   - Provides extensive help resources and guides for users.

Scope of MiKTeX

1. **Educational Institutions**:
   - Used by students and researchers to create theses, dissertations, and reports.
2. **Technical Writing**:
   - Supports industries that require complex document formatting, including those with mathematical or scientific content.
3. **Publishing Industry**:
   - Commonly used for typesetting books, journals, and research papers.
4. **Corporate Use**:

- Employed for creating polished presentations, reports, and technical manuals.

5. **Global Accessibility**:
   - MiKTeX's portable version allows users to access it on any computer without installation.

Applications of MiKTeX

1. **Academic Research**:
   - Preparing high-quality papers, articles, and journals for publication in top-tier outlets.
2. **Theses and Dissertations**:
   - Formatting documents for submission to universities and academic institutions.
3. **Presentations**:
   - Creating professional presentations using the Beamer class.
4. **Book Writing**:
   - Typesetting books with advanced formatting, including indexing and referencing.
5. **Technical Documentation**:
   - Writing software documentation, user guides, and system manuals.
6. **Reports and Proposals**:
   - Generating structured, well-organized documents for corporate or governmental purposes.
7. **Resumes and CVs**:
   - Designing elegant, professional resumes.

Significance of MiKTeX

1. **Accessibility for Beginners**:
   - MiKTeX simplifies LaTeX usage, making it accessible even to non-experts.
2. **Versatile Usage**:
   - Suitable for diverse fields, including academia, publishing, and engineering.
3. **Cost-Efficient**:
   - Free and open-source, offering a cost-effective solution for professional document preparation.
4. **Community Support**:
   - Backed by a large community, making it easier to find help and resources.

Limitations of MiKTeX

1. **Windows-Centric Design**:
   - Although available on other platforms, MiKTeX is primarily optimized for Windows.
2. **Dependency on Updates**:

- Requires frequent updates to stay compatible with the latest LaTeX packages.

3. **Learning Curve**:
   - Beginners unfamiliar with LaTeX syntax may initially struggle.

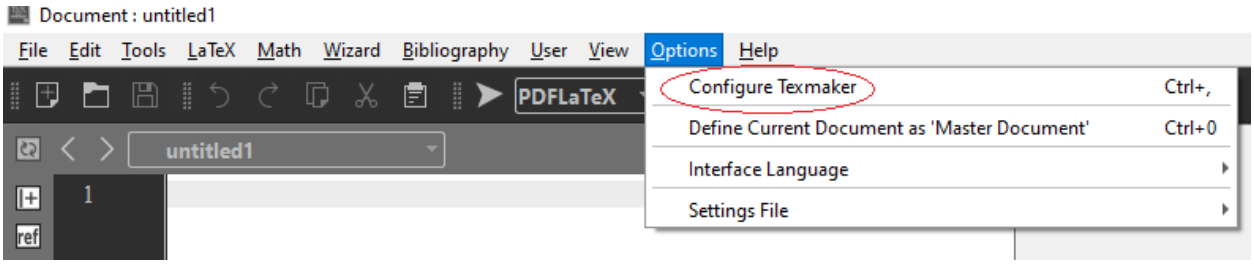
Comparison with Other LaTeX Distributions

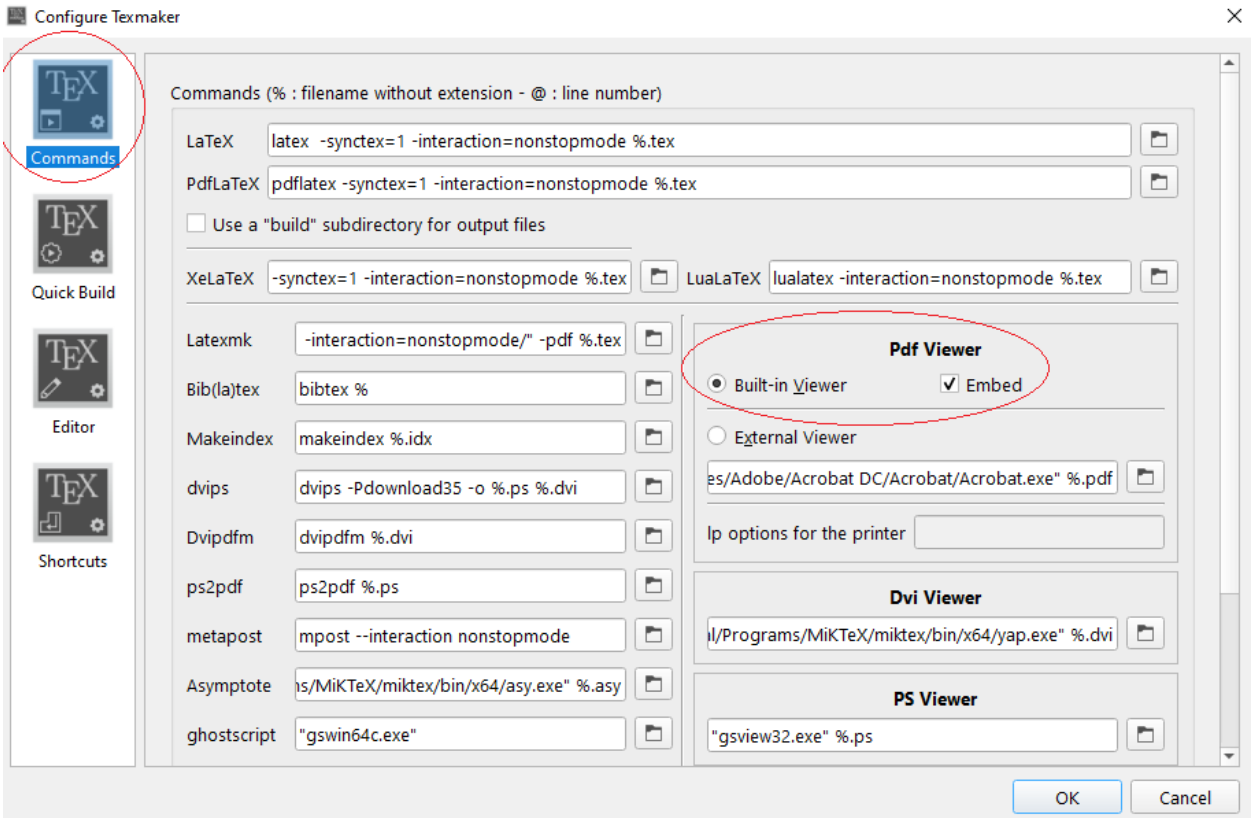
Feature	MiKTeX	TeX Live	Overleaf
Platform	Windows, macOS, Linux	Cross-platform	Cloud-based
Package Management	Automatic	Requires manual installation	Automatic
Ease of Use	Beginner-friendly	Slightly complex	Easiest
Internet Dependency	Minimal	Minimal	High
Collaboration	Limited	Limited	Real-time collaboration

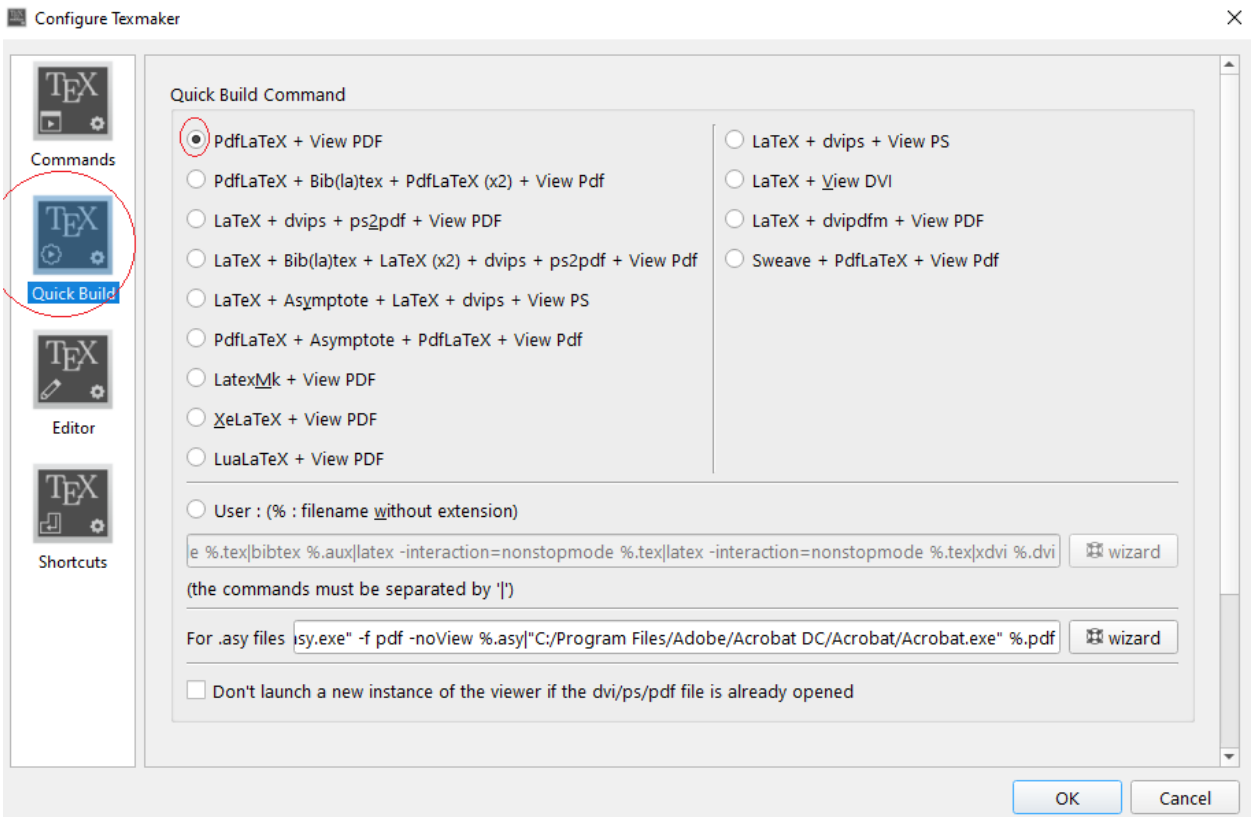
Conclusion

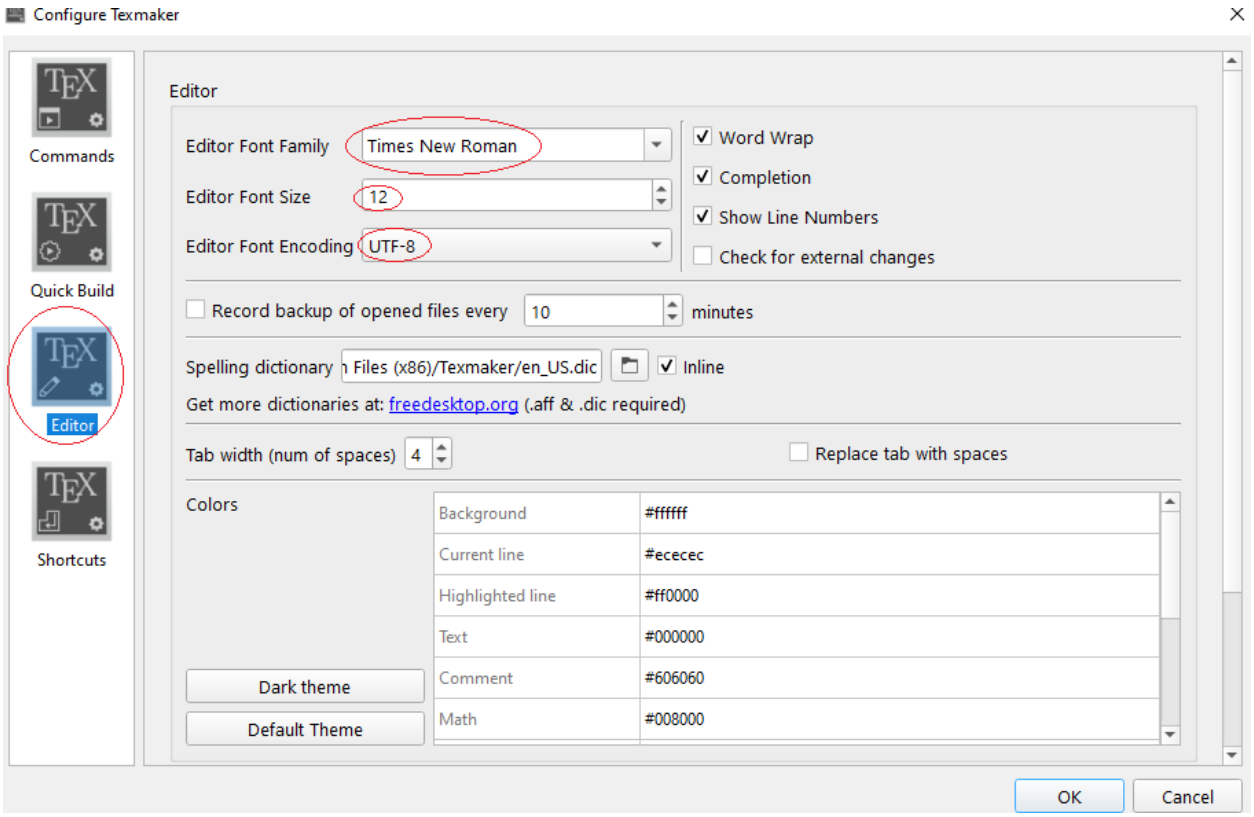
MiKTeX is an excellent choice for anyone looking to work with LaTeX, particularly those on Windows systems. Its automatic package management, ease of use, and flexibility make it a preferred tool for students, researchers, and professionals alike. Whether you are writing a scientific paper, preparing a presentation, or typesetting a book, MiKTeX provides the necessary tools and features to meet your needs effectively.

