

# Introduction To Machine Design Lecture Notes PDF

**Introduction to machine design lecture notes** serve as a foundational resource for engineering students and professionals aiming to understand the principles, methodologies, and applications involved in designing mechanical components and systems. Whether you're a novice or an experienced engineer, comprehensive lecture notes on machine design can significantly enhance your knowledge, improve your design skills, and prepare you for practical challenges in the field. This article provides an in-depth overview of what these lecture notes encompass, their importance, key topics covered, and tips for effective learning.

## Understanding the Significance of Machine Design Lecture Notes

### Why Are Lecture Notes Essential?

Lecture notes are an invaluable supplement to textbooks and practical experience. They condense complex concepts into understandable formats, highlight critical points, and often include illustrative diagrams, examples, and solved problems. Specifically, in machine design, lecture notes help students grasp the systematic approach to designing mechanical components, ensuring safety, efficiency, and durability.

### Benefits of Using Well-Structured Lecture Notes

- Enhance Conceptual Clarity: Clarify theoretical foundations and practical applications.
- Structured Learning Path: Follow a logical progression from basic to advanced topics.
- Preparation for Exams and Projects: Serve as quick revision tools.
- Practical Insights: Include real-world examples and case studies.
- Reference Material: Useful for future professional projects and research.

## Core Topics Covered in Machine Design Lecture Notes

### 1. Fundamentals of Machine Design

This section introduces the basic concepts, scope, and importance of machine design. It covers the objectives like strength, durability, and cost-effectiveness, alongside the role of material selection and mechanical properties.

## 2. Material Selection and Properties

Understanding materials is crucial for designing reliable components. Topics include:

- Types of materials used in machine components (metals, polymers, composites)
- Mechanical properties such as tensile strength, hardness, ductility, and toughness
- Factors influencing material choice based on application, load conditions, and environmental factors

## 3. Failure Theories and Stress Analysis

Predicting failure modes is fundamental to safe design. This section covers:

- Stress analysis techniques
- Failure theories like maximum shear stress, maximum normal stress, and distortion energy
- Design safety factors

## 4. Design of Shafts

Shafts are critical components transmitting power. Topics include:

- Design criteria for shafts under torsion and bending
- Stress concentration factors
- Design equations and standards

## 5. Design of Gear and Gear Trains

Gears are essential for motion transmission. Lecture notes cover:

- Types of gears and their applications
- Gear tooth design principles
- Gear ratios and gear train calculations

## 6. Design of Bearings and Lubrication

For smooth operation, proper bearing selection is vital. Topics include:

- Types of bearings (ball, roller, sleeve)
- Design considerations and load capacities
- Lubrication methods and their impact on bearing life

## 7. Design of Springs

Springs absorb shocks and store energy. This section discusses:

- Types of springs (helical, leaf, torsion)
- Design equations based on load and deflection
- Material selection for spring manufacturing

## 8. Power Transmission Elements

Including belts, chains, and couplings, this section covers:

- Design criteria and selection guides
- Efficiency considerations
- Maintenance and operational factors

## 9. Structural Components and Frames

Designing supportive structures involves:

- Material and cross-section selection
- Stress analysis of frames and supports
- Vibration and stability considerations

# Approach to Learning from Machine Design Lecture Notes

## Effective Reading Strategies

- Start with the objectives and overview sections to get a roadmap of the topics.
- Focus on diagrams and illustrations?they often clarify complex concepts.
- Work through solved examples to understand the application of formulas and principles.
- Highlight key points and prepare summaries for quick revision.

## Practical Application and Problem Solving

Applying concepts through practice problems is vital. Use lecture notes to:

- Attempt end-of-chapter exercises and examples.
- Simulate design calculations based on real-world scenarios.
- Participate in laboratory exercises or projects to reinforce theory.

## Utilizing Supplementary Resources

While lecture notes are comprehensive, augment your learning with:

- Standard textbooks on machine design
- Online tutorials and video lectures
- Research papers and case studies

## Importance of Continuous Updates and Revisions

Machine design is a dynamic field with ongoing advancements. It's crucial to:

- Stay updated with the latest standards and materials
- Incorporate new design methodologies and software tools
- Revise lecture notes periodically to include recent developments

## Conclusion

In summary, **introduction to machine design lecture notes** provide an essential foundation for understanding the systematic process of designing mechanical components. They encompass fundamental principles, material considerations, stress analysis, and specific component designs such as shafts, gears, bearings, and springs. Effective utilization of these notes, combined with practical problem-solving and continuous learning, empowers engineering students and professionals to develop innovative, safe, and efficient mechanical systems. Whether for academic success, professional growth, or research, well-structured machine design lecture notes are an indispensable resource in the field of mechanical engineering.

