

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.Tech. I Year III Term

Assignment

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Id. No	241P1R1009
Branch	CSE
Year and Term	I Year III Term
Course Name	Research Publication and Ethics
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Assessment Type	Assignment
Module Number	2

Assignment on Virtual Labs

1. Introduction

Virtual Labs are interactive online platforms that simulate real laboratory experiments. They aim to enhance students' conceptual understanding by allowing them to perform experiments virtually from anywhere.

2. Purpose and Objectives

The objective of Virtual Labs is to complement physical labs with simulation-based learning, making experimentation accessible and repeatable. It supports remote learning and helps students improve their understanding of concepts through virtual practice.

3. Features of Virtual Labs

- Interactive simulations and animations
- Theory, procedure, simulation, and quizzes for each experiment
- Available in various subjects and engineering streams
- Supports low-bandwidth usage
- Accessible anytime, anywhere

4. Subjects Covered

- Physics
- Chemistry
- Electrical and Electronics Engineering
- Computer Science and Engineering
- Mechanical Engineering
- Civil Engineering
- Biotechnology and Biomedical Engineering

5. Access and Usage

Students and faculty can access Virtual Labs via the official portal: <https://www.vlab.co.in>. This initiative is supported by the Ministry of Education under NMEICT and coordinated by IIT Delhi.

6. Benefits of Using Virtual Labs

- Enables safe, repeatable, and flexible experimentation
- Prepares students before real lab sessions
- Helps in learning from home during remote classes
- Enhances visualization and understanding of theoretical concepts

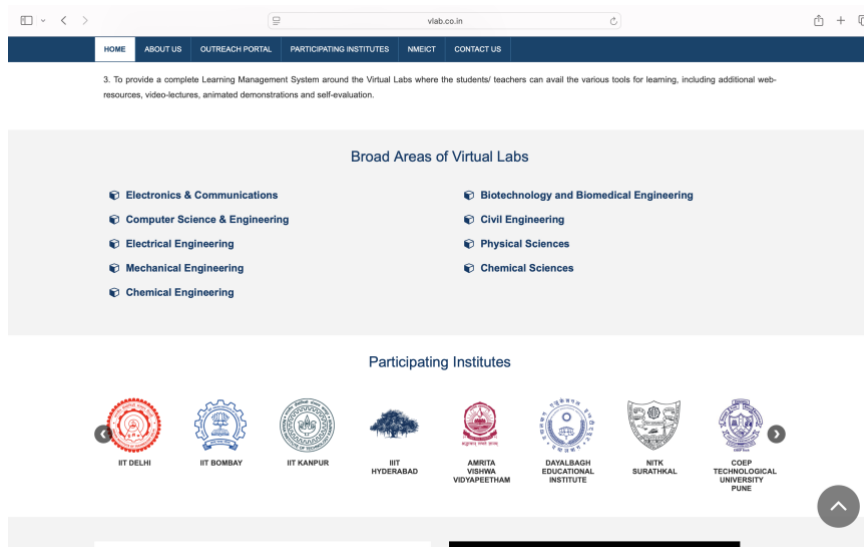
7. Sequence of Steps to Perform a Virtual Experiment (Mechanical Branch)