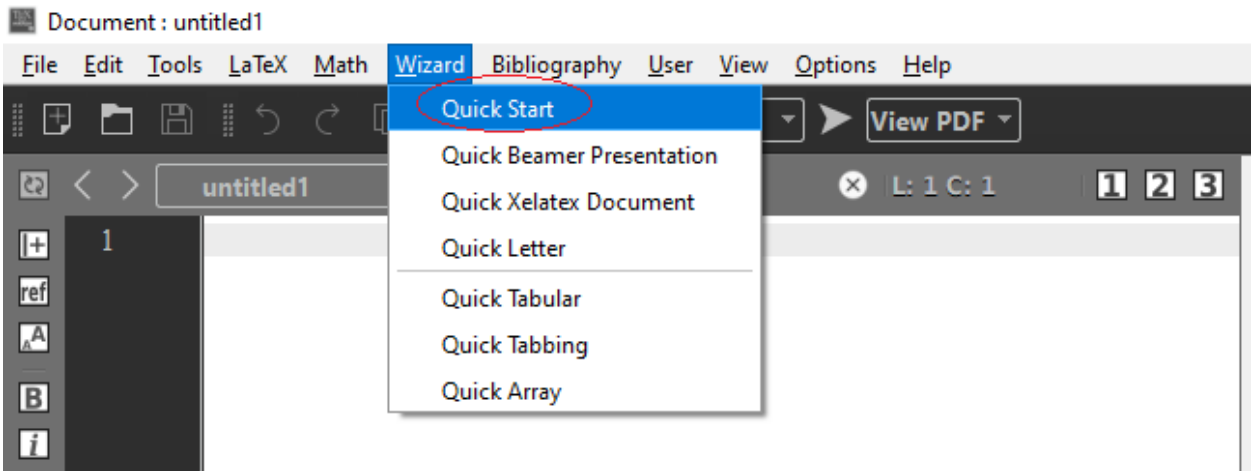
BASIC SETUP

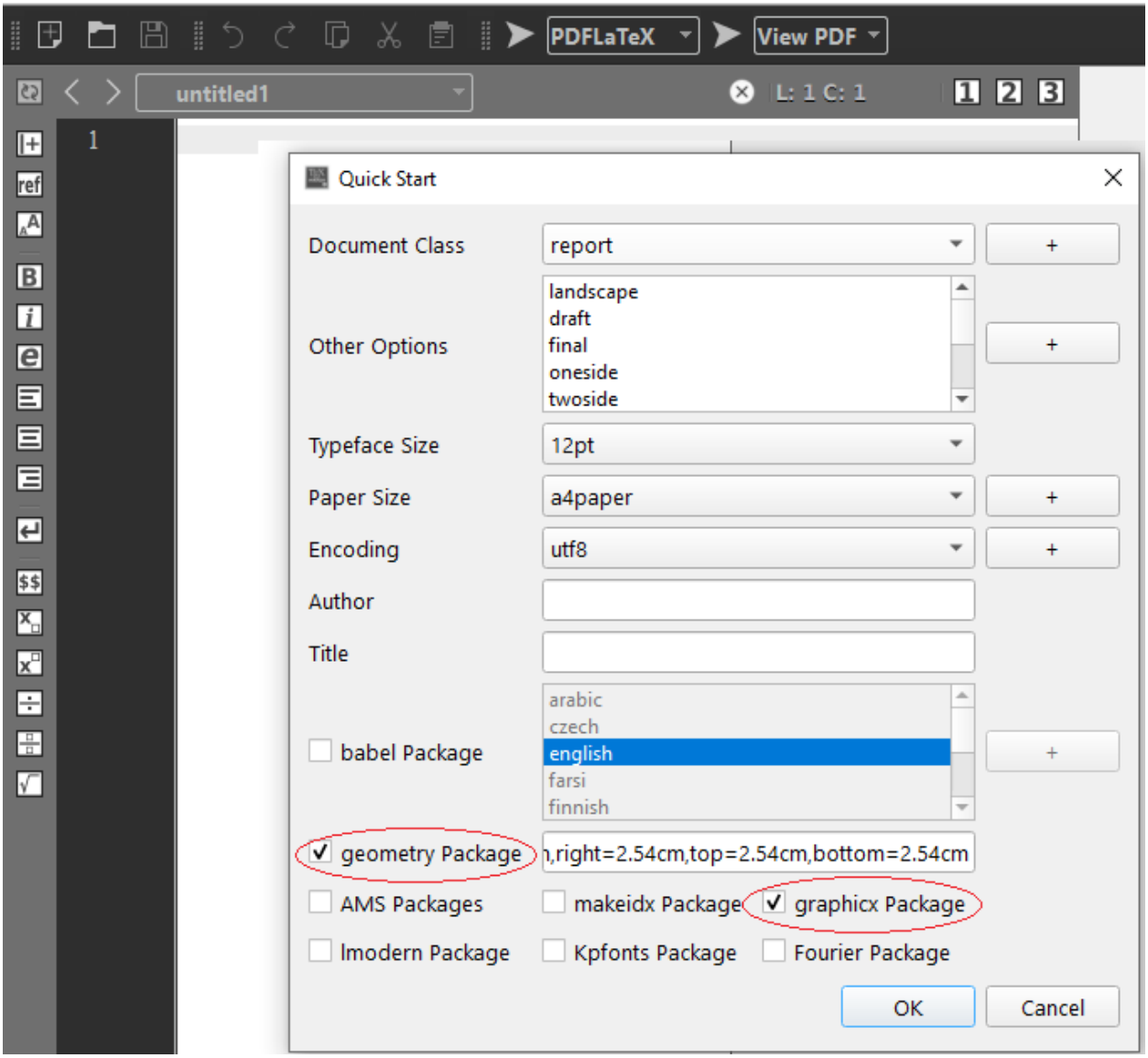

Document : untitled1
File Edit Tools LaTeX Math Wizard Bibliography User View Options Help
PDFLaTeX
untitled1
1
ref
Configure Texmaker Ctrl+,
Define Current Document as 'Master Document' Ctrl+0
Interface Language
Settings File


Configure Texmaker
Commands
Quick Build
Editor
Shortcuts
Commands (% : filename without extension - @ : line number)
LaTeX latex -synctex=1 -interaction=nonstopmode %.tex
PdfLaTeX pdflatex -synctex=1 -interaction=nonstopmode %.tex
Use a "build" subdirectory for output files
XeLaTeX -synctex=1 -interaction=nonstopmode %.tex
LuaLaTeX lualatex -interaction=nonstopmode %.tex
Latexmk -interaction=nonstopmode/" -pdf %.tex
Bib(la)tex bibtex %
Makeindex makeindex %.idx
dvips dvips -Pdownload35 -o %.ps %.dvi
Dvipdfm dvipdfm %.dvi
ps2pdf ps2pdf %.ps
metapost mpost --interaction nonstopmode
Asymptote s/MiKTeX/miktex/bin/x64/asy.exe" %.asy
ghostscript "gswin64c.exe"
Pdf Viewer
Built-in Viewer
Embed
External Viewer
es/Adobe/Acrobat DC/Acrobat/Acrobat.exe" %.pdf
lp options for the printer
Dvi Viewer
l/Programs/MiKTeX/miktex/bin/x64/yap.exe" %.dvi
PS Viewer
"gsview32.exe" %.ps
OK
Cancel


Configure Texmaker
Commands
Quick Build
Editor
Shortcuts
Quick Build Command
PdfLaTeX + View PDF
PdfLaTeX + Bib(la)tex + PdfLaTeX (x2) + View Pdf
LaTeX + dvips + ps2pdf + View PDF
LaTeX + Bib(la)tex + LaTeX (x2) + dvips + ps2pdf + View Pdf
LaTeX + Asymptote + LaTeX + dvips + View PS
PdfLaTeX + Asymptote + PdfLaTeX + View Pdf
LatexMk + View PDF
XeLaTeX + View PDF
LuaLaTeX + View PDF
LaTeX + dvips + View PS
LaTeX + View DVI
LaTeX + dvipdfm + View PDF
Sweave + PdfLaTeX + View Pdf
User : (% : filename without extension)
e %.tex|bibtex %.aux|latex -interaction=nonstopmode %.tex|latex -interaction=nonstopmode %.tex|xdvi %.dvi
wizard
(the commands must be separated by '|')
For .asy files
sy.exe" -f pdf -noView %.asy|"C:/Program Files/Adobe/Acrobat DC/Acrobat/Acrobat.exe" %.pdf
wizard
Don't launch a new instance of the viewer if the dvi/ps/pdf file is already opened
OK
Cancel


Configure Texmaker
Commands
Quick Build
Editor
Shortcuts
Editor
Editor Font Family
Times New Roman
Editor Font Size
12
Editor Font Encoding
UTF-8
Word Wrap
Completion
Show Line Numbers
Check for external changes
Record backup of opened files every
10
minutes
Spelling dictionary
Files (x86)/Texmaker/en_US.dic
Inline
Get more dictionaries at: freedesktop.org (.aff & .dic required)
Tab width (num of spaces)
4
Replace tab with spaces
Colors
Background
#ffffff
Current line
#ececec
Highlighted line
#ff0000
Text
#000000
Comment
#606060
Math
#008000
Dark theme
Default Theme
OK
Cancel


Document : untitled1
File Edit Tools LaTeX Math Wizard Bibliography User View Options Help
Quick Start
Quick Beamer Presentation
Quick Xelatex Document
Quick Letter
Quick Tabular
Quick Tabbing
Quick Array
View PDF
untitled1
L: 1 C: 1


PDFLaTeX
View PDF
untitled1
L: 1 C: 1
Quick Start
Document Class
report
Other Options
landscape
draft
final
oneside
twoside
Typeface Size
12pt
Paper Size
a4paper
Encoding
utf8
Author
Title
babel Package
arabic
czech
english
farsi
finnish
geometry Package
,right=2.54cm,top=2.54cm,bottom=2.54cm
AMS Packages
makeidx Package
graphicx Package
lmodern Package
Kpfonts Package
Fourier Package
OK
Cancel

EXPERIMENT-01: TITLE PAGE

Aim: Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]

```
%To set A4 size paper with 12 font size for normal text
\documentclass[12pt,a4paper,titlepage]{article}
\usepackage{graphicx}  %To insert images
\usepackage{xcolor}  % To change font color
\graphicspath{{Z:/Notes/Latex/images/}}%To Show path of images
\usepackage[left=3.2cm,right=2.54cm,top=1.5cm,bottom=0.5cm]{geometry}

\begin{document}

\begin{titlepage}  %To make the title
\centering
\Large
Project Report on
\Huge
\\[0.5cm]  %To maintain 0.5cm line spacing
\textbf{\textcolor{blue}{“Application of Latex in Report Writing”}}
\Large
\\[0.5cm]Submitted To
\\[0.5cm]
\includegraphics[scale=0.2]{logo_vtu}
\\
\textbf{Visvesvaraya Technological University}
\\Jnana Sangama, Belagavi – 590018
\\[0.5cm]Submitted in partial fulfilment of the requirement for the award of degree of
\\[0.3cm]\textbf{BACHELOR OF ENGINEERING}
\\In
\\Computer Science and Engineering
\\[0.5cm]Submitted By
\\
\textbf{\textcolor{red}{STUDENT NAME}}
\\(1WT23CS000)
\\[0.5cm]Under the Guidance of
\\\textbf{\textcolor{blue}{Dr.NAVEED}}
\\Assistant Professor
\\Department of Mechanical Engineering

\\[0.5cm]
\includegraphics[scale=0.12]{logo_gitw}  % To insert image directly
\\
\textbf{Ghousia Institute of Technology for Women}
```

```
\\DRC Post Dairy Circle Hosur Road Bengaluru -560029
\text{November-2024}

\end{titlepage}
\end{document}
```

OUTPUT:

Project Report on

"Application of Latex in Report Writing"

Submitted To

Visvesvaraya Technological University
Jnana Sangama, Belagavi – 590018

Submitted in partial fulfilment of the requirement for the award of degree of

BACHELOR OF ENGINEERING
In
Computer Science and Engineering

Submitted By
STUDENT NAME
(1WT23CS000)

Under the Guidance of
Dr.NAVEED
Assistant Professor
Department of Mechanical Engineering

Ghousia Institute of Technology for Women
DRC Post Dairy Circle Hosur Road Bengaluru -560029
November-2024

EXPERIMENT-02: PROJECT CERTIFICATE

Aim: Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]

```
\documentclass[12pt,a4paper]{article}
\usepackage{graphicx}
\usepackage{xcolor}
\usepackage{ragged2e}   %for using justify
\usepackage[left=3cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{geom
etry}
\graphicspath{{Z:/Notes/Latex/images/}}

\begin{document}

\centering
\Large
\textbf{Ghousia Institute of Technology for Women}
\large
\\Affiliated to Visvesvaraya Technological University Belagavi
\\Approved by AICTE, New Delhi, Recognised by Government of Karnataka.
\\[0.3cm]
\Large
\textbf{Department of Computer Science and Engineering}
\\[0.5cm]
\includegraphics[scale=0.1]{logo_gitw}
\\
\Huge
\textbf{\textcolor{blue}{CERTIFICATE}}
\\
\justify
\large
```

Certified that the project work entitled “Title of the Project”, is a bonafide work carried out by STUDENT NAME-1 (Register No), STUDENT NAME-2 (Register No) , STUDENT NAME-3 (Register No) and STUDENT NAME-4 (Register No) in partial fulfillment for the award of BACHELOR OF ENGINEERING in Computer Science and Engineering of the Visvesvaraya Technological University, Belagavi during the academic year 2024-25 .It is certified that all the corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the above said degree.

```
\\[2cm]

\begin{tabular}
{p{5cm}p{5cm}p{5cm}}  %there are 3 columns with 5cm spacing
\centering \textbf{Guide Name}  &    % Here & is used to separate the columns
```

```
\centering \textbf{HOD Name} &
\centering \textbf{Principal Name}&

\centering \textit{Signature of Guide} &     %textit means text in italic form
\centering \textit{Signature of HOD}    &
\centering \textit{Signature of Principal}
\end{tabular}
\\[1cm]

\centering\textbf{ External Viva}
\\[0.5cm]

\begin{tabular}
{p{8cm}p{8cm}} %there are 2 columns with 8cm spacing
\\
\centering \textbf{Name of the Examiners} &
\centering \textbf{Signature with Date} &
\\
\centering {1.....}&
\centering {.....}&
\\
\centering{2.....}&
\centering{.....}
\end{tabular}

\renewcommand{\thepage}{\roman{page}} % To change page numbering from Arabic to roman.

\end{document}
```

OUTPUT:

Ghousia Institute of Technology for Women

Affiliated to Visvesvaraya Technological University Belagavi
Approved by AICTE, New Delhi, Recognised by Govenment of Karnataka.

Department of Computer Science and Engineering

CERTIFICATE

Certified that the project work entitled "Title of the Project", is a bonafide work carried out by STUDENT NAME-1 (Register No), STUDENT NAME-2 (Register No) , STUDENT NAME-3 (Register No) and STUDENT NAME-4 (Register No) in partial fulfillment for the award of BACHELOR OF ENGINEERING in Computer Science and Engineering of the Visvesvaraya Technological University, Belagavi during the academic year 2024-25 .It is certified that all the corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the above said degree

Guide Name	**HOD Name**	**Principal Name**
Signature of Guide	*Signature of HOD*	*Signature of Principal*

External Viva

Name of the Examiners	**Signature with Date**
1.....	.....
2.....	.....