Introduction to Machine Design Lecture Notes: An Expert Review

In the realm of mechanical engineering, machine design stands as a cornerstone discipline that

bridges theoretical principles with practical applications. For students and professionals alike, comprehensive and well-structured lecture notes in machine design serve as invaluable resources that facilitate understanding, foster innovation, and support academic excellence. In this expert review, we delve into the core components, pedagogical strengths, and practical utility of Introduction to Machine Design Lecture Notes, offering an in-depth perspective akin to a product evaluation.

## Understanding the Significance of Machine Design Lecture Notes

Machine design involves creating and analyzing mechanical components and systems that perform specific functions efficiently, safely, and reliably. The lecture notes in this subject are more than mere summaries; they are educational tools that encapsulate core concepts, industry standards, and problem-solving techniques.

Why are quality lecture notes essential?

- **Foundation Building:** They lay the groundwork for understanding complex concepts such as stress analysis, material selection, and failure theories.
- **Reference Material:** Serve as quick references during coursework, projects, or professional practice.
- **Self-Study Resource:** Enable learners to review topics independently, reinforcing classroom learning.
- **Preparation for Industry:** Equip students with knowledge aligned with real-world engineering challenges.

## Core Components of Machine Design Lecture Notes

A comprehensive set of lecture notes in machine design typically covers multiple interconnected topics. Below, we explore these components in detail.

### 1. Fundamentals of Machine Design

This section introduces core principles, including:

- **Design Process:** Clarifies systematic approaches involving problem identification, data collection, concept development, analysis, and testing.
- **Material Properties:** Discusses the importance of understanding material behavior under various loads, including elasticity, plasticity, and fatigue.
- **Types of Loads and Stresses:** Covers axial, shear, bending, torsional, and combined stresses,

with stress-strain relationships.

- Factor of Safety: Explains safety margins, their calculations, and significance in ensuring reliability.

## 2. Material Selection and Properties

Lecture notes emphasize the critical role of selecting appropriate materials based on:

- Mechanical properties (strength, ductility, toughness)
- Environmental resistance (corrosion, temperature)
- Cost and manufacturability considerations

Common materials covered include steels, cast irons, aluminum alloys, and composites, with detailed charts and comparison tables.

## 3. Design of Shafts, Bearings, and Gears

These are fundamental machine elements, and the notes typically include:

- Shaft Design: Calculations for diameter, bending, and torsional stresses; methods to mitigate fatigue failure.
- Bearings: Types (plain, rolling-element, fluid), selection criteria, and maintenance considerations.
- Gears: Gear types, gear ratios, gear tooth design, and lubrication practices.

## 4. Power Transmission Elements

Focuses on components that transfer power efficiently, including:

- Couplings and clutches
- Belt and chain drives
- Pulley systems

Design considerations include torque transmission capacity, slip prevention, and wear resistance.

## 5. Failure Theories and Design Against Failures

Understanding failure mechanisms is vital. The notes elaborate on:

- Failure Theories: Maximum shear stress, maximum normal stress, and distortion energy theories.
- Fatigue and Creep: Design strategies to prevent failure due to cyclic loading or high temperature.
- Corrosion and Wear: Protective measures like coating, lubrication, and material selection.

## 6. Design for Manufacturing and Assembly

Practical aspects include:

- Tolerance and fit considerations
- Ease of assembly and disassembly
- Cost-effective manufacturing processes

## Pedagogical Strengths of Machine Design Lecture Notes

Effective lecture notes are characterized by clarity, depth, and applicability. Here are some of the notable pedagogical strengths observed in high-quality machine design notes:

### Structured Layout and Logical Flow

The notes often follow a logical progression?from fundamental concepts to advanced topics?facilitating incremental learning. Each section begins with objectives, followed by detailed explanations, examples, and summaries.