1. **Visit the Virtual Lab Portal**
 - Open <https://www.vlab.co.in>
 - Navigate to *Mechanical Engineering* under the *Broad Areas of Virtual Labs*
2. **Select the Relevant Lab**
 - Choose a specific lab such as:
 - *Kinematics and Dynamics of Machines Lab*
 - *Thermodynamics Lab*
 - *Strength of Materials Lab*
 - *Heat and Mass Transfer Lab*
 - *Fluid Mechanics Lab*
3. **Choose the Experiment**
 - From the list, select the experiment you want to perform, for example:
 - “Torsion Test”
 - “Bernoulli’s Theorem”
 - “Pin Fin Heat Transfer”
 - “Governor Mechanism”
4. **Read the Theory**
 - Go to the **Theory** section to understand the background, equations, and objectives of the experiment.
 - This helps to know the concept and expected behavior of the system.
5. **Study the Procedure**
 - Review the **Procedure** step-by-step to understand how the experiment is to be conducted.
 - Know the inputs, controls, and output parameters to observe.
6. **Run the Simulation**
 - Open the **Simulator** tab.
 - Set initial values (e.g., speed, load, temperature, length) as per the instructions.
 - Click on **Start Simulation** or equivalent button to begin the experiment.
 - Observe changes and record readings.
7. **Perform Calculations (if needed)**
 - Use the observed data to perform calculations such as torque, efficiency, stress, heat transfer rate, etc.
 - Compare theoretical and simulated results if applicable.
8. **Answer Viva or Self-Evaluation Questions**
 - Attempt the **Viva Voce** or **Self-Assessment** section to test your understanding of the experiment.
 - These may include multiple choice or short-answer questions.
9. **Download or Record Observations**
 - Take screenshots or notes of the simulation output and graphs.
 - Use the data to prepare your lab record or report.
10. **Repeat for Better Understanding (Optional)**

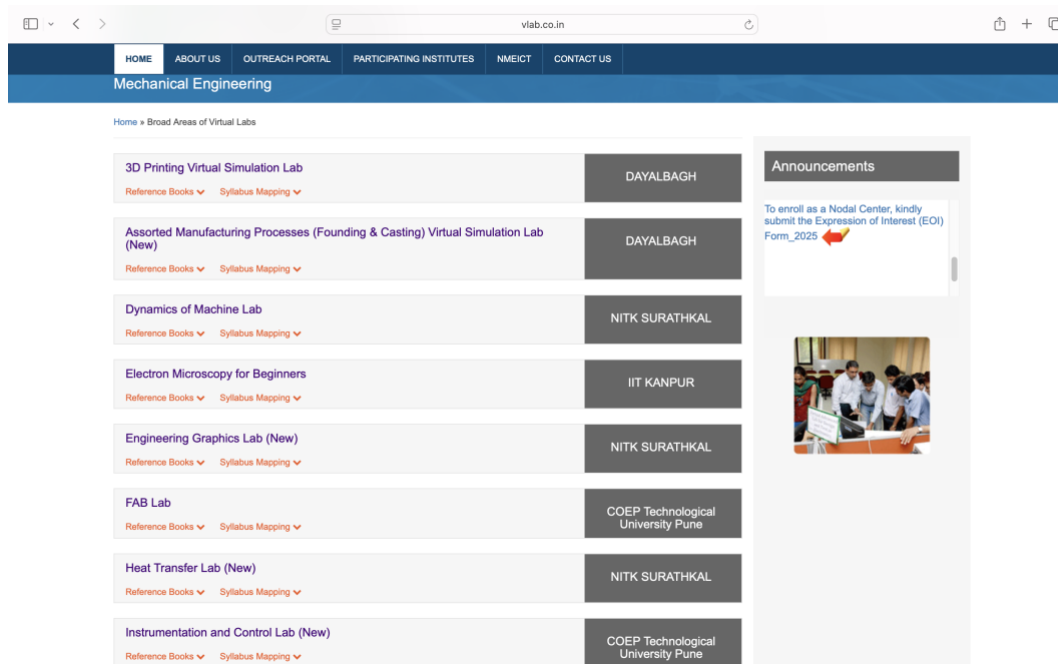
- You may reset and repeat the experiment with different inputs to observe variation in results.