EXPERIMENT-03: ABSTRACT & ACKNOWLEDGEMENT

Aim: Develop a LaTeX script to create a document that displays the sample Abstract/Summary and Acknowledgement

```
\documentclass[12pt,a4paper]{report}
\usepackage[utf8]{inputenc} %to support greek symbols
\usepackage{graphicx}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{ragged2e}
\usepackage{setspace}%for setting 1.5 line spacing
\renewcommand{\thepage}{\roman{page}}%for changing page number in roman

\begin{document}
\centering
\Huge
\textbf{ABSTRACT}
\\[1cm]
\justify
\large
\onehalfspacing
Ghousia Institute of Technology for Women, located near dairy Circle on Hosur Road, Bangalore, is surrounded by several key facilities. The area has prominent educational institutions like Christ University and St. John's Medical College. The locality offers ample shopping options such as Forum Mall and Oasis Centre in Koramangala, along with numerous local supermarkets. There are various eateries and cafes in the vicinity, especially in Koramangala and Jayanagar, known for their vibrant food scenes. The college is well-connected by BMTC bus services and is close to metro stations like Jayanagar, providing easy accessibility. Recreational spots like Lalbagh Botanical Garden and Cubbon Park are also within a short distance, making the area a convenient and lively place for students.
\\The college campus is not just a physical structure but a pulsating center of activity, creativity, and community. It serves as the heartbeat of the students, resonating with a multitude of events, emotions, and memories that enrich the college experience.
\\The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences
\\It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose. It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.
\clearpage  %to shift to next page
\centering
\Huge
```

```
\textbf{ACKNOWLEDGEMENT}
\\[1cm]
\large
\justify
\onehalfspacing
```
It is distinct pleasure to acknowledge \textbf{Guide Name,} Designation, Department with profound gratitude for his moral inspiration, encouragement, valuable guidance and suggestions throughout the course of our project work and preparation of this report.
\\We sincerely thank to \textbf{HOD Name,} Designation, Department for his constant support during the course of work.
\\We are extremely grateful to \textbf{Principal Name,} Principal, Ghousia Institute of Technology for Women for his support and co-operation during this course of work.
\\We are thankful to all the teaching, non-teaching and administrative staff of Ghousia Institute of Technology for Women for their kind cooperation.
\\Our special and sincere thanks to our parents, brothers and sister for their kind cooperation and timely help to carry out this project work successfully.
```
\\[8cm]
\textbf{Student Name}
\\1WT23CS000


\end{document}
```

OUTPUT:

ABSTRACT

Ghousia Institute of Technology for Women, located near dairy Circle on Hosur Road, Bangalore, is surrounded by several key facilities. The area has prominent educational institutions like Christ University and St. John's Medical College. The locality offers ample shopping options such as Forum Mall and Oasis Centre in Koramangala, along with numerous local supermarkets. There are various eateries and cafes in the vicinity, especially in Koramangala and Jayanagar, known for their vibrant food scenes. The college is well-connected by BMTC bus services and is close to metro stations like Jayanagar, providing easy accessibility. Recreational spots like Lalbagh Botanical Garden and Cubbon Park are also within a short distance, making the area a convenient and lively place for students.

The college campus is not just a physical structure but a pulsating center of activity, creativity, and community. It serves as the heartbeat of the students, resonating with a multitude of events, emotions, and memories that enrich the college experience.

The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences

It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose. It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.

ACKNOWLEDGEMENT

It is distinct pleasure to acknowledge **Guide Name,** Designation, Department with profound gratitude for his moral inspiration, encouragement, valuable guidance and suggestions throughout the course of our project work and preparation of this report.

We sincerely thank to **HOD Name,** Designation, Department for his constant support during the course of work.

We are extremely grateful to **Principal Name,** Principal, Ghousia Institute of Technology for Women for his support and co-operation during this course of work.

We are thankful to all the teaching, non-teaching and administrative staff of Ghousia Institute of Technology for Women for their kind co-operation.

Our special and sincere thanks to our parents, brothers and sister for their kind cooperation and timely help to carry out this project work successfully.

Student Name
1WT23CS000

EXPERIMENT-04: Chapter-01 ABOUT GITW

Aim: Develop a LaTeX script to create a simple document that consists of sections, sub-sections, and a paragraph with dummy text in each section followed with table of contents. And also include header [title of document] and footer [institute name, page number] in the document.

```
\documentclass[12pt,a4paper]{report}
\usepackage[utf8]{inputenc}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{setspace} % For line spacing
\usepackage{ragged2e}%for justifying
\usepackage{enumitem}% for  numbering of items
\usepackage{fancyhdr} % for using header
\pagestyle{fancy}
\fancyhf{}%To erase default header & footer
\fancyhead[C]{Application of Latex in Report Writing}
\fancyfoot[L]{Ghousia Institute of Technology for Women}
\fancyfoot[R]{\thepage}
\renewcommand{\footrulewidth}{0.4pt} %to draw line above footer
\renewcommand\thesection{\thechapter.\arabic{section}} % Label
sections as Chapter.Section
\renewcommand\thesubsection{\thesection.\arabic{subsection}}
% Label subsections as Chapter.Section.Subsection
\usepackage{hyperref} % To make contents in hyper link type
\hypersetup{colorlinks=true, linkcolor=blue}

\begin{document}
\Large
\tableofcontents     % to highlight contents
\clearpage

%Chapter-1 ABOUT GITW

\setcounter{chapter}{1}% To start numbering from chapter 1
\Large
\textbf{Chapter-01} \hspace{3cm} \textbf{ABOUT GITW}
\vspace{1cm} % to provide vertical space after chapter label
\onehalfspacing   % it provides 1.5 line spacing throughout the report
\large
\justify
```

Ghousia Institute of Technology (GITW) for Women was established in the year 2023. It is affiliated to Visvesvaraya Technological University (VTU), Belagavi, Karnataka and recognized by AICTE, New Delhi, and the Government of Karnataka, ranking first in women's minority education in the state. The college provides hostel facilities and organizes diverse programs enhancing students' overall personality. It offers B.E Programs in:

```
\begin{enumerate}[label=\roman*)]   % * represent items followed with )
    \item  Computer Science and Engineering (CS)
    \item  Information Science and Engineering (IS) and
    \item  Electronics and Communication Engineering (EC)
\end{enumerate}

\section{Women Empowerment}
\subsection{Our Vision}
To be a pioneer institute in articulating young women into dynamic engineers and technologists equipped with skills, knowledge, ethics and an attitude to serve the society.
\subsection{Our Mission}
To make our students good citizens by inculcating in them creativity, effective communication skills, robust facilities for curricular & co-curricular activities, technological knowledge and ethical behavior.
\section{Facilities Available}
\subsection{Campus Life}
The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.
\subsection{Library and Information Center}
The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities.

\end{document}
```

OUTPUT

Contents

Chapter-01 ABOUT GITW

Ghousia Institute of Technology (GITW) for Women was established in the year 2023. It is affiliated to Visvesvaraya Technological University (VTU), Belagavi, Karnataka and recognized by AICTE, New Delhi, and the Government of Karnataka, ranking first in women's minority education in the state. The college provides hostel facilities and organizes diverse programs enhancing students' overall personality. It offers B.E Programs in:

i) Computer Science and Engineering (CS)

ii) Information Science and Engineering (IS) and

iii) Electronics and Communication Engineering (EC)

1.1 Women Empowerment

1.1.1 Our Vision

To be a pioneer institute in articulating young women into dynamic engineers and technologists equipped with skills, knowledge, ethics and an attitude to serve the society.

1.1.2 Our Mission

To make our students good citizens by inculcating in them creativity, effective communication skills, robust facilities for curricular co-curricular activities, technological knowledge and ethical behavior. [**?**]

1.2 Facilities Available

1.2.1 Campus Life

The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.

1.2.2 Library and Information Center

The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities.

EXPERIMENT-05: Chapter-02 FIGURES

Aim: Develop a LaTeX script to include the simple as well side-by-side graphics/pictures/figures in the document by using the subgraph concept

```
\documentclass[12pt,a4paper]{report}
\usepackage[utf8]{inputenc}%to support greek symbols
\usepackage{graphicx} %to support images
\graphicspath{{Z:/Notes/Latex/images/}}%To Show path of images
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{ragged2e}%for justifying
\usepackage[labelfont=bf,textfont=bf]{caption}% for making figure caption
bold
\usepackage{amsmath} % to number figures as per chapter no
\usepackage{caption} % to number figures as per chapter no
\numberwithin{figure}{chapter} % to number figures as per chapter no
\usepackage{subcaption} % For subfigure support
\renewcommand\thesection{\thechapter.\arabic{section}} % Label
sections as Chapter.Section
\usepackage{hyperref} % To make contents in hyper link type
\hypersetup{colorlinks=true, linkcolor=blue}

\begin{document}
\Large
\listoffigures            % to higjlight figures
\clearpage
%Chapter-2  FIGURES
\setcounter{chapter}{2}% To start numbering figure from chapter 1
\Large
\textbf{Chapter-02} \hspace{3cm} \textbf{FIGURES}
\vspace{1cm} % to provide vertical space after chapter label
\large
\justify


\section{Campus Life}

The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.

\begin{figure}[h]    % here h mean "here" it specifies the path of figure
\centering
```

```
\includegraphics[scale=0.25]{campus1}
\caption{GITW Campus}
\end{figure}}
\noindent   % to remove indent from paragraph
```

It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose. It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.

```
\section{Library and Information Center}
```

The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities.

```
\begin{figure}[h]
\centering
\begin{subfigure}{0.3\textwidth}
    \centering
    \includegraphics[width=\textwidth]{library1}
   \end{subfigure}
\hfill
\begin{subfigure}{0.3\textwidth}
    \centering
    \includegraphics[width=\textwidth]{library2}
\end{subfigure}
\hfill
\begin{subfigure}{0.3\textwidth}
    \centering
    \includegraphics[width=\textwidth]{library3}
 \end{subfigure}
\caption{Library and information center}
\end{figure}
\noindent
```

By offering a quiet space for focused study and group discussions, the library enhances students' analytical and critical thinking skills. Moreover, it helps them stay updated with the latest advancements in technology and industry trends, thereby encouraging continuous learning and professional development.

```
\end{document}
```

OUTPUT:

List of Figures

Chapter-02 FIGURES

2.1 Campus Life

The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts. These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.

Figure 2.1: GITW Campus

It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose. It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.

2.2 Library and Information Center

The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities.

Figure 2.2: Library and information center

By offering a quiet space for focused study and group discussions, the library enhances students' analytical and critical thinking skills. Moreover, it helps them stay updated with the latest advancements in technology and industry trends, thereby encouraging continuous learning and professional development.

EXPERIMENT-06: Chapter-02 ABOUT GITW (2 columns)

Aim: Develop a LaTeX script in two columns format consisting of sections, sub-sections, figures.

```
\documentclass[12pt,a4paper,twocolumn]{report} % for two columns
\usepackage[utf8]{inputenc}%to support greek symbols
\usepackage{graphicx} %to support images
\graphicspath{{Z:/Notes/Latex/images/}}%To Show path of images
\usepackage[margin=1in]{geometry}% for two column format
\usepackage{setspace} % For line spacing
\usepackage{ragged2e}%for justifying
\usepackage[labelfont=bf,textfont=bf]{caption}% for making figure caption
bold
\usepackage{amsmath} % to number figures as per chapter no
\usepackage{caption} % to number figures as per chapter no
\numberwithin{figure}{chapter} % to number figures as per chapter no
\setlength{\columnsep}{1cm}% to set space between the two columns
\setcounter{chapter}{2}% To start numbering figure from chapter 2
\renewcommand\thesection{\thechapter.\arabic{section}} % Label
sections as Chapter.Section
\renewcommand\thesubsection{\thesection.\arabic{subsection}}
% Label subsections as Chapter.Section.Subsection

\begin{document}
\Large
\twocolumn[{
     \textbf{Chapter-02} \hspace{3cm} \textbf{ABOUT GITW}
    \vspace{1cm} % Add some vertical space
}] % this is used for Chapter-2 ABOUT GITW . hspace=horizontal spacing

\onehalfspacing  % it provides 1.5 line spacing throughout the report
\large
\justify

\section{Facilities Available}
\subsection{Campus Life}
The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts.
\\These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.

\begin{figure}[h]    % here h mean "here" it specifies the path of figure
\centering
\includegraphics[scale=0.18]{campus1}
\caption{GITW Campus}
```

```
\end{figure}}
```
It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose.
\\ It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.

```
\subsection{Physics Laboratory}
```
Physics is fundamental to engineering education, as it forms the backbone of all technical disciplines and provides a solid understanding of the principles that govern natural phenomena.
\\ For women in engineering, studying physics is especially empowering because it cultivates critical thinking, problem-solving abilities, and analytical skills that are essential for innovation and technological advancements.

```
\clearpage
\begin{figure}[h]    % here h mean "here" it specifies the path of figure
\centering
\includegraphics[scale=0.5]{physics1}
\end{figure}}
\begin{figure}[h]    % here h mean "here" it specifies the path of figure
\centering
\includegraphics[scale=0.5]{physics2}
\end{figure}}
\begin{figure}[h]    % here h mean "here" it specifies the path of figure
\centering
\includegraphics[scale=0.5]{physics3}
\caption{Physics laboratory.}
\end{figure}}
```

Physics allows women engineers to grasp core concepts such as mechanics, electromagnetism, and thermodynamics, enabling them to apply these principles to design and optimize solutions in various fields like civil, electrical, and mechanical engineering.
\\
Further, Chemistry is vital in engineering education as it bridges the gap between scientific principles and practical applications, especially in fields like chemical, environmental, and materials engineering. For women pursuing engineering, a strong understanding of chemistry enables them to delve into the molecular and atomic-level interactions that are essential for developing new materials, optimizing industrial processes, and ensuring sustainability in various engineering solutions.
\\ Chemistry empowers women to contribute to innovations in diverse areas such as renewable energy, pharmaceuticals, and nanotechnology. It equips them with the skills to analyze complex chemical reactions, understand material properties, and create safer, more efficient products.

```
\end{document}
```

OUTPUT:

Chapter-02 ABOUT GITW

2.1 Facilities Available

2.1.1 Campus Life

The campus is a stage for artistic expression and cultural celebration. It is the place where students showcase their talents, creativity, and passion, captivating audiences and fostering a sense of appreciation for the arts.

These cultural events not only entertain but also educate, provoking reflection, empathy, and a deeper understanding of diverse perspectives and experiences.

Figure 2.1: GITW Campus

It embodies the spirit of the college, pulsating with energy, passion, and a sense of purpose.

It is a place where ideas converge, talents shine, and connections are forged, shaping memorable experiences and shaping the future leaders of tomorrow.

2.1.2 Physics Laboratory

Physics is fundamental to engineering education, as it forms the backbone of all technical disciplines and provides a solid understanding of the principles that govern natural phenomena.

For women in engineering, studying physics is especially empowering because it cultivates critical thinking, problem-solving abilities, and analytical skills that are essential for innovation and technological advancements.