### Illustrations and Diagrams

Complex concepts are elucidated through clear diagrams, sketches, and flowcharts, enhancing visual understanding. For example:

- Cross-sectional views of shafts under various loads
- Gear tooth profiles
- Stress distribution diagrams

### Worked Examples and Practice Problems

Inclusion of numerous examples demonstrates application of theoretical principles:

- Calculations of shaft diameters under combined stresses
- Material selection based on load conditions
- Gear tooth strength analysis

Practice problems at the end of each section allow learners to test their comprehension, often with step-by-step solutions.

## **Incorporation of Industry Standards**

Lectures incorporate relevant standards such as IS, ASTM, and DIN, ensuring alignment with real-world engineering practices.

## **Use of Modern Teaching Aids**

Some notes integrate:

- Tables for quick reference
- Charts for material properties
- Software-based simulations or references to CAD tools

## **Practical Utility and Applications of the Lecture Notes**

The true value of lecture notes lies in their practical application in academic projects, industrial design, and research.

## **Academic Success and Exam Preparation**

Students can rely on these notes for:

- Clarifying doubts during coursework
- Quick revision before exams
- Preparing for interviews and technical tests

## **Design Projects and Engineering Practice**

Professionals use these notes as a quick reference guide during product development phases, ensuring adherence to design standards and safety protocols.

## **Research and Innovation**

Advanced sections often include recent developments in smart materials, failure analysis techniques, and computer-aided design (CAD) methodologies, fostering innovation.

## Conclusion: The Value Proposition of Machine Design Lecture Notes

In conclusion, Introduction to Machine Design Lecture Notes are more than just educational handouts; they are vital tools that support the journey from theoretical understanding to practical implementation. An ideal set of notes combines clarity, depth, visual aids, and real-world relevance, enabling learners to master complex concepts, develop critical thinking, and prepare for professional challenges.

For students, educators, and practicing engineers, investing in high-quality lecture notes translates into enhanced comprehension, increased confidence, and a competitive edge in the field of mechanical design. As the engineering landscape continues to evolve with technological advancements, such comprehensive resources will remain indispensable for fostering the next generation of innovative, reliable, and efficient machine designs.

**Question** What are the main objectives of an introduction to machine design lecture? The main objectives are to familiarize students with fundamental concepts of designing mechanical components, understanding load analysis, material selection, and the application of design principles to develop efficient and reliable machines. Which topics are typically covered in the initial lectures of machine design? Initial lectures usually cover basic concepts such as stress and strain, types of loads, material properties, failure theories, and an overview of design processes and standards. Why is understanding material properties important in machine design? Material properties determine the strength, durability, and suitability of components under various loading conditions, ensuring safety, performance, and longevity of the designed machine parts. How does an introduction to machine design help in real-world engineering applications? It provides foundational knowledge that enables engineers to develop safe, efficient, and cost-effective mechanical systems, from small components to complex machinery, by applying appropriate design methods and standards. What are common tools and software used in machine design lectures? Common tools include CAD software like SolidWorks or AutoCAD, finite element analysis (FEA) tools such as ANSYS, and other simulation programs that aid in modeling and analyzing mechanical components. How can students best prepare for a machine design lecture course? Students should strengthen their understanding of mechanics, materials, and basic engineering principles, review relevant mathematics, and practice solving problems related to statics and strength of materials.

**Related keywords:** machine design, lecture notes, mechanical engineering, gear design, stress analysis, material selection, structural analysis, mechanical components, design principles, engineering curriculum

## tally erp inventory notes

**tally erp inventory notes** are an essential resource for businesses and accounting professionals who utilize Tally ERP software to manage their inventory processes effectively. Understanding how to navigate, utilize, and optimize inventory notes within Tally ERP can significantly enhance inventory control, streamline operations, and ensure accurate reporting. Whether you are a beginner or an experienced user, having comprehensive notes and guidelines can make your inventory management smoother and more efficient. In this article, we will explore the key aspects of Tally ERP inventory notes, covering fundamental concepts, features, best practices, and troubleshooting tips to help you make the most of this powerful tool.

## Understanding Tally ERP Inventory Notes

### What Are Inventory Notes in Tally ERP?

Inventory notes in Tally ERP are annotations or remarks that users can attach to specific inventory transactions, stock items, or stock groups. These notes serve as a way to document additional information, special instructions, or relevant details that are not captured in standard transaction entries. They are particularly useful for internal communication, audit trails, or clarifying particular inventory movements.