8. Sample screenshots showing the Virtual Labs interface and experiment module:

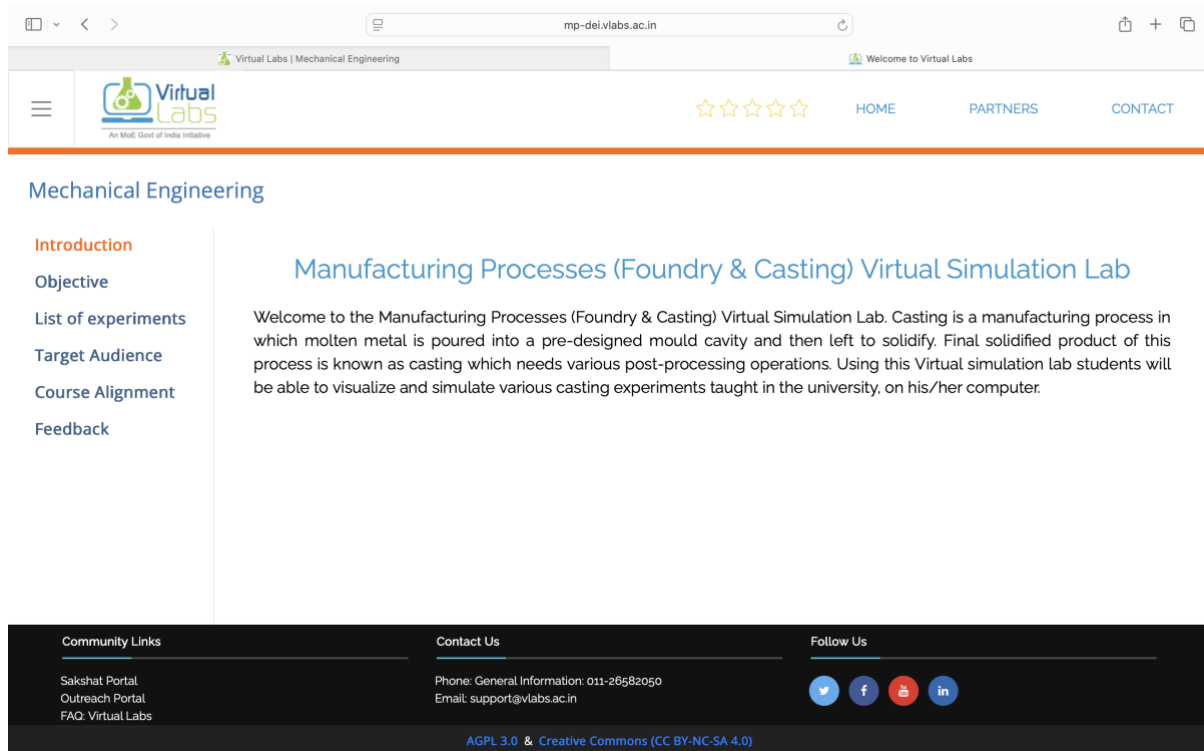
8.1 Broad Areas



8.2 Broad areas of virtual labs in Mechanical Engineering



8.3 Selection of Lab(Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab)



The screenshot shows the Virtual Labs website interface. The top navigation bar includes the Virtual Labs logo, a star rating, and links for HOME, PARTNERS, and CONTACT. The main content area is titled "Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab". A sidebar on the left lists navigation options: Introduction, Objective, List of experiments, Target Audience, Course Alignment, and Feedback. The main text describes the casting process and the purpose of the virtual simulation lab. The footer contains community links, contact information, and social media icons.

Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab

Welcome to the Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab. Casting is a manufacturing process in which molten metal is poured into a pre-designed mould cavity and then left to solidify. Final solidified product of this process is known as casting which needs various post-processing operations. Using this Virtual simulation lab students will be able to visualize and simulate various casting experiments taught in the university, on his/her computer.