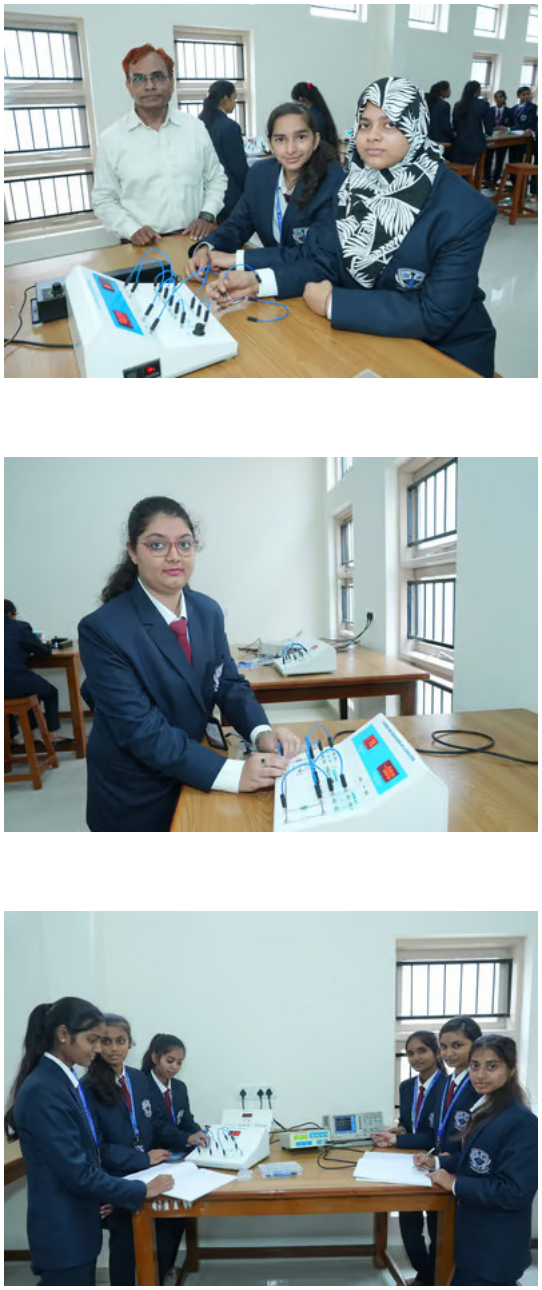


Figure 2.2: Physics laboratory.

Physics allows women engineers to grasp core concepts such as mechanics, electromagnetism, and thermodynamics, enabling them to apply these principles to design and optimize solutions in various fields like civil, electrical, and mechanical engineering.

Further, Chemistry is vital in engineering education as it bridges the gap between scientific principles and practical applications, especially in fields like chemical, environmental, and materials engineering. For women pursuing engineering, a strong understanding of chemistry enables them to delve into the molecular and atomic-level interactions that are essential for developing new materials, optimizing industrial processes, and ensuring sustainability in various engineering solutions.

Chemistry empowers women to contribute to innovations in diverse areas such as renewable energy, pharmaceuticals, and nanotechnology. It equips them with the skills to analyze complex chemical reactions, understand material properties, and create safer, more efficient products.

EXPERIMENT-07: Chapter-03 ACADEMIC PERFORMANCE

Aim: Develop a LaTeX script to create a document that contains the following table with proper labels.

S.No	USN	Student Name	Marks		
			Subject1	Subject2	Subject3
1	4XX22XX001	Name 1	89	60	90
2	4XX22XX002	Name 2	78	45	98
3	4XX22XX003	Name 3	67	55	59

```
\documentclass{article}
\usepackage[utf8]{inputenc}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{geometry}
\usepackage{array} % for using tables
\usepackage{caption} % Allows customization of captions
\captionsetup{labelformat=empty} % Removes the default table labelling

\begin{document}
%Chapter-03 STUDENT ACADEMIC PERFORMANCE
\Large
\textbf{Chapter-03} \hspace{1cm} \textbf{ ACADEMIC PERFORMANCE}
\\[0.5cm]

% given table consist of 7 vertical lines and 5 horizal line with extra horizal  line for column 4 to 6.

\begin{table}[h!] % h- here and ! strictly
\centering
\large
\caption{\textbf{\LargeTable 3.1:  Students academic performance}}
\\[0.3cm]
\renewcommand{\arraystretch}{2} % Adjust row height
\setlength{\tabcolsep}{10pt} % Adjust column width

\begin{tabular}{|c|c|c|c|c|c|} % to draw 7 vertical lines with centering of text
\hline% to draw 1st horizontal line
\textbf{S.No} &\textbf{USN} &\textbf{Student Name}
&\multicolumn{3}{c|}{\textbf{Marks}} % to merge 3 columns and add text at center
\\\cline{4-6}   % To draw  horizontal line only from 4th to 6th column. cline is used
&&&% No text added in 1st to 3rd column
\textbf{Subject1} &\textbf{Subject2} &\textbf{Subject3}
```

```
\\\hline% 2nd horizal line
1 & 1WT23CS000 & Name 1 & 89 & 60 & 90
\\\hline% 3rd horizonatl line
2 & 1WT23CS000 & Name 2 & 78 & 45 & 98
\\\hline% 4th horizontal line
3 & 1WT23CS000 & Name 3 & 67 & 55 & 59
\\\hline% 5th horizontal line

\end{tabular}

\end{table}


\end{document}
```

OUTPUT:

Chapter-03 ACADEMIC PERFORMANCE

Table 3.1: Students academic performance

S.No	USN	Student Name	Marks		
			Subject1	Subject2	Subject3
1	1WT23CS000	Name 1	89	60	90
2	1WT23CS000	Name 2	78	45	98
3	1WT23CS000	Name 3	67	55	59

EXPERIMENT-08: Chapter-04 Bibliography

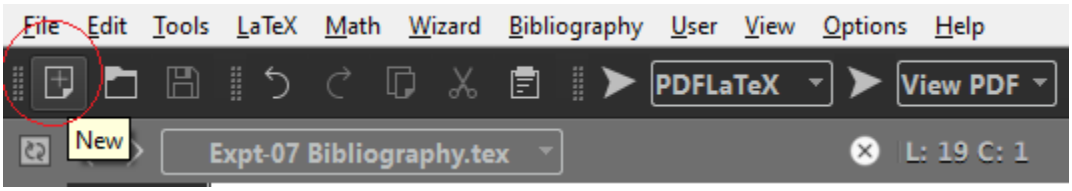
Aim: Develop a LaTeX script to create a document that consists of paragraphs with a minimum of 10 citations in it and display the reference in the section.

```
\documentclass[12pt,a4paper]{report}
\usepackage[utf8]{inputenc}
\usepackage{graphicx}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{hyperref}
\usepackage{xcolor}   % Load xcolor package for color options
% Set color for citations (e.g., blue)
\hypersetup{ colorlinks=true, citecolor=blue} % to make cite key blue
color

\begin{document}
%Chapter-04 BIBLIOGRAPHY
\Large
\textbf{Chapter-04} \hspace{1cm} \textbf{ BIBLIOGRAPHY}
\\[1cm]
\Large
Library and Information Center: The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. \cite{reference1}\\[1cm]
It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities. By offering a quiet space for focused study and group discussions, the library enhances students' analytical and critical thinking skills. \cite{reference2}  \\[1cm]
Moreover, it helps them stay updated with the latest advancements in technology and industry trends, thereby encouraging continuous learning and professional development.\cite{reference3}\\
% To add Some more citations refer google scholar and update some articles in references.bib file
\cite{reference4,reference5,reference6,reference7,reference8,reference9,reference10}


\renewcommand{\bibname}{REFERENCES} % Change "Bibliography" to "REFERENCES"
\bibliographystyle{unsrt}     % unsrt makes list of reference as per given order
.bib file
\bibliography{references.bib}


\end{document}
```

In the above \bibliography{references.bib}
Here {references.bib} represent a bib file created in the same directory of the Latex with data of references given in standard format as shown below.

To create references.bib file

Click on New file icon



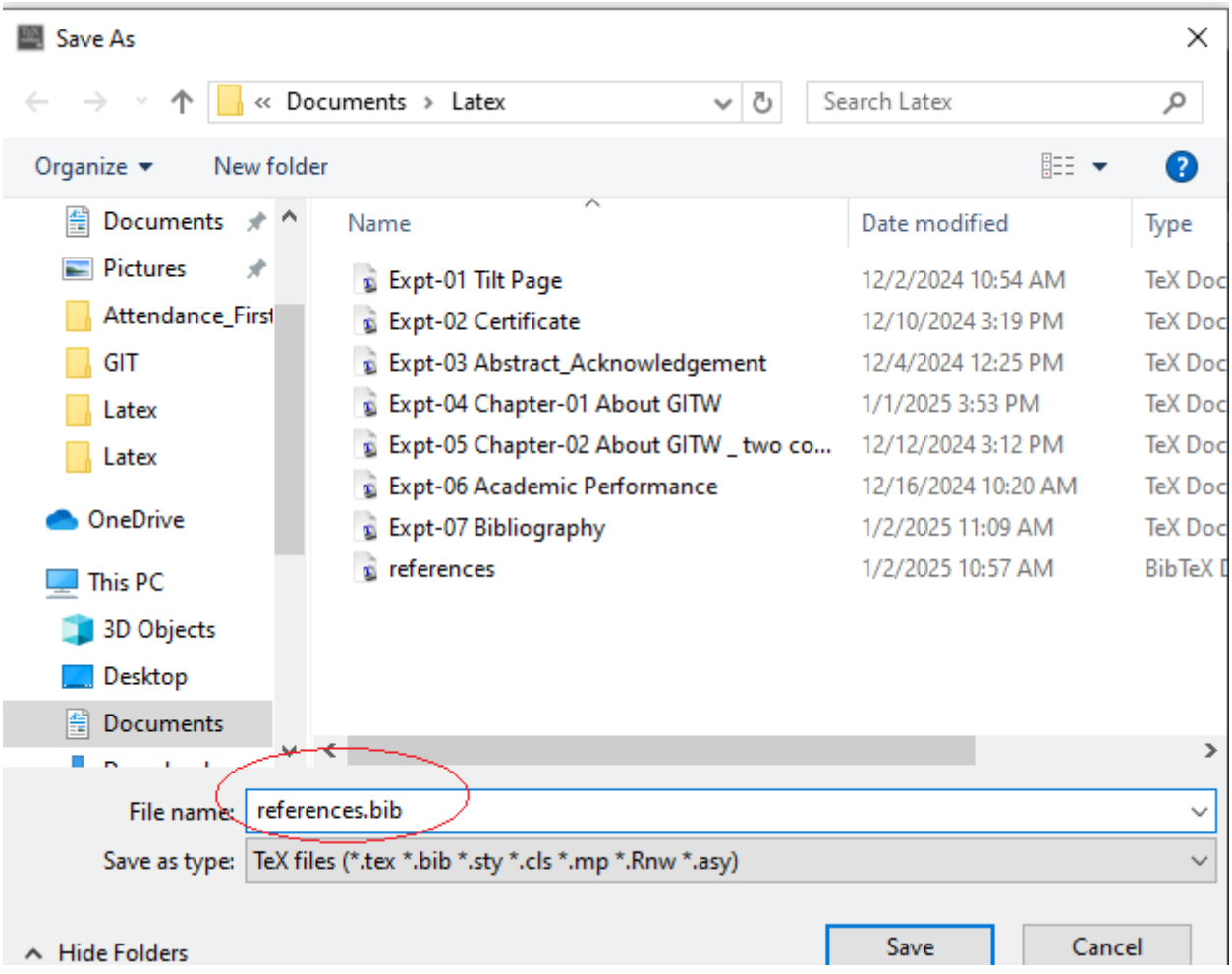
Type the data shown below:

```
@book{reference1,
  author    = {Dr.Naveed},
  title     = {LaTeX: A Document Preparation System},
  year      = {1994},
  publisher = {Addison-Wesley},
}
@article{reference2,
  author    = {Miss.1WT23CS000},
  title     = {Empowering Women in Engineering Education},
  journal   = {International Journal of Education},
  year      = {2023},
  volume    = {45},
  number    = {3},
  pages     = {123-130},
  url       = {https://example.com/empowering-women},
}
@misc{reference3,
  author    = {Miss.1WT23IS000},
  title     = {Introduction to BibTeX},
  year      = {2025},
  url       = {https://example.com/bibtex-guide},
  note      = {Accessed: 2025-01-01},
}

@article{reference4,
  title={Metal matrix composites},
  author={Mortensen, Andreas and Llorca, Javier},
  journal={Annual review of materials research},
  volume={40},
  number={1},
  pages={243--270},
  year={2010},
  publisher={Annual Reviews}
}

@article{reference5,
  title={Metal matrix composites},
```