### Key Purposes of Inventory Notes

- Providing additional context to transactions
- Documenting reasons for stock adjustments or discrepancies
- Noting special handling instructions
- Facilitating internal communication among team members
- Ensuring audit compliance and traceability

## How to Create and Use Inventory Notes in Tally ERP

### Adding Inventory Notes to Transactions

To add inventory notes to a transaction in Tally ERP, follow these steps:

- Open the transaction voucher (e.g., Stock Journal, Purchase, Sales)
- Navigate to the particular line item or entry where you want to add notes
- Look for the ?Narration? or ?Remarks? field associated with the item or transaction

- Enter your notes or comments relevant to that transaction
- Save the transaction

It's important to ensure that notes are clear, concise, and relevant to facilitate future review or audits.

## Attaching Notes to Stock Items or Groups

In addition to transaction-level notes, Tally ERP allows users to add notes directly to stock items or groups:

- Go to Gateway of Tally > Inventory Info.
- Select Stock Items or Stock Groups
- Choose the specific item or group for which you want to add notes
- Press ?Alt+Enter? to view the detailed stock item or group ledger
- Locate the ?Description? or ?Notes? field and enter your notes
- Save your changes

This feature helps in maintaining detailed records for each inventory element.

## Managing Inventory Notes Effectively

### Best Practices for Using Inventory Notes

To maximize the usefulness of inventory notes, consider the following best practices:

- Be specific and descriptive in your notes to avoid ambiguity
- Use standardized terminology for consistent documentation
- Regularly review and update notes to reflect current information
- Limit the length of notes to keep them concise and readable
- Train staff to understand and utilize notes appropriately

### Organizing Inventory Notes for Better Access

Effective organization of notes ensures quick retrieval and clarity:

- Maintain a centralized note-taking system or log for complex or recurrent issues
- Use consistent tags or keywords within notes for easy filtering

- Link notes to relevant transactions or stock items for context
- Regularly audit notes to identify patterns or recurring issues

## Benefits of Maintaining Accurate Inventory Notes

### Enhanced Inventory Control

Accurate notes help in tracking the history of stock movements, reasons for adjustments, and special handling instructions. This detailed information improves decision-making and inventory accuracy.

### Improved Audit and Compliance

Well-maintained notes provide a clear audit trail, demonstrating transparency and compliance with internal policies and regulatory standards.

### Facilitating Communication

Inventory notes serve as a communication tool among team members, ensuring everyone is aware of specific details related to inventory items or transactions.

### Reducing Errors and Discrepancies

Clear notes can help identify the root causes of discrepancies, reducing errors in stock counts, valuations, or adjustments.

## Common Challenges and Troubleshooting Tips

### Challenges in Managing Inventory Notes

- Overly vague or generic notes
- Lack of standardized procedures for note entry
- Difficulty in locating relevant notes during audits
- Notes becoming outdated or irrelevant over time

### Tips for Overcoming Challenges

- Establish clear guidelines for note-taking and documentation
- Use templates or predefined formats for consistency

- Regularly review and update notes to ensure accuracy
- Leverage Tally ERP's search and filter features to locate notes efficiently

## Advanced Tips for Leveraging Inventory Notes

### Integrating Notes with Reports

While Tally ERP does not natively support reporting based solely on inventory notes, users can:

- Export transaction data along with notes to external tools for analysis
- Use custom fields or additional modules for enhanced note tracking

### Automating Note Entry

For large-scale operations, consider:

- Using macros or scripts to insert standardized notes during bulk imports
- Configuring user roles and permissions to control who can add or modify notes

## Conclusion

Inventory notes in Tally ERP are a vital component of comprehensive inventory management, offering clarity, documentation, and control over stock movements and statuses. By understanding how to create, organize, and utilize these notes effectively, businesses can enhance their operational efficiency, improve audit readiness, and foster better internal communication. Implementing best practices and leveraging the full capabilities of Tally ERP for inventory notes can lead to more accurate inventory tracking, reduced discrepancies, and ultimately, a more streamlined supply chain and accounting process. Whether for small businesses or large enterprises, mastering inventory notes is a step toward more transparent and effective inventory management.