Community Links

- Sakshat Portal
- Outreach Portal
- FAQ: Virtual Labs

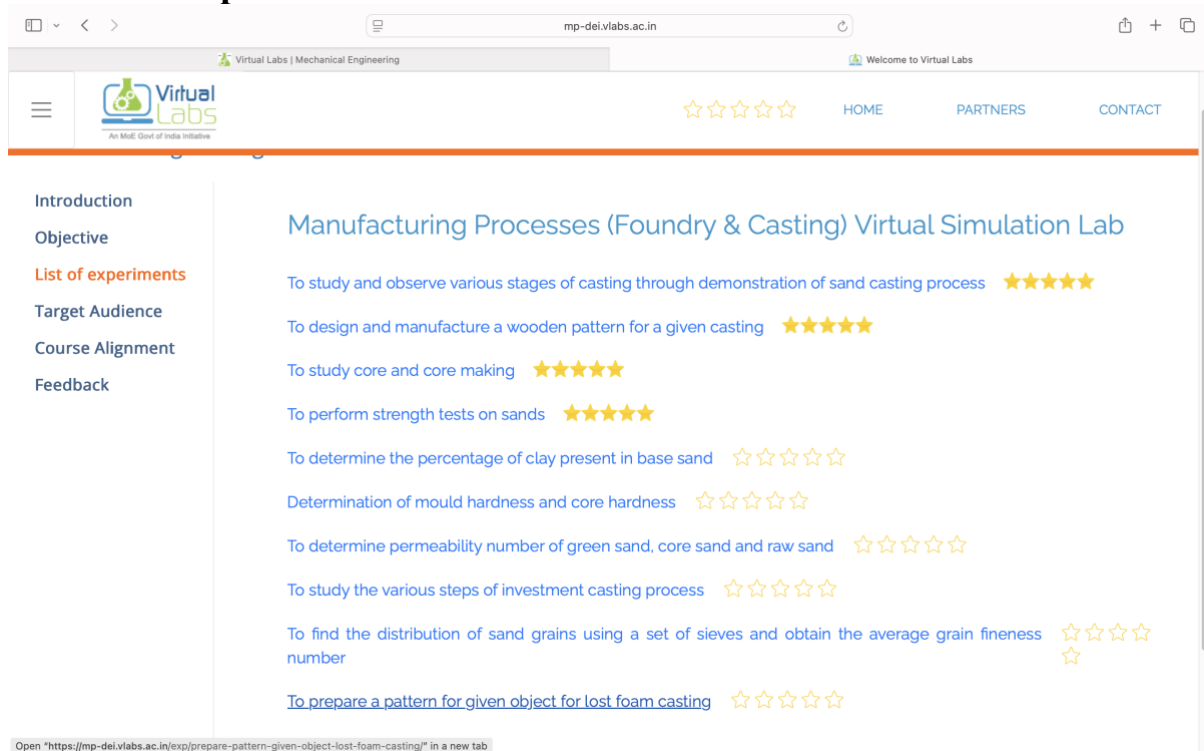
Contact Us

Phone: General Information: 011-26582050
Email: support@vlabs.ac.in

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8.4 List of Experiments



The screenshot shows the Virtual Labs website interface with the "List of experiments" section highlighted in the sidebar. The main content area lists ten experiments with their descriptions and star ratings.