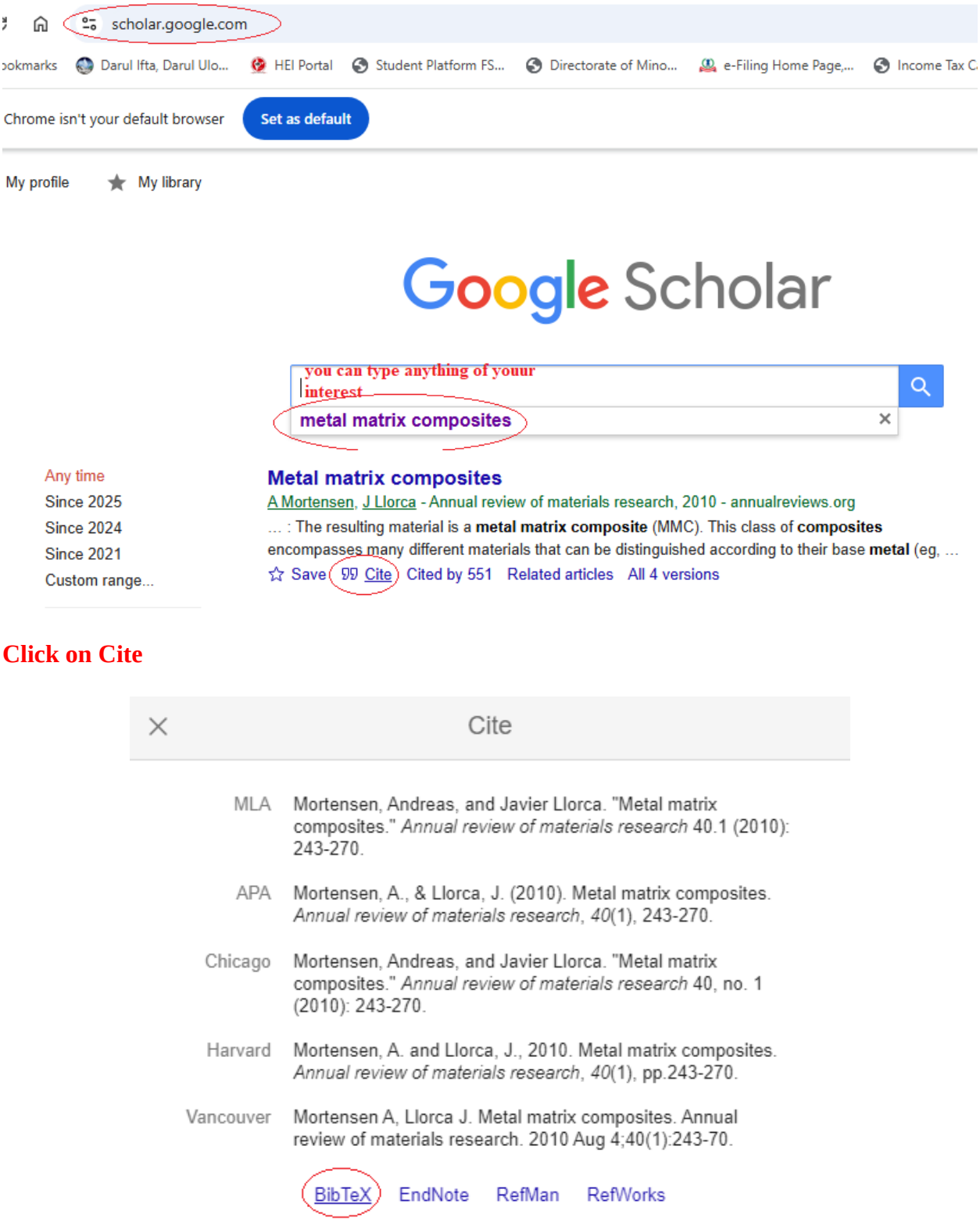
```
  author={Rohatgi, Pradeep K},
  journal={Defence science journal},
  volume={43},
  number={4},
  pages={323},
  year={1993},
  publisher={Defence Scientific Information \& Documentation
Centre}
}

@article{reference6,
  title={Basics of metal matrix composites},
  author={Kainer, Karl Ulrich},
  journal={Metal Matrix Composites: Custom-made Materials for
Automotive and Aerospace Engineering},
  pages={1--54},
  year={2006},
  publisher={Wiley Online Library}
}

@book{reference7,
  title={Metal matrix composites},
  author={Evans, Alexander and San Marchi, Christopher and
Mortensen, Andreas and Evans, Alexander and San Marchi,
Christopher and Mortensen, Andreas},
  year={2003},
  publisher={Springer}
}

@article{reference8,
  title={Metal matrix composites--from science to technological
significance},
  author={Miracle, DB},
  journal={Composites science and technology},
  volume={65},
  number={15-16},
  pages={2526--2540},
  year={2005},
  publisher={Elsevier}
}

@book{reference9,
  title={Metal matrix composites},
  author={Chawla, Krishan K and Chawla, Krishan K},
  year={1998},
  publisher={Springer}
```

```
}

@article{reference10,
  title={The processing of metal matrix composites—an overview},
  author={Ralph, Brian and Yuen, HC and Lee, Wing Bun},
  journal={Journal of materials processing technology},
  volume={63},
  number={1-3},
  pages={339--353},
  year={1997},
  publisher={Elsevier}
}
```

The above data is in .bib format.
Save the above file with references.bib



Note: We can use Google Scholar to get references of any journal in .bib format.

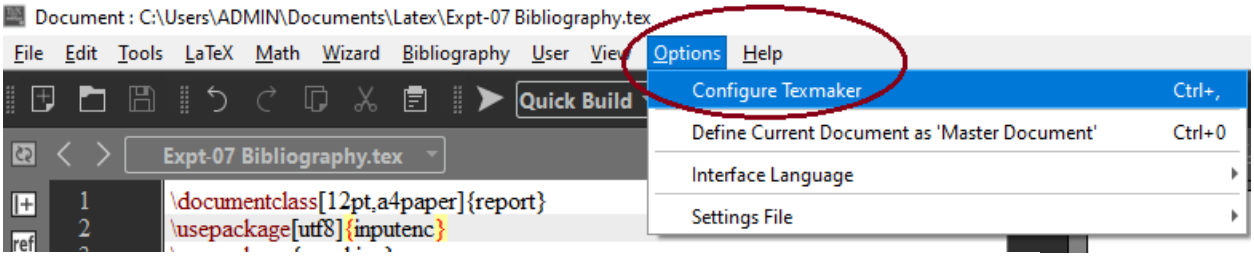


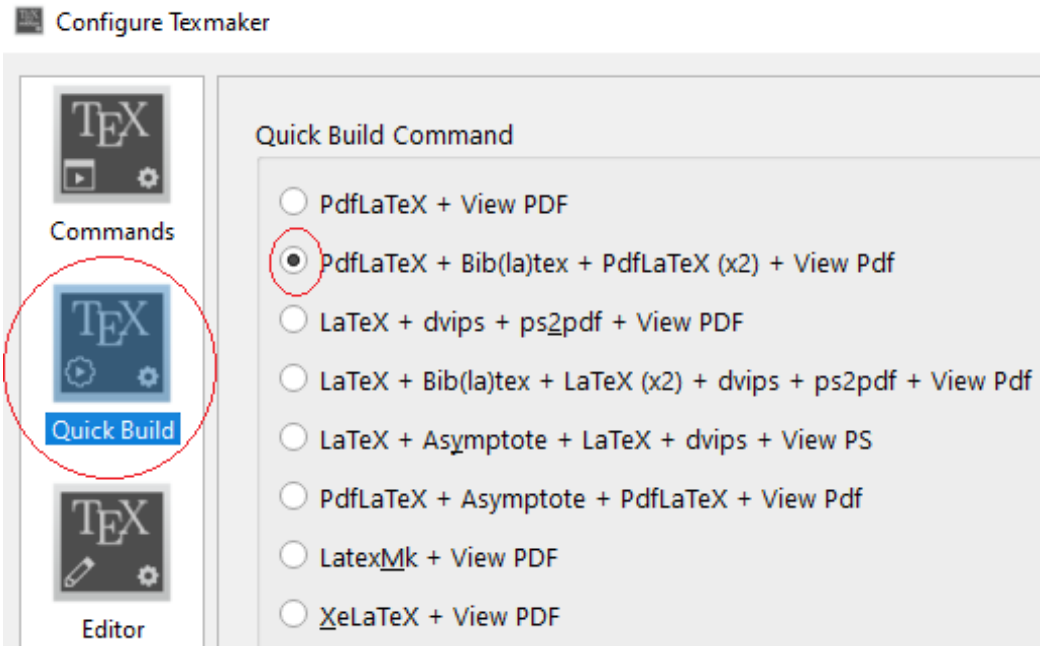
Click on Cite

```
@article{mortensen2010metal,
  title={Metal matrix composites},
  author={Mortensen, Andreas and Llorca, Javier},
  journal={Annual review of materials research},
  volume={40},
  number={1},
  pages={243--270},
  year={2010},
  publisher={Annual Reviews}
}
```

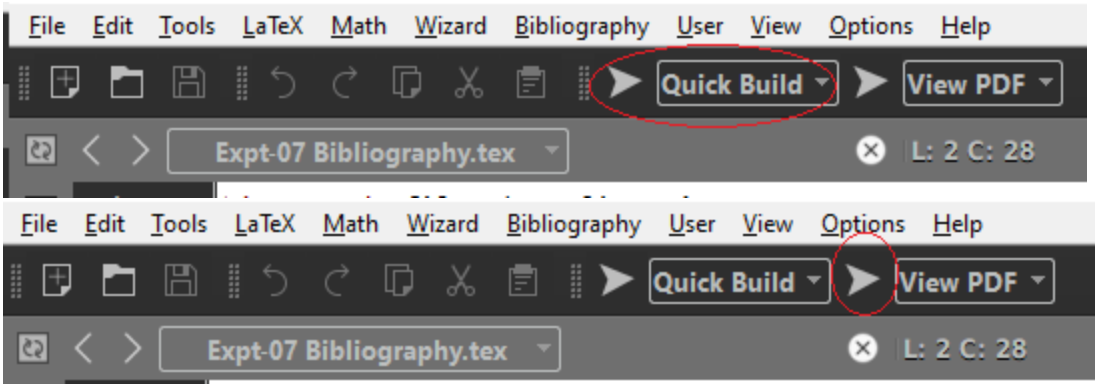
We can change name of the article. We have used reference1, reference2 and reference3 in our references.bib file.

Tu run the Bibliography select Second option in the Quick Build option as shown below.





After this select Quick Build and then click on RUN and Then click on PDF viewer as shown below


File Edit Tools LaTeX Math Wizard Bibliography User View Options Help
Quick Build
View PDF
Expt-07 Bibliography.tex
L: 2 C: 28
File Edit Tools LaTeX Math Wizard Bibliography User View Options Help
Quick Build
View PDF
Expt-07 Bibliography.tex
L: 2 C: 28

OUTPUT:

Chapter-04 BIBLIOGRAPHY

Library and Information Center: The library in an engineering college is a vital resource center that significantly contributes to the academic and professional growth of students and faculty. [1]

It provides access to a wide array of books, journals, research papers, and digital resources that support the understanding of complex engineering concepts and foster research activities. By offering a quiet space for focused study and group discussions, the library enhances students' analytical and critical thinking skills. [2]

Moreover, it helps them stay updated with the latest advancements in technology and industry trends, thereby encouraging continuous learning and professional development.[3]
[4, 5, 6, 7, 8, 9, 10]

REFERENCES

[1] Dr.Naveed. *LaTeX: A Document Preparation System*. Addison-Wesley, 1994.

[2] Miss.1WT23CS000. Empowering women in engineering education. *International Journal of Education*, 45(3):123–130, 2023.

[3] Miss.1WT23IS000. Introduction to bibtex, 2025. Accessed: 2025-01-01.

[4] Andreas Mortensen and Javier Llorca. Metal matrix composites. *Annual review of materials research*, 40(1):243–270, 2010.

[5] Pradeep K Rohatgi. Metal matrix composites. *Defence science journal*, 43(4):323, 1993.

[6] Karl Ulrich Kainer. Basics of metal matrix composites. *Metal Matrix Composites: Custom-made Materials for Automotive and Aerospace Engineering*, pages 1–54, 2006.

[7] Alexander Evans, Christopher San Marchi, Andreas Mortensen, Alexander Evans, Christopher San Marchi, and Andreas Mortensen. *Metal matrix composites*. Springer, 2003.

[8] DB Miracle. Metal matrix composites–from science to technological significance. *Composites science and technology*, 65(15-16):2526–2540, 2005.

[9] Krishan K Chawla and Krishan K Chawla. *Metal matrix composites*. Springer, 1998.

[10] Brian Ralph, HC Yuen, and Wing Bun Lee. The processing of metal matrix composites—an overview. *Journal of materials processing technology*, 63(1-3):339–353, 1997.

EXPERIMENT-09: Chapter-05 MATHEMATICAL EQUATIONS.

Aim: Develop a LaTeX script to create a document that consists of the following two mathematical equations

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-8)}}{2 \cdot 1}$$

$$x = \frac{-2 \pm \sqrt{4 + 32}}{2}$$

$$\begin{aligned} \varphi_\sigma^\lambda A_t &= \sum_{\pi \in C_t} \operatorname{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda \\ &= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda \\ &= A_{\sigma t} \varphi_\sigma^\lambda \end{aligned}$$

Here is the LaTeX script to create a document with the equations shown in your image:

```
\documentclass[12pt,a4paper]{article}
\usepackage[utf8]{inputenc}
\usepackage{amsmath} % For advanced math typesetting
\usepackage{amssymb} % For additional math symbols
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}

% Define a chapter counter (since article class doesn't support
chapters)
\newcounter{chapter}
\setcounter{chapter}{5}% Set the current chapter number

\numberwithin{equation}{chapter} % Link equation numbering to the chapter
counter


\begin{document}
\Large
\textbf{Chapter-05}\hspace{1cm}\textbf{MATHEMATICAL EQUATIONS}

\section*{Solving a Quadratic Equation}    %* removes numbering for section

The quadratic formula is given by:

\begin{equation}
    x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{equation}
```

Substituting the values a = 1, b = 2, and c = -8 into the formula:

```
\begin{equation}
    x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-8)}}{2 \cdot 1}
\end{equation}
```

Simplifying further:

```
\begin{equation}
    x = \frac{-2 \pm \sqrt{4 + 32}}{2}
\end{equation}
```

```
To get final answer:
```

```
\begin{equation}
x= -1 \pm 3
\end{equation}
```

\section*{Mathematical Derivation**}**

```
\begin{align}
\varphi_\sigma^\lambda A_t &= \sum_{\pi  \in  C_t}
\operatorname{sgn}(\pi)
\varphi_\sigma^\lambda \varphi_\pi^\lambda \\
&= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn} (\sigma^{-1}
\tau \sigma)
\varphi_\sigma^ \lambda  \varphi_ {\sigma^{-1} \tau
\sigma}^\lambda\\
&= A_{\sigma t} \varphi_\sigma^\lambda
\end{align}
```

```
% Dont give any line of gap in the above after \begin{align} ,\\ and \end{align}
```

\end{document}

Steps:

1. **Equations**:

    - The equation environment is used to display the mathematical equations with alignment and numbering.

2. **Mathematical Notations**:

    - \pm: For the plus-minus symbol (±).
    - \sqrt{}: For the square root.
    - \frac{}{}: For fractions.

 Key Notations:

- \varphi: Represents the Greek letter φ.
- \lambda: Represents the Greek letter λ.
- \operatorname{sgn}: Typesets "sgn" (sign function) in upright text.
- \sum: Summation symbol ∑
- \sigma Represents the Greek letter σ.
- \pi Represents the Greek letter π.
- \in Represents the Greek letter ε
- Subscripts (_) and superscripts (^) are used for variables like φ_σ^λ.

- &= It helps in proper alignment of = sign..

OUTPUT:

Chapter-05 MATHEMATICAL EQUATIONS

Solving a Quadratic Equation

The quadratic formula is given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{5.1}$$

Substituting the values a = 1, b = 2, and c = -8 into the formula:

$$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-8)}}{2 \cdot 1} \tag{5.2}$$

Simplifying further:

$$x = \frac{-2 \pm \sqrt{4 + 32}}{2} \tag{5.3}$$

To get final answer:

$$x = -1 \pm 3 \tag{5.4}$$

Mathematical Derivation

$$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda \tag{5.5}$$

$$= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda \tag{5.6}$$

$$= A_{\sigma t} \varphi_\sigma^\lambda \tag{5.7}$$

EXPERIMENT-10: Chapter-06 Numbered Theorems, Definitions, Corollaries, and Lemmas

Aim: Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document

In mathematics and other scientific fields, **theorems**, **lemmas**, **definitions**, and **corollaries** are used to organize and present logical arguments, formal reasoning, and foundational concepts. Here's what each of these terms means and how they are used:

1. Theorem: A theorem is a formal statement that has been proven to be true based on previously established statements, such as axioms, definitions, or other theorems. It is often the central result or conclusion in a discussion or proof.

2. Lemma: A **lemma** is a supporting proposition or a smaller result that is proven to help in the proof of a larger theorem. It is often used as a stepping stone to derive more complex results. It simplify or break down a problem into manageable pieces before proving the main result (theorem).

3. Definition: A **definition** specifies the precise meaning of a term or concept, which is used in theorems, proofs, and discussions. They are foundational and do not require proof because they simply establish terminology or conventions.It provide clarity and formalization of concepts.