**Tally ERP Inventory Notes: An In-Depth Investigation into Inventory Management Features and Best Practices**

In the realm of enterprise resource planning (ERP), Tally ERP has emerged as a trusted name, especially among small and medium-sized businesses seeking comprehensive yet user-friendly solutions. Among its core functionalities, inventory management plays a pivotal role in ensuring operational efficiency, stock accuracy, and streamlined supply chain processes. This article provides an in-depth investigation into Tally ERP Inventory Notes, exploring their significance, features, best practices, and how they impact overall inventory management.

## Understanding Tally ERP Inventory Notes

At its core, Tally ERP Inventory Notes refer to detailed annotations, documentation, or digital notes associated with inventory items, transactions, or stock movements within the Tally environment. These notes serve as a crucial communication tool for various stakeholders, including inventory managers, warehouse staff, finance teams, and auditors.

Unlike basic inventory records, inventory notes in Tally often include supplementary information such as:

- Specific handling instructions
- Batch or serial number details
- Quality notes
- Inspection comments
- Special storage conditions
- Delivery or receipt remarks

They enhance traceability, transparency, and accuracy in inventory management processes.

## The Significance of Inventory Notes in Tally ERP

Effective inventory notes are vital for several reasons:

- Improved Traceability

Notes provide detailed histories of stock items, including movements, damages, or quality issues, enabling quick tracing during audits or disputes.

- Enhanced Communication

They facilitate clear communication across departments, ensuring everyone is aligned on stock conditions and special instructions.

- Regulatory Compliance

Certain industries require meticulous documentation for regulatory audits, and inventory notes help fulfill these requirements.

- Operational Efficiency

By recording specific instructions and remarks, inventory handling becomes more streamlined, reducing errors and delays.

- Data Accuracy and Reporting

Detailed notes contribute to more accurate inventory reports, aiding in better decision-making.

## **Features of Inventory Notes in Tally ERP**

Tally ERP offers various features that support the recording and management of inventory notes:

### **1. Multiple Entry Points for Notes**

- Notes can be added at multiple stages such as purchase, sales, stock transfers, and adjustments.
- They can be attached to specific items within transactions.

### **2. Customizable Remarks**

- Users can define custom fields or remarks tailored to specific needs.
- For example, adding fields for batch expiry dates or handling instructions.

### **3. Integration with Inventory Modules**

- Notes are integrated seamlessly with stock items, enabling real-time visibility.
- They support batch and serial number tracking, crucial for industries like pharmaceuticals or electronics.

### **4. User Access and Permissions**

- Role-based access ensures that only authorized personnel can add, edit, or view sensitive inventory notes.
- This feature safeguards data integrity.

## 5. Search and Filter Capabilities

- Advanced search options allow users to locate specific notes based on criteria such as date, item, or transaction type.

## 6. Export and Audit Trails

- Notes can be exported for external review.
- Audit trails track changes to notes, ensuring accountability.

# Implementing Effective Inventory Notes in Tally ERP

To maximize the benefits of inventory notes, organizations should follow best practices in their implementation:

## 1. Standardize Note Formats and Content

- Develop templates for common notes such as damage reports, quality issues, or special handling.
- Use consistent terminology for clarity.

## 2. Train Staff Thoroughly

- Ensure warehouse and inventory staff understand how and when to record notes.
- Emphasize the importance of detailed, accurate entries.

## 3. Integrate Notes into Workflow Processes

- Embed note-taking into routine procedures like receiving, dispatching, and stock reconciliation.
- Use Tally ERP's automation features to prompt note entries at critical points.

## 4. Maintain Data Security and Access Controls

- Restrict editing rights to prevent unauthorized modifications.
- Regularly review permissions.

## 5. Regular Review and Audits

- Periodically audit inventory notes to identify inconsistencies or missing information.
- Use audit findings for continuous process improvement.

## Case Studies: Practical Applications of Inventory Notes in Tally ERP

### Case Study 1: Pharmaceutical Industry

A mid-sized pharmaceutical company leverages Tally ERP to manage its extensive batch inventory. Inventory notes are used extensively to record batch expiry dates, storage conditions, and quality inspection results. This detailed documentation ensures compliance with regulatory standards and simplifies recall processes if necessary.

### Case Study 2: Electronics Retailer

An electronics retailer uses inventory notes to track serial numbers, warranty periods, and customer-specific remarks. When stock is transferred between stores, notes help maintain serial number tracking, minimizing theft and misplacement.