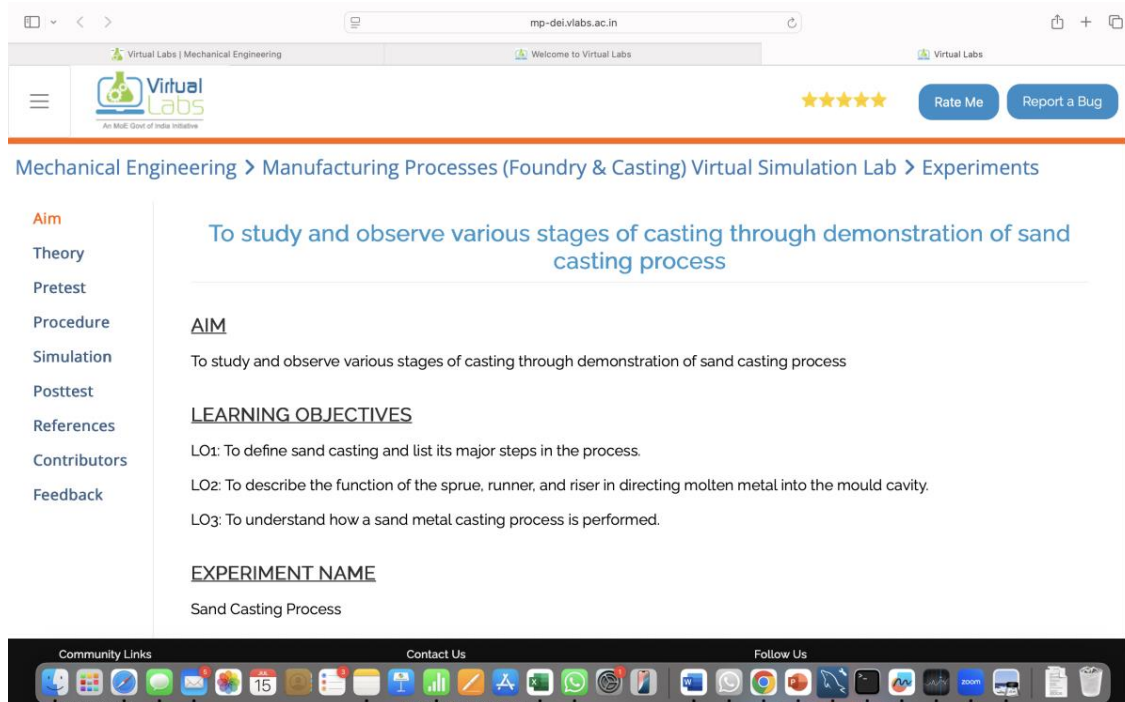
Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab

- To study and observe various stages of casting through demonstration of sand casting process ★★★★★
- To design and manufacture a wooden pattern for a given casting ★★★★★
- To study core and core making ★★★★★
- To perform strength tests on sands ★★★★★
- To determine the percentage of clay present in base sand ☆☆☆☆☆
- Determination of mould hardness and core hardness ☆☆☆☆☆
- To determine permeability number of green sand, core sand and raw sand ☆☆☆☆☆
- To study the various steps of investment casting process ☆☆☆☆☆
- To find the distribution of sand grains using a set of sieves and obtain the average grain fineness number ☆☆☆☆☆
- To prepare a pattern for given object for lost foam casting ☆☆☆☆☆

Open "https://mp-dei.vlabs.ac.in/exp/prepare-pattern-given-object-lost-foam-casting/" in a new tab

8.5 Selection of an experiment(To study and observe various stages of casting through demonstration of sand casting process)