4. Corollary: A **corollary** is a statement that follows directly and easily from a previously proven theorem or proposition. It is often considered a "bonus" result or an immediate consequence of a larger theorem. It state additional results derived from a theorem.

In LaTeX, the command \(…….. \) is used to typeset mathematics in inline mode**.** It denotes that the content inside should be treated as mathematical expressions. It renders the math inline, meaning it will appear as part of the normal flow of text.

```
\documentclass[12pt,a4paper]{article}
\usepackage[utf8]{inputenc}
\usepackage{amsthm} % For theorem environments like theorem, definition, lemma
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{geometry}

% To label subsections with Theorem, Definition, Lemma and Corollary with numbering as per chapter number
\newtheorem{theorem}{Theorem}[chapter] % Number theorems by chapter
\newtheorem{lemma}[theorem]{Lemma} % For numbering Lemma with continuity of theorem " [theorem]{Lemma}" is used
\newtheorem{corollary}[theorem]{Corollary} % Number Corollary with continuity of theorem
\theoremstyle{definition} % To change style of text used in definition to non-italic form
\newtheorem{definition}[theorem]{Definition} % Number Definition with continuity of theorem
```

```
\newcounter{chapter}
\setcounter{chapter}{6}


\begin{document}
\Large
\textbf{Chapter-06}\hspace{1cm}\textbf{Numbered Theorems, Definitions, Corollaries and Lemmas}

\section*{Theorem}
\begin{theorem}
If \( a \) and \( b \) are odd integers, then their product \( a \cdot b \) is also odd.
\end{theorem}

\section*{Definition}
\begin{definition}
A function \( f \colon X \to Y \) is called injective (or one-to-one) if for all \( x_1, x_2 \in X \), \( f(x_1) = f(x_2) \) implies \( x_1 = x_2 \).
\end{definition}

\section*{Lemma}
\begin{lemma}
Let \( A \) and \( B \) be sets. If \( A \subseteq B \) and \( B \subseteq C \), then \( A \subseteq C \).
\end{lemma}

\section*{Corollary}
\begin{corollary}
If \( A \subseteq B \) and \( A = B \), then \( B \subseteq A \).
\end{corollary}

\end{document}
```

Note:

\cdot Represents dot symbol "."
\colon Represents ":"
\to Represents the symbol →
\subseteq Represents the Greek letter ⊆

OUTPUT:

Chapter-06 Numbered Theorems, Definitions, Corollaries and Lemmas

Theorem

Theorem 6.1. *If a and b are odd integers, then their product $a \cdot b$ is also odd.*

Definition

Definition 6.2. A function $f: X \to Y$ is called injective (or one-to-one) if for all $x_1, x_2 \in X$, $f(x_1) = f(x_2)$ implies $x_1 = x_2$.

Lemma

Lemma 6.3. *Let A and B be sets. If $A \subseteq B$ and $B \subseteq C$, then $A \subseteq C$.*

Corollary

Corollary 6.4. *If $A \subseteq B$ and $A = B$, then $B \subseteq A$.*

EXPERIMENT-11: Chapter-07 TREE DIAGRAM WITH TIKZ LIBRARY

Aim: Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library.

Explanation

1. **TikZ Library**:
    - The script uses the trees library for defining the hierarchical structure.
2. **Structure**:
    - The root node A has two children (B and C).
    - Nodes B and C each have two children (D, E and F, G respectively).
3. **Customizations**:
    - level 1/.style and level 2/.style specify the sibling distance at each level of the tree.
    - edge from parent/.style defines edges with an arrow pointing downward.
    - every node/.style styles the nodes as circles with a fixed size and small font.

```
\documentclass[12pt,a4paper]{article}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{tikz}
\usetikzlibrary{trees}

\begin{document}
\Large
\textbf{Chapter-07}\hspace{1cm}\textbf{Tree Diagram with Tikz Library}
\section*{Tree Diagram}
\center

\begin{tikzpicture}[
 level 1/.style={sibling distance=5cm},     % for distance b/w B and C
 level 2/.style={sibling distance=2.5cm}, % for distance b/w D and E as well
F and G
edge from parent/.style={draw, -latex},   % to show arrow symbol
every node/.style={draw, circle, minimum size=1cm, font=\small}
  % to draw circle
   ]
  % in above /.style forward slash / is used without space.
```

```
% Root node
\node {A}
  % Level 1
   child {node {B}
    % Level 2
      child {node {D}}
      child {node {E}}
   }
   child {node {C}
    % Level 2
      child {node {F}}
      child {node {G}}
   };                                          % to end \node ; is used

\end{tikzpicture}

\\
\large
\textbf{Figure. 7.1 Simple tree diagram using Tikz library}
\end{document}
```

OUTPUT:

Chapter-07 Tree Diagram with Tikz Library

Tree Diagram

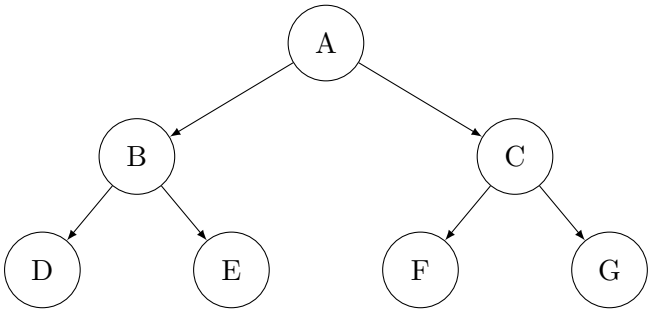


Figure. 7.1 Simple tree diagram using Tikz library

EXPERIMENT-12: Chapter-08 ALGORITHM LIBRARY

Aim: Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library

Write an Algorithm to find maximum of two numbers a and b.

The algorithm environment is used as a floating container for the algorithm, allowing it to be labeled and captioned, similar to figures or tables. The algorithmic package defines the steps of the algorithm using commands like \REQUIRE (for inputs), \ENSURE (for outputs), \FOR (for loops), and \RETURN (to specify the result). This package emphasizes a clean and minimalistic pseudocode style.

```
\documentclass[12pt,a4paper]{article}
\usepackage[left=3.2cm,right=2.54cm,top=2.54cm,bottom=2.54cm]{ge
ometry}
\usepackage{algorithm}
\usepackage{algorithmic}

\begin{document}
\Large
\textbf{Chapter-08}\hspace{1cm}\textbf{Algorithm Library}

\section*{Find Maximum of Two Numbers}

\begin{algorithm}      % It labels with word Algorithm with number 1 within two h-lines
\caption{To find maximum of a and b}     % withouut \caption it will not work

\begin{algorithmic}[1]      % It starts writing algorithm from line no 1, 2, 3 ,...
\REQUIRE Two numbers $a$ and $b$   % $ is used to tell a and b are maths symb
\ENSURE Maximum of $a$ and $b$
\IF{$a > b$}      % only single $ used
    \RETURN $a$
\ELSE
    \RETURN $b$
\ENDIF

\end{algorithmic}

\end{algorithm}

\end{document}
```

Note: \RETURN, \IF, \ENSURE etc are set in upper case by default in Latex.

OUTPUT:

Chapter-08 Algorithm Library

Find Maximum of Two Numbers

Algorithm 1 To find maximum of a and b

Require: Two numbers a and b
Ensure: Maximum of a and b

```
1: if a > b then
2:     return a
3: else
4:     return b
5: end if
```

CODING SUMMARY:

Codes (Packages)	Description
\usepackage{graphic}	To insert images
\usepackage{xcolor}	To change font color
\usepackage[left=3.2cm,right=2.54cm, top=1.5cm,bottom=0.5cm]{geometry}	To set the page margin
\usepackage{ragged2e}	For using justify
\usepackage[utf8]{inputenc}	To support greek symbols
\usepackage{setspace}	For setting 1.5 line spacing
\usepackage{enumitem}	For numbering of items
\usepackage{fancyhdr}	For using header
\usepackage{hyperref}	To make contents in hyper link type
\usepackage[labelfont=bf, textfont=bf]{caption}%	For making figure caption bold
\usepackage{amsmath}	To number figures as per chapter no
\usepackage{caption}	To number figures as per chapter no
\usepackage{subcaption}	For subfigure support
\usepackage{array}	For using tables
\usepackage{amsmath}	For advanced math typesetting
\usepackage{amssymb}	For additional math symbols
\usepackage{amsthm}	For theorem environments like theorem, definition, lemma
\usepackage{tikz}	To use Tikz Library
\usepackage{algorithm}	To use Algorithms and to label it
\usepackage{algorithmic}	To start writing Algorithms
\usepackage{comment}	To comment multiple lines

Codes	Description
\documentclass[12pt,a4paper,titlepage]{article}	To make A4 size paper, normal font 12
\graphicspath{{Z:/Notes/Latex/images/}}	To Show path of images
\begin{document} \end{document}	To start writing document.
\begin{titlepage} \end{titlepage}	To make the title
\centering	To make the matter center.
\small \normalsize \large \Large \huge \Huge	To increase the font size in from small to big order
\textbf{text} \textit{text}	To convert text into bold or italics. bf- bold font. it-italics
\\[0.5cm]	\\ for next line [] with 0.5 cm vertical space
\includegraphics[scale=0.2]{figureName}	To insert figure directly.
\textbf{\textcolor{red}{text}}	To color the text
\justify	To justify paragraphs
\begin{tabular}{p{5cm}p{5cm}p{5cm}} \end{tabular}	There are 3 columns with 5cm spacing
\renewcommand{\thepage}{\roman{page}}	To change page numbering from Arabic to roman.
\onehalfspacing	To provide 1.5 line spacing
\clearpage	To shift to next page
\pagestyle{fancy}	To make header and footer text look fancy
\fancyhf{}	To erase default header & footer
\fancyhead[C]{text}	To place header note at center
\fancyfoot[L]{text}	To place footer note at left
\fancyfoot[R]{\thepage}	To place page number in the footer at right
\renewcommand{\footrulewidth}{0.4pt}	To draw line above footer
\renewcommand\thesection {\thechapter.\arabic{section}}	To label sections as Chapter.Section
\renewcommand\thesubsection {\thesection.\arabic{subsection}}	To label subsections as Chapter.Section.Subsection

\hypersetup{colorlinks=true, linkcolor=blue}	To make Contents list and figure list in blue color
\tableofcontents	To highlight contents
\setcounter{chapter}{1}	To start numbering from chapter 1
\hspace{3cm}	To provide horizontal spacing
\vspace{1cm}	To provide vertical space after chapter label
\begin{enumerate}[label=\roman*)] \item …. \item … \end{enumerate}	To labels topics in points form.
\section{text}	To provide main heading
\subsection{text}	Tp provide sub heading
\listoffigures	To highlight figures
\begin{figure}[h] \end{figure}}	Here h mean "here" it specifies the path of figure
\caption{figure name}	To provide tile of the figure
\noindent	To remove indent from paragraph
\begin{subfigure}{0.3\textwidth} \end{subfigure}	To include multiple figures
\hfill	To add figure side by side
\documentclass[12pt,a4paper,twocolumn] {report}	For two columns
\numberwithin{figure}{chapter}	To number figures as per chapter no
\setlength{\columnsep}{1cm}	To set space between the two columns
\setcounter{chapter}{2}	To start numbering figure from chapter 2
\twocolumn[{{*}}]	This is used for two columns manually
\begin{figure}[h] \end{figure}}	Here h mean "here" it specifies the path of figure
\captionsetup{labelformat=empty}	Removes the default table labelling
\begin{table}[h!] \end{table}	h- here and ! strictly
\begin{tabular}{|c|c|c|c|c|c|c|} \end{tabular}	To draw 7 vertical lines with centering of text

\hline	To draw 1st horizontal line
\multicolumn{3}{c|}{\textbf{Marks}}	To merge 3 columns and add text at center
\cline{4-6}	To draw horizontal line only from 4th to 6th column. cline is used
\renewcommand{\bibname}{REFERENCES}	To change "Bibliography" to "REFERENCES"
\bibliographystyle{unsrt}	unsrt makes list of reference as per given order .bib file
\bibliography{references.bib}	To refer the reference file with .bib format used for references
\newcounter{chapter}	To rename chapter manually
\setcounter{chapter}{5}	Set the current chapter number
\numberwithin{equation}{chapter}	To link equation numbering to the chapter counter
\section*{text}	* removes numbering for section
\begin{equation} \end{equation}	To use mathematical equations
\begin{align} \end{align}	To align the mathematical equations with = properly
\varphi	Represents the Greek letter φ.
\lambda	Represents the Greek letter λ.
\operatorname{sgn}	Typesets "sgn" (sign function) in upright text.
\sum	Summation symbol ∑
\sigma	Represents the Greek letter σ.
\pi	Represents the Greek letter π.
\in	Represents the Greek letter ε
(_) (^)	Subscripts and superscripts
&=	It helps in proper alignment of = sign..
\newtheorem{theorem}{Theorem}[chapter]	To number theorems by chapter
\newtheorem{lemma}[theorem]{Lemma}	For numbering Lemma with continuity of theorem " [theorem]{Lemma}" is used
\newtheorem{corollary}[theorem]{Corollary}	To number Corollary with continuity of theorem

\theoremstyle{definition}	To change style of text used in definition to non-italic form
\newtheorem{definition}[theorem]{Definition}	To number Definition with continuity of theorem
\cdot	Represents dot symbol "."
\colon	Represents ":"
\to	Represents the symbol →
\subseteq	Represents the Greek letter ⊆
\usetikzlibrary{trees}	For using tikz library which stores pictures
\begin{tikzpicture}[….] \end{tikzpicture}	For using tikz diagrams
\node {A}	For using parent node
child {node {B}}	For using children node
\begin{algorithm} \end{algorithm}	For using Algoritms
\begin{algorithmic}[1] \end{algorithmic}	It starts writing algorithm from line no 1, 2, 3 ,...
\begin{comment} \end{comment}	For commenting multiple lines
%	For commenting single line

EXPERIMENT-13: ASSIGNMENT

AIM: Prepare a sample report using LaTex.

Development and Characterization of Heat Treatable Hybrid Metal Matrix Composites

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ABSTRACT

In recent years, there has been an ever-increasing demand for enhancing mechanical properties of Aluminum Matrix Composites (AMCs), which are finding wide applications in the field of aerospace, automobile, defence etc,. Among all available aluminium alloys, Al6061 is extensively used owing to its excellent wear resistance and ease of processing. Newer techniques of improving the hardness and wear resistance of Al6061 by dispersing an appropriate mixture of hard ceramic powder and whiskers in the aluminium alloy are gaining popularity. The conventional aluminium based composites possess only one type of reinforcements. Addition of hard reinforcements such as silicon carbide, alumina, titanium carbide, improves hardness, strength and wear resistance of the composites. However, these composites possessing hard reinforcement do posses several problems during their machining operation. AMCs reinforced with particles of Gr have been reported to be possessing better wear characteristics owing to the reduced wear because of formation of a thin layer of Gr particles, which prevents metal to metal contact of the sliding surfaces. Further, heat treatment has a profound influence on mechanical properties of heat treatable aluminium alloys and its composites. For a solutionising temperature of 530^0C, solutionising duration of 1hr, ageing temperature of 175^0C, quenching media and ageing duration significantly alters mechanical properties of both aluminium alloy and its composites. In the light of the above, the present paper aims at developing aluminium based hybrid metal matrix composites containing both silicon carbide and graphite and characterize their mechanical properties by subjecting it to heat treatment.