## Common Challenges and Solutions in Managing Inventory Notes

Despite their advantages, organizations may face challenges in managing inventory notes effectively:

- Challenge: Inconsistent note entries leading to data gaps

Solution: Implement standardized templates and conduct regular staff training.

- Challenge: Overloading notes with unnecessary information

Solution: Define clear guidelines on what constitutes relevant notes to maintain clarity.

- Challenge: Difficulty in retrieving specific notes during audits

Solution: Utilize Tally's search, filter, and export features for efficient retrieval.

- Challenge: Ensuring data security for sensitive notes

Solution: Enforce role-based permissions and audit trails.

## **Future Trends and Enhancements in Tally ERP Inventory Notes**

As technology evolves, so do the capabilities related to inventory notes:

- Integration with Barcode and RFID Technologies

Automate note entry through scanning, reducing manual errors.

- Use of Cloud-Based Storage

Enhance collaboration and remote access to detailed inventory notes.

- AI and Analytics Integration

Analyze notes for patterns, predictive maintenance, or quality issues.

- Mobile Application Support

Allow warehouse staff to record notes on-the-go via mobile devices.

## **Conclusion: The Strategic Value of Inventory Notes in Tally ERP**

Tally ERP Inventory Notes are more than mere annotations; they are strategic tools that enhance transparency, accountability, and operational efficiency. Properly implemented, they enable organizations to maintain high standards of inventory control, ensure compliance, and facilitate informed decision-making. As businesses grow and inventory complexities increase, leveraging the full potential of inventory notes within Tally ERP becomes indispensable.

To harness maximum benefits, companies should standardize note practices, invest in staff training, and utilize Tally's advanced features for search, security, and reporting. With continuous technological advancements, inventory notes are poised to become even more integral to comprehensive ERP solutions, supporting smarter, faster, and more reliable inventory management strategies.

In Summary:

- Inventory notes in Tally ERP serve as essential documentation tools.
- They improve traceability, communication, and compliance.
- Effective management requires standardization, training, and technological integration.
- Future innovations will further enhance their utility, making inventory notes a cornerstone of modern ERP systems.

By understanding and implementing best practices for Tally ERP Inventory Notes, organizations can significantly elevate their inventory management capabilities, leading to increased operational excellence and competitive advantage.

**Question** What are the key features of Tally ERP inventory management? Tally ERP inventory management offers features like stock tracking, batch and expiry management, multiple warehouse handling, barcode scanning, and real-time stock updates to streamline inventory control. **Answer** How can I create and manage inventory notes in Tally ERP? You can create inventory notes in Tally ERP by recording stock movements through vouchers like Stock Journal, Delivery Note, or Purchase Receipt, which document the details of inventory transactions systematically. Can Tally ERP generate reports based on inventory notes? Yes, Tally ERP can generate detailed inventory reports such as Stock Summary, Movement Analysis, and Batch-wise Reports, which are based on data recorded through inventory notes and vouchers. How do inventory notes help in tracking stock movements in Tally ERP? Inventory notes record every stock transaction, allowing users to monitor stock inflow and outflow accurately, detect discrepancies, and maintain optimal inventory levels. Is it possible to customize inventory notes in Tally ERP for specific business needs? Yes, Tally ERP allows customization of inventory notes and vouchers to suit specific business requirements, including defining custom fields and workflows. What are best practices for maintaining accurate inventory notes in Tally ERP? Best practices include updating inventory notes promptly after transactions, reconciling stock regularly, maintaining detailed documentation, and training staff on proper voucher entry procedures. How does Tally ERP ensure data security for inventory notes? Tally ERP offers user-level access controls, secure data storage, and backup options to protect inventory data and ensure only authorized personnel can make changes to inventory notes. Can Tally ERP integrate inventory notes with other modules like accounting and sales? Yes, Tally ERP seamlessly integrates inventory notes with accounting, sales, and purchase modules, ensuring consistent data flow and comprehensive business management.

**Related keywords:** Tally ERP inventory, inventory management, Tally ERP notes, stock management, inventory tracking, Tally ERP training, inventory reports, Tally ERP tutorials, warehouse management, inventory control

**Read the full article online:** [TALLY ERP INVENTORY NOTES](#)