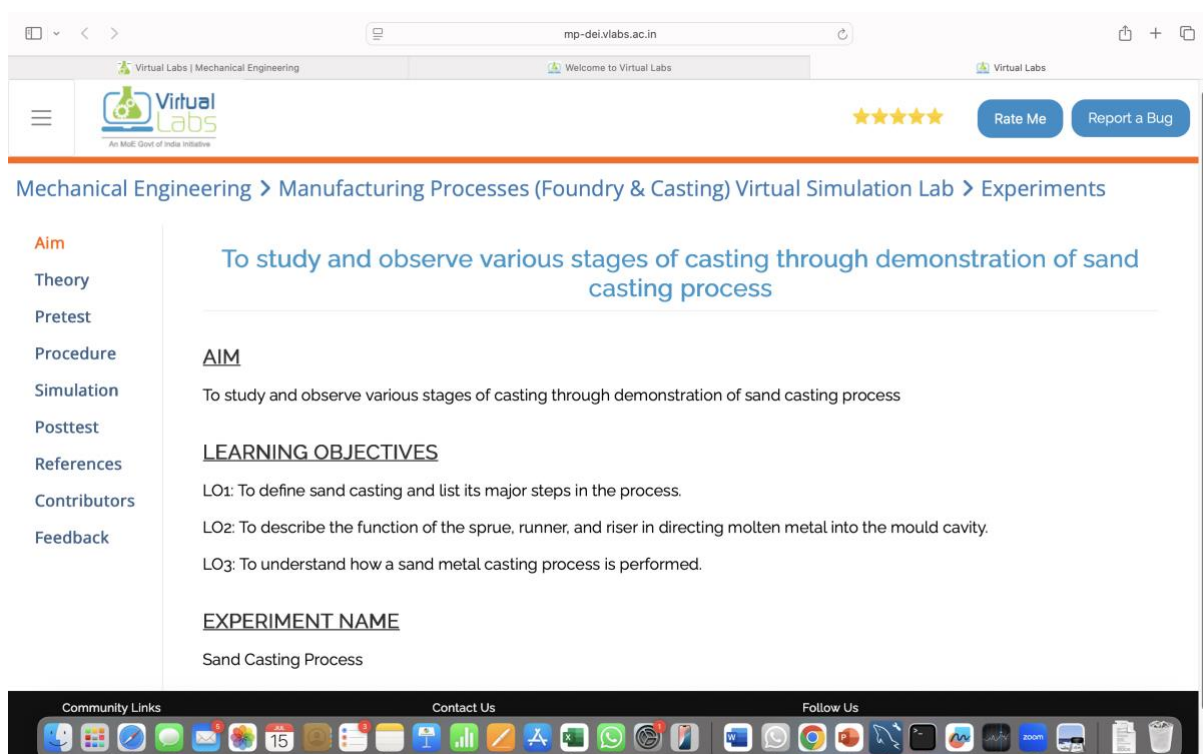
8.5.1 Aim



The screenshot shows the Virtual Labs website interface. The browser address bar displays 'mp-dei.vlabs.ac.in'. The page title is 'Mechanical Engineering > Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab > Experiments'. The left sidebar contains a menu with options: Aim, Theory, Pretest, Procedure, Simulation, Posttest, References, Contributors, and Feedback. The main content area displays the following information:

- Aim:** To study and observe various stages of casting through demonstration of sand casting process
- LEARNING OBJECTIVES:**
 - LO1: To define sand casting and list its major steps in the process.
 - LO2: To describe the function of the sprue, runner, and riser in directing molten metal into the mould cavity.
 - LO3: To understand how a sand metal casting process is performed.
- EXPERIMENT NAME:** Sand Casting Process

8.5.1 Theory



This screenshot is identical to the one above, showing the Virtual Labs website interface for the Sand Casting Process experiment. The browser address bar displays 'mp-dei.vlabs.ac.in'. The page title is 'Mechanical Engineering > Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab > Experiments'. The left sidebar contains a menu with options: Aim, Theory, Pretest, Procedure, Simulation, Posttest, References, Contributors, and Feedback. The main content area displays the following information:

- Aim:** To study and observe various stages of casting through demonstration of sand casting process
- LEARNING OBJECTIVES:**
 - LO1: To define sand casting and list its major steps in the process.
 - LO2: To describe the function of the sprue, runner, and riser in directing molten metal into the mould cavity.
 - LO3: To understand how a sand metal casting process is performed.
- EXPERIMENT NAME:** Sand Casting Process

8.5.2 Pretest

The screenshot shows the Virtual Labs interface for the sand casting process simulation. The browser address bar displays 'mp-del.vlabs.ac.in'. The page title is 'Virtual Labs | Mechanical Engineering'. The main heading is 'To study and observe various stages of casting through demonstration of sand casting process'. The left sidebar contains a navigation menu with the following items: Aim, Theory, Pretest (highlighted), Procedure, Simulation, Posttest, References, Contributors, and Feedback. The main content area contains three multiple-choice questions (MCQs) related to sand casting:

- What is the primary purpose of sand casting? (LO1)**
 - a: To manufacture plastic parts
 - b: To shape molten metal into a desired form using a sand mould
 - c: To increase the hardness of metal
 - d: To join two metal pieces together
- What is the function of a core in sand casting? (LO3)**
 - a: To create a hollow section inside the casting
 - b: To increase the cooling rate of molten metal
 - c: To help remove the pattern easily
 - d: To reduce the melting temperature of metal
- Which material is most commonly used for making moulds in sand casting? (LO1)**
 - a: Plaster
 - b: Ceramic
 - c: Sand
 - d: Wax