Keywords: Hybrid Metal Matrix Composites, Microhardness, Heat treatment, Vortex casting technique.

1. Introduction

In recent years aluminium matrix composites (AMCs) are gaining widespread popularity in several technological sectors owing to their excellent corrosion and wear resistance, higher fatigue life, good high temperature oxidation resistance in addition to being light in weight when compared with conventional alloys. At present AMCs are attractive alternatives for aerospace and automotive applications because of their high stiffness-to-weight characteristics[3]. Currently, focus on development of aluminium, copper, magnesium, titanium based metal matrix composites is carried out to explore their possible applications in several high-tech areas. The various reinforcements that have been tried out to develop AMCs are graphite, silicon carbide, titanium carbide, tungsten, boron, Al_2O_3, flyash, Zr, Si_3N_4, TiB_2. The conventional aluminium based composites possess only one type of reinforcements. Addition of hard reinforcements such as silicon carbide, alumina, titanium carbide, improves hardness, strength and wear resistance of the composites[4]. However, these composites possessing hard reinforcement do posses several problems during their machining operation. AMCs reinforced with particles of Gr have been reported to be possessing better wear characteristics owing to the reduced wear because of formation of a thin layer of Gr particles, which prevents metal to metal contact of the sliding surfaces. AMCs reinforced with SiC particulates are known for higher modulus, strength and wear resistance compared to conventional alloys. Addition of SiC particulates increases both mechanical strength and wear resistance of Al alloy. But the consequent increase in hardness makes the machining difficult. On the other hand, addition of Gr particulates facilitates easy machining and results in reduced wear of Al–Gr composites compared to Al alloy [1]. It is reported that the surface finish of the hard reinforced metal matrix composites are inferior when compared with the matrix alloy. Further it is absorbed that during turning, the hard reinforced metal matrix composites resulted in higher flank wear with increased content of the reinforcement. It is reported that composites possessing softer reinforcement- possess good machinability index. [10]

Hence the current interest is to produce Hybrid Metal Matrix Composites (HMMCs) were in more than one type, shape and size of the reinforcement are used to obtain synergistic properties of the reinforcement and the matrix chosen. It is reported that hybridization of reinforcement has enhanced structural, physical, mechanical and tribological behavior of HMMC's when compared with metal matrix alloy[5]. Hence attempts are made to develop aluminum based hybrid metal matrix composites consisting of both hard reinforcement (SiC) and soft reinforcement (Gr) in the present paper. Further to enhance the mechanical properties, the specimens are subjected to heat treatment processes.

2. Experimental details

2.1 Composite preparation

Al6061 based composites were prepared by vortex method of liquid metallurgy route. A quantity of 3kgs of Al6061 alloy was used each time in an electric melting furnace with graphite crucible for melting with furnace temperature set at 710^0C. Silicon carbide particles of 10 micron size and graphite particles of 60 micron size were used. The permanent molds of cast iron along with the reinforcements were heated in order to reduce the effect of chilling during solidification[7]. Degassing of the melt was done with commercially available tablets of hexachloroethane (C_2Cl_6). After degassing, the preheated SiC and Gr were added slowly into the vortex while continuing the stirring process up to 10 minutes. The amount of reinforcement was varied from 1wt% to 4wt% in steps of 1wt% of Gr keeping constant 7wt%SiC.

2.2 Evaluation of hardness

Vickers micro hardness test was performed on all samples of Al6061 and its hybrid composites for both with and without heat treatment cases. The polished samples were subjected for micro hardness tests using shimadzu micro hardness tester as shown in fig.2.2. A load of 100 g for period of 10 sec was applied. The hardness was noted by taking the diagonal lengths of indentation produced. The tests were carried out at five different locations in order to negate the possible effect of indenter resting on the harder particles. The average of all the five readings was taken as hardness of sample.

Fig. 2.2 Photograph of Shimadzu microhardness tester

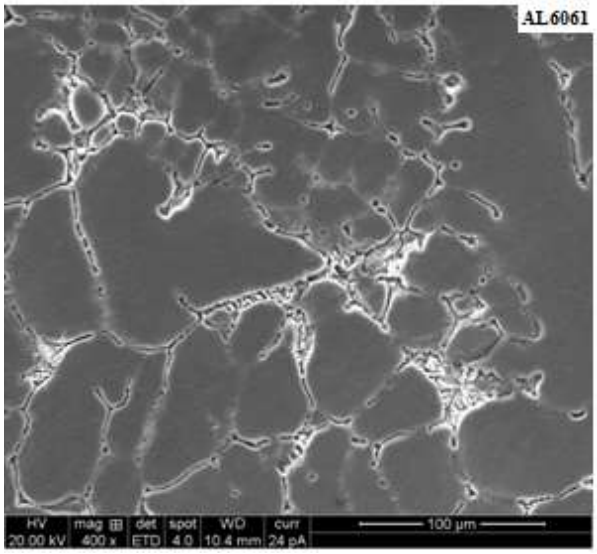
Table 2.1 Specifications of shimadzu microhardness tester

Make	Shimadzu, Japan
Loading method	Lever method by Electric automatic loading system
Period of loading	5, 10, 15, 30, & 45sec
Loading weight	15, 25, 30, 100, 150, 200, 300, 500, 800 & 1000grams
Indenter	Vickers
Magnifications	100 times
Microscope	400 times
Measuring objectives	40 times
Max. measuring scale	200µm
Standard scale	With one division of 20µm
Measuring scale	With one division of 0.5µm

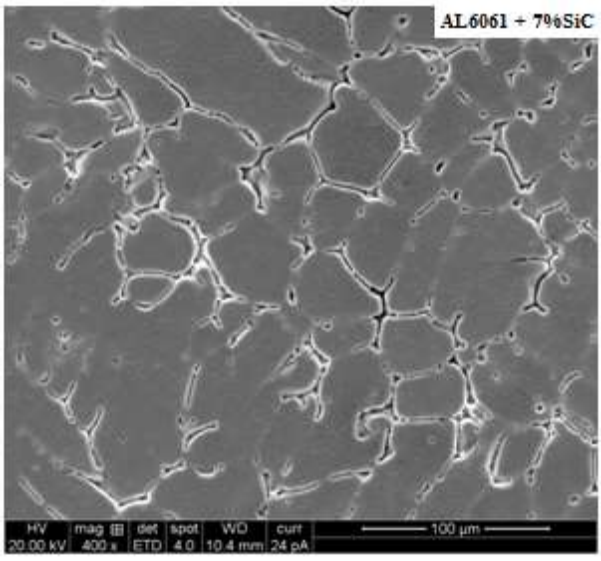
3. Results and discussion

3.1 Scanning electron micrograph studies

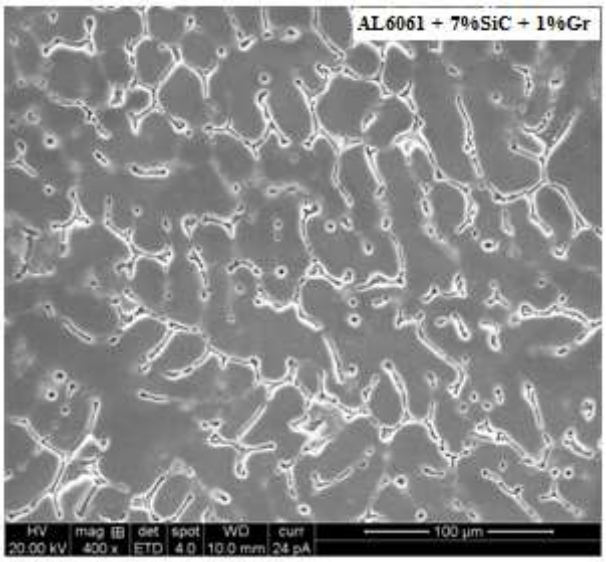
The Scanning electron micrographs of Al6061 and its composites are shown in fig. 3.1 (a-f)



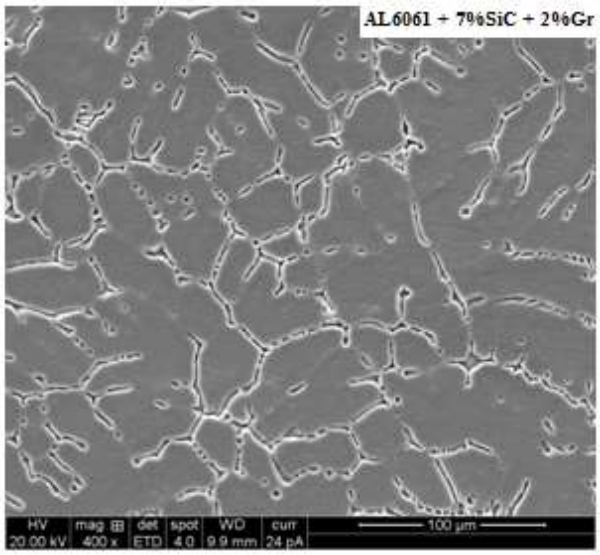
(a)



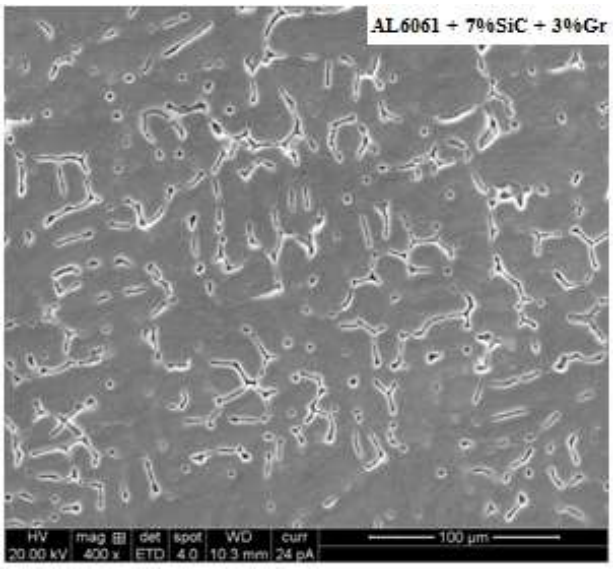
(b)



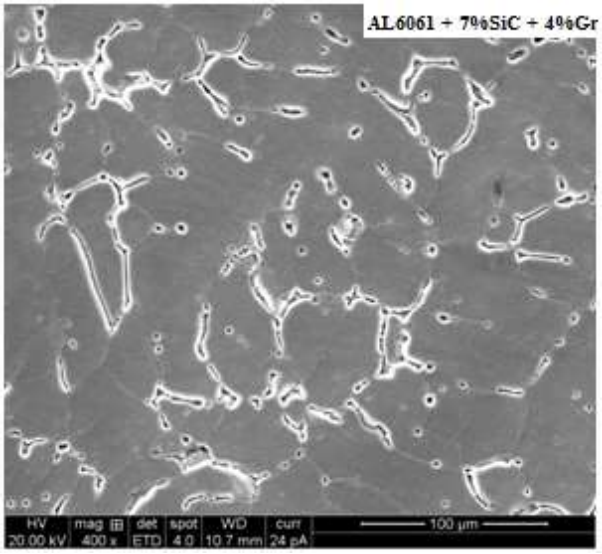
(c)



(d)



(e)



(f)

Fig.3. 1 (a – f) Optical microphotographs of Al6061 and its hybrid composites

It is observed from fig. 3.1 (a-f) that the SiC and Gr particles are fairly uniformly distributed. The extent of porosity noticed is also less. There is a clear evidence of homogeneous distribution of reinforcements, although a clear cut identification of SiC and Gr is quite difficult.

3.2 Hardness test.

3.2.1 Effect of reinforcements without heat treatment.

The effect of reinforcements on microhardness of Al6061 alloy and its composites is as shown in Fig. 3.2

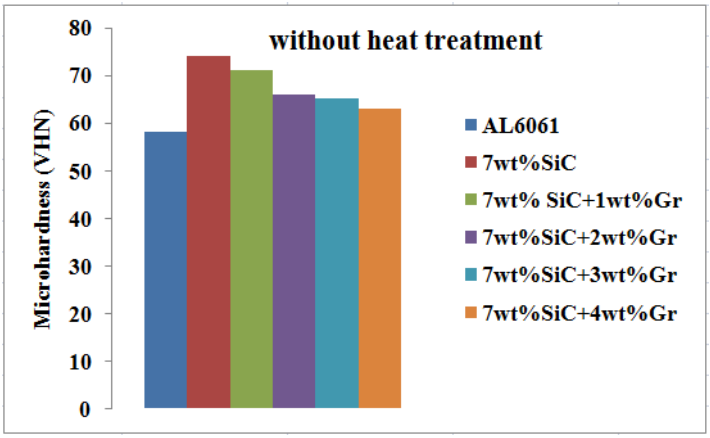


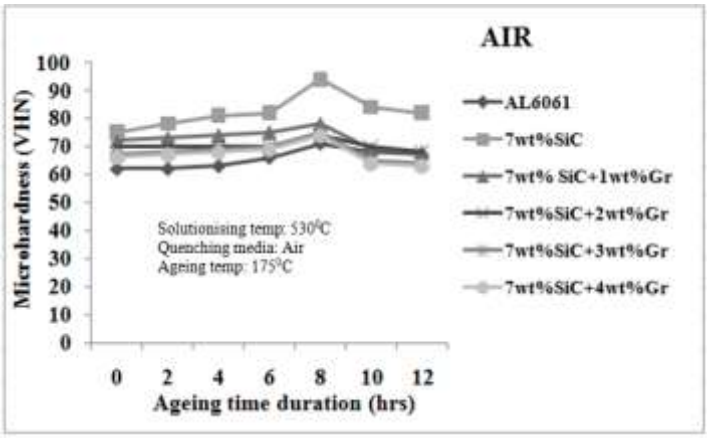
Fig. 3.2 Effect of reinforcements on microhardness of AL6061 alloy and its composites

It is observed from fig. 3.2 that the hardness of the AL6061 increases with addition of silicon carbide. But with addition of graphite the hardness decreases. To overcome this, the SiC hard ceramic particle was

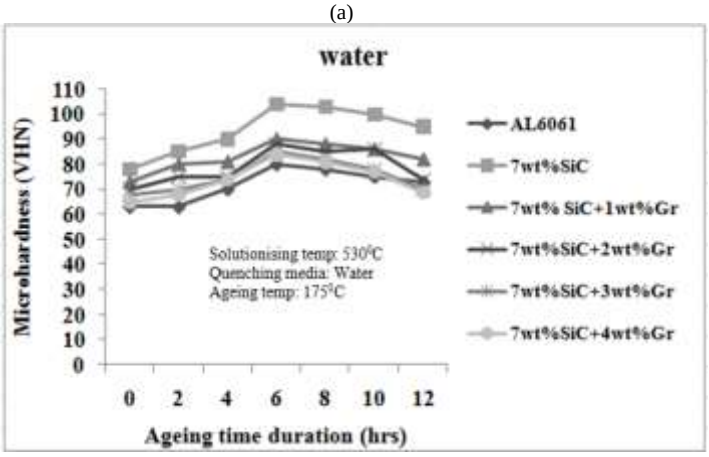
added and was maintained constant 7wt%. Sic particles can act as the obstacles to the movement of dislocation as referred by Mahalingegowda and T Rajmohan [8]. The SiC particles in the matrix alloy provide protection to the softer matrix. Thus, limiting the deformation and also resists the penetration and cutting of slides on the surface of the composites. Hardness of all the hybrid composites was significantly greater than that of the base alloy characterized to the hard nature of SiC particles. The higher hardness values for the hybrid composites containing 7 wt. % of SiC is due to the presence of hard SiC particles. This result is a good agreement with the result of F. Akhlaghi and Zare-bidaki [2].

3.2.1 Effect of reinforcements with heat treatment.

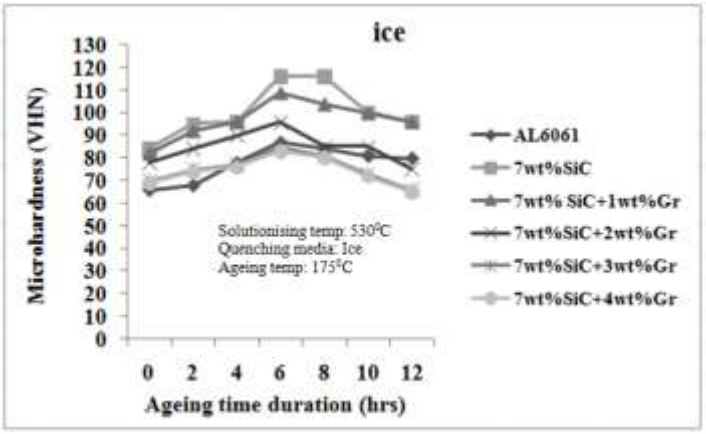
The effect of reinforcements with variation of ageing time on microhardness of heat treated Al6061 alloy and its composites is shown in Fig. 3.3 (a – c)



(a)



(b)



(c)

Fig. 3.3 (a – c) Effect of reinforcements with variation of ageing time on microhardness of heat treated AL6061 alloy and its composites.

It is observed from fig. 3.3 (a-c) that the hardness increases with heat treatment. Heat treatment has a profound influence on the microhardness of the matrix alloy as well as its hybrid composites. For a solutionising temperature of 530^0C, for duration of 1hr, ageing temperature of 175^0C, quenching media and ageing duration significantly enhances the microhardness of both the matrix alloy and its composites.

4. Conclusion

Al6061-SiC-Gr hybrid composites have been successfully produced by vortex method upto 4wt% Gr with constant 7wt% SiC. Fabrication of hybrid composites with more than 4wt% of Gr with constant 7wt% SiC was not achieved successfully due to low density of graphite. Scanning electron micrograph studies clearly revealed uniformity in the distribution of reinforcements and excellent bond between the matrix and the reinforcement. Microhardness of Al6061 decreases with increases with increase in graphite content. Microhardness of Al6061 based hybrid composites is higher when compared with that of the matrix alloy. Presence of content of hard silicon carbide reinforcement in the hybrid composites leads to enhancement in microhardness of hybrid composites. Further heat treatment has a profound influence on the microhardness of the matrix alloy as well as its hybrid composites. For all the heat treatment processes studied ice quenching with ageing duration of 6hrs resulted in improved hardness of both the unreinforced matrix alloy and its hybrid composites.

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Viva-Voce Questions:

1. **Q: What is LaTeX?**
   A: LaTeX is a high-quality typesetting system designed for technical and scientific documentation.
2. **Q: Who developed LaTeX?**
   A: Leslie Lamport developed LaTeX in the early 1980s.
3. **Q: On what system is LaTeX built?**
   A: It is built on the TeX typesetting system created by Donald Knuth.
4. **Q: What is the key advantage of LaTeX over word processors?**
   A: It focuses on content, automates formatting, and handles complex mathematical notations efficiently.
5. **Q: Name a few LaTeX features.**
   A: Professional typesetting, consistency, automation, cross-platform support, and customizability.
6. **Q: Is LaTeX open-source?**
   A: Yes.
7. **Q: What kind of documents is LaTeX best suited for?**
   A: Academic papers, thesis, books, and technical documentation.
8. **Q: What is a LaTeX distribution?**
   A: A bundle of LaTeX tools, compilers, and packages (e.g., MiKTeX, TeX Live).
9. **Q: Mention one limitation of LaTeX.**
   A: It has a steep learning curve.
10. **Q: What is a `.tex` file?**
    A: It is the source file where LaTeX code is written.
11. **Q: What command compiles LaTeX code?**
    A: `pdflatex filename.tex`
12. **Q: What is the output format of a LaTeX document?**
    A: Typically PDF.
13. **Q: What is a LaTeX class file?**
    A: A `.cls` file that defines the formatting style of a document.
14. **Q: Name two environments in LaTeX.**
    A: `document`, `equation`
15. **Q: What does `\usepackage` do?**
    A: It loads additional LaTeX packages.
16. **Q: What is `\begin{document}` used for?**
    A: It marks the beginning of the document content.
17. **Q: What does `\maketitle` do?**
    A: It generates a title using `\title`, `\author`, and `\date`.
18. **Q: How do you comment a line in LaTeX?**
    A: Use `%` at the beginning of the line.
19. **Q: What is the purpose of `geometry` package?**
    A: To set page margins.
20. **Q: What is the `graphicx` package used for?**
    A: For inserting images.
21. **Q: Name a desktop-based LaTeX editor.**
    A: TeXmaker.
22. **Q: What is Overleaf?**
    A: A cloud-based LaTeX editor with real-time collaboration.
23. **Q: Is TeXmaker free?**
    A: Yes, it is open-source.
24. **Q: What are TeXmaker's features?**
    A: PDF viewer, syntax highlighting, error detection, auto-completion.
25. **Q: What is MiKTeX?**
    A: A LaTeX distribution mainly for Windows.
26. **Q: How does MiKTeX handle packages?**
    A: It can install them automatically.
27. **Q: Can TeXmaker run without MiKTeX or TeX Live?**
    A: No, it depends on a LaTeX distribution.
28. **Q: What is Texstudio?**
    A: Another cross-platform LaTeX editor.
29. **Q: Difference between Overleaf and TeXmaker?**
    A: Overleaf is cloud-based with collaboration; TeXmaker is offline.

30. **Q: Can MiKTeX run on Linux?**
    A: Yes, but it's optimized for Windows.
31. **Q: What is a `.bib` file in LaTeX?**
    A: It contains references used for bibliography.
32. **Q: What package is used for citation?**
    A: `\usepackage{cite}` or `natbib`.
33. **Q: What is Beamer used for?**
    A: Creating presentations.
34. **Q: Which editor supports version control integration?**
    A: Overleaf.
35. **Q: How to install additional LaTeX packages in MiKTeX?**
    A: Use the MiKTeX package manager.
36. **Q: What's the use of TeX Live?**
    A: It's a comprehensive LaTeX distribution for all OS.
37. **Q: Name two online LaTeX editors besides Overleaf.**
    A: Papeeria, Authorea.
38. **Q: Is internet needed to use TeXmaker?**
    A: No, unless downloading packages.
39. **Q: Does Overleaf support GitHub integration?**
    A: Yes.
40. **Q: Which editor is best for beginners?**
    A: TeXworks or TeXmaker.
41. **Q: What command starts a title page?**
    A: `\begin{titlepage} ... \end{titlepage}`
42. **Q: Which command inserts an image?**
    A: `\includegraphics{}`
43. **Q: How to create a certificate page?**
    A: Using `\textbf`, `tabular`, and `\justify`.
44. **Q: What is the purpose of `\centering`?**
    A: It centers the content.
45. **Q: How to change font color?**
    A: Use `\textcolor{color}{text}` from `xcolor` package.
46. **Q: Which command is used to define margins?**
    A: `\usepackage{geometry}`
47. **Q: What is `\tableofcontents` used for?**
    A: Generates the table of contents.
48. **Q: Which package helps with section numbering?**
    A: `\renewcommand\thesection` and `\thechapter`
49. **Q: How to number figures by chapter?**
    A: `\numberwithin{figure}{chapter}`
50. **Q: How are multiple images shown side by side?**
    A: Using `subfigure` or `subcaption` package.
51. **Q: Which class is used for a two-column layout?**
    A: `\documentclass[twocolumn]{report}`
52. **Q: What is `\onehalfspacing`?**
    A: Sets line spacing to 1.5.
53. **Q: How to add headers and footers?**
    A: Using `fancyhdr` package.
54. **Q: How to create tables in LaTeX?**
    A: Using the `tabular` environment.
55. **Q: How are columns aligned in tables?**
    A: With `c`, `l`, `r` in the column specification.
56. **Q: What does `\hline` do?**
    A: Inserts a horizontal line in a table.
57. **Q: What is the purpose of `\cline{}`?**
    A: Draws a horizontal line across specific columns.
58. **Q: What is `\renewcommand{\thepage}{\roman{page}}`?**
    A: Changes page numbering to Roman numerals.
59. **Q: What's the command for bibliography file inclusion?**
    A: `\bibliography{filename}`
60. **Which style sorts bibliography by appearance?**
    The `unsrt` bibliography style sorts references in the order they are cited in the document, rather than alphabetically.

61. **What does `\cite{}` do?**
    It adds an in-text citation in the document corresponding to a reference in the bibliography file.
62. **How to define bibliography entries?**
    Bibliography entries are defined in a `.bib` file using formats like `@book`, `@article`, `@misc`, with fields like author, title, year, etc.
63. **What is the format for books in BibTeX?**
    Use `@book{refID, author = {...}, title = {...}, year = {...}, publisher = {...}}`.
64. **How to write a mathematical equation in display mode?**
    Use the `equation` environment like `\begin{equation} ... \end{equation}` to display and number equations.
65. **How to align multiple equations?**
    Use the `align` environment from the `amsmath` package, allowing alignment at specific symbols like `=`.
66. **What does `\pm` denote?**
    It denotes the plus-minus sign (±), commonly used in equations like the quadratic formula.
67. **What is `\sqrt{}`?**
    This command is used to create square roots in equations (e.g., `\sqrt{a^2 + b^2}`).
68. **What is the quadratic formula?**
    It is: x=−b±b2−4ac2ax = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, used to find the roots of a quadratic equation.
69. **What does `\frac{}{}` represent?**
    It formats a mathematical fraction, such as `\frac{1}{2}` for one-half.
70. **How to number equations by chapter?**
    Use `\numberwithin{equation}{chapter}` to prepend chapter numbers to equation numbers.
71. **What does `\section*{}` do?**
    It creates an unnumbered section, often used for titles like “Acknowledgement” or “Abstract”.
72. **How to insert Greek symbols?**
    Use LaTeX commands like `\alpha`, `\beta`, `\lambda`, `\phi`, etc., for Greek letters.
73. **Which command creates justified text?**
    Use the `\justify` command provided by the `ragged2e` package to justify paragraph alignment.
74. **What is `\clearpage` used for?**
    It forces the rest of the content to move to the next page and clears all pending floats like figures and tables.
75. **How to use headers in two-column format?**
    Use `twocolumn` in the document class and format headers using the `fancyhdr` package.
76. **What’s the use of `\begin{enumerate}`?**
    It creates a numbered list. Each item is specified using the `\item` command.
77. **What does `label=\roman*)` do in enumerate?**
    It changes the list numbering style to Roman numerals with closing parenthesis (i), ii), iii), etc.).
78. **How to create a document with sections and TOC?**
    Use `\section{}`, `\subsection{}` for structure and `\tableofcontents` to generate the content list.
79. **What is the purpose of `\textbf{}`?**
    It formats the enclosed text in boldface.
80. **How does LaTeX ensure consistency?**
    LaTeX automatically handles numbering, formatting, and referencing, which ensures consistency across documents.
81. **What is WYSIWYG and how is LaTeX different?**
    WYSIWYG (What You See Is What You Get) editors show final output while

typing. LaTeX uses code-based formatting requiring compilation.

82. **How to create a section in LaTeX?**
    Use the command `\section{Section Title}` to start a new section.
83. **How to insert a line break?**
    Use double backslashes (`\\`) to create a new line within a paragraph or table cell.
84. **What is `\setlength{\tabcolsep}` used for?**
    It sets the horizontal padding (space) between columns in a table.
85. **How to compile bibliography?**
    Run the sequence: LaTeX → BibTeX → LaTeX → LaTeX to ensure references are properly updated.
86. **What is a LaTeX template?**
    A pre-designed `.tex` file with predefined structure, packages, and commands, used to create specific documents like CVs or theses.
87. **What is the use of `\hypersetup`?**
    Configures the behavior and appearance of hyperlinks, such as link color and border style.
88. **What are `fancyhdr` features?**
    The `fancyhdr` package allows advanced control over headers and footers in LaTeX documents.
89. **What's the advantage of `align` over `equation`?**
    `align` allows multiple equations with alignment, ideal for derivations or systems of equations.
90. **What is `\renewcommand` used for?**
    It overrides the default behavior of LaTeX commands, e.g., changing section numbering or page style.
91. **Can we include videos in LaTeX?**
    Yes, using packages like `media9` or `multimedia` (PDF only), videos can be embedded in LaTeX-generated PDFs.
92. **What's the difference between `article` and `report` class?**
    `article` is used for shorter documents without chapters; `report` supports chapters and is suitable for theses and reports.
93. **How is `justify` different from `center`?**
    `justify` aligns text evenly on both margins; `center` aligns content horizontally in the middle.
94. **What does `\Large` do?**
    It increases the font size of the subsequent text.
95. **What is the `ragged2e` package used for?**
    It provides advanced paragraph formatting, including the `\justify` command for full justification.
96. **What is the benefit of using LaTeX for CVs?**
    It allows precise formatting, reusable templates, and a professional appearance with minimal effort.
97. **What is the Beamer class?**
    A LaTeX class used for creating visually appealing slide presentations with overlays, themes, and animations.
98. **Can LaTeX handle large documents?**
    Yes, LaTeX is well-suited for books and theses due to its ability to manage large-scale content efficiently.
99. **Why is LaTeX preferred in academia?**
    It produces consistent, professional-quality documents, handles citations and references effectively, and is ideal for technical content.

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