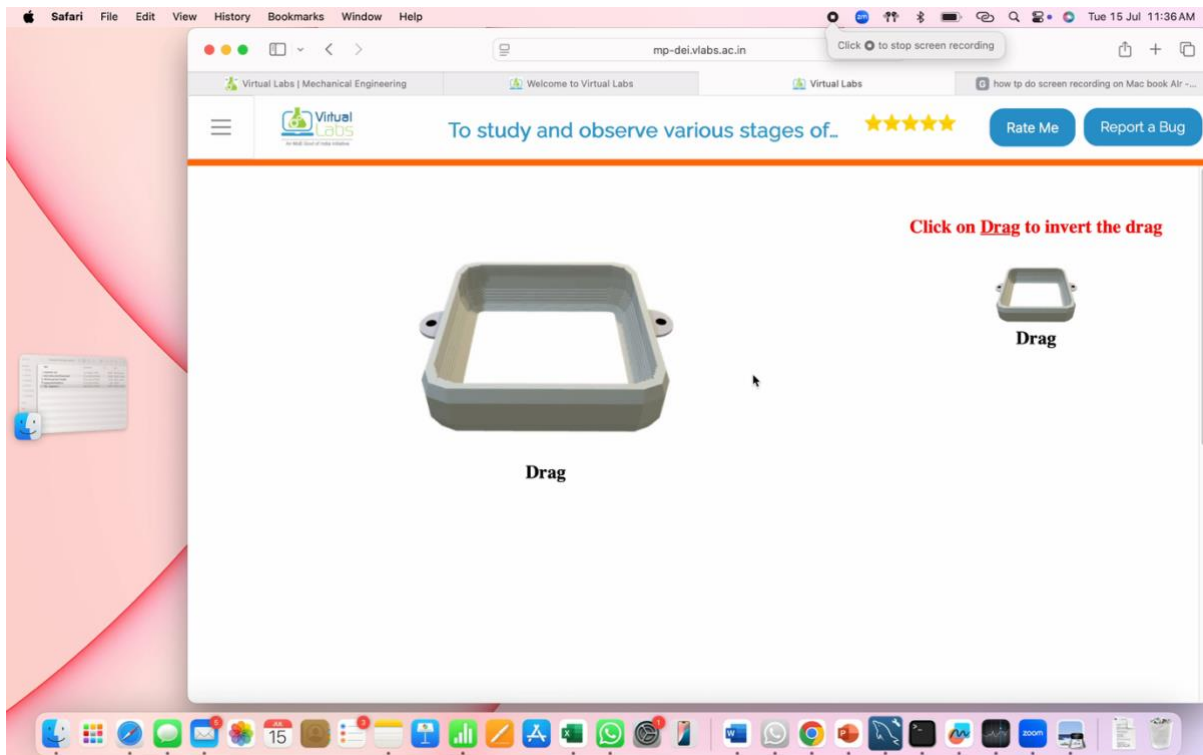
8.5.1 Procedure

The screenshot shows the Virtual Labs interface for the sand casting process simulation. The browser address bar displays 'mp-del.vlabs.ac.in'. The page title is 'Virtual Labs | Mechanical Engineering'. The main heading is 'To study and observe various stages of casting through demonstration of sand casting process'. The left sidebar contains a navigation menu with the following items: Aim, Theory, Pretest, Procedure (highlighted), Simulation, Posttest, References, Contributors, and Feedback. The main content area contains a list of steps for the sand casting process:

- PLACE the inverted pattern at the bottom of the inverted drag
- TRANSFER the sand into the drag with shovel
- RAM the sand into the drag and INVERT it (the pattern faces upward)
- SPRINKLE the parting sand over the drag
- FIX the cope on the drag with guide pins
- PLACE the sprue and the riser perpendicularly into the cope at the allotted positions
- FILL the cope with the moulding sand and RAM it
- REMOVE riser and sprue
- REMOVE the pattern by removing the guide pins and relocate them after remove the mould
- DAMP a depression for pouring basin at the opening of the riser
- POUR the molten metal into the pouring basin
- After cooling, metal casting is prepared
- CLICK on the casting to see various defects

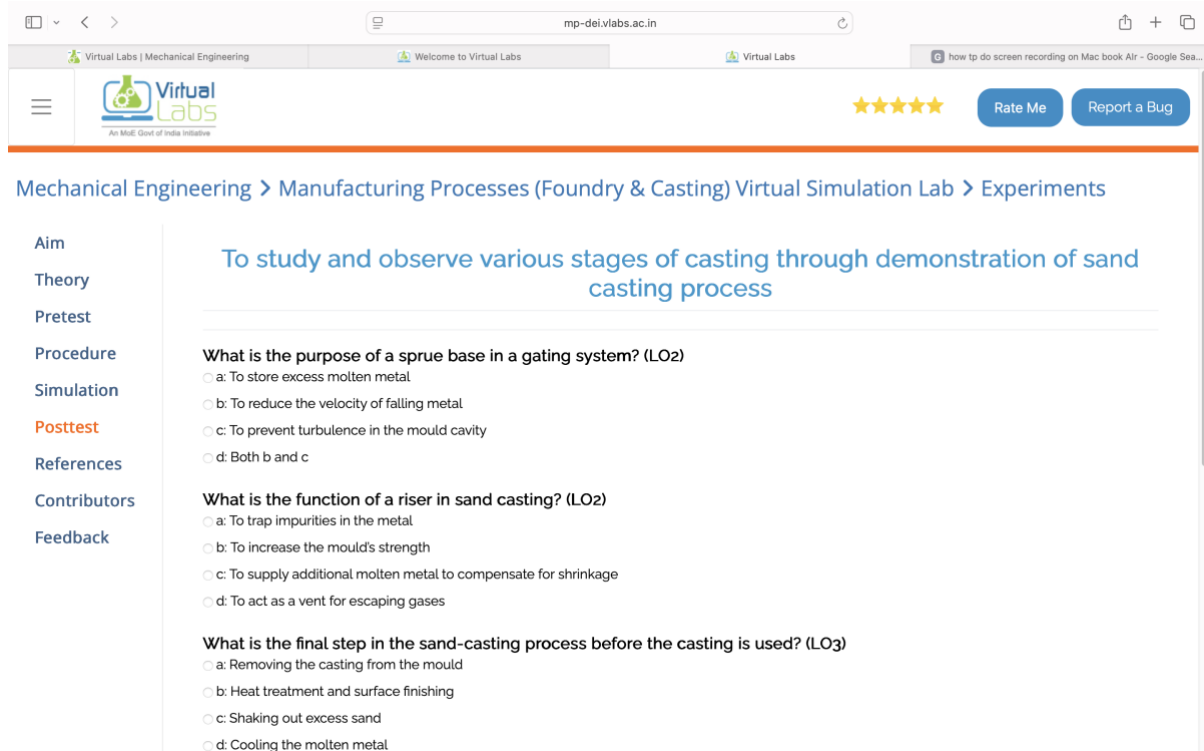
8.5.1 Simulation

(Screen Recording Video of the Simulation)



https://drive.google.com/file/d/1aJqVNBIPg6jPRheQfg6AFegopJfCRL3T/view?usp=share_link

8.5.1 Posttest



The screenshot shows a web browser at the URL `mp-del.vlabs.ac.in`. The page is titled "Mechanical Engineering > Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab > Experiments". On the left, a sidebar lists navigation options: Aim, Theory, Pretest, Procedure, Simulation, **Posttest** (highlighted in orange), References, Contributors, and Feedback. The main content area has a heading "To study and observe various stages of casting through demonstration of sand casting process". Below this, there are three questions with multiple-choice options:

What is the purpose of a sprue base in a gating system? (LO2)

- ☐ a: To store excess molten metal
- ☐ b: To reduce the velocity of falling metal
- ☐ c: To prevent turbulence in the mould cavity
- ☐ d: Both b and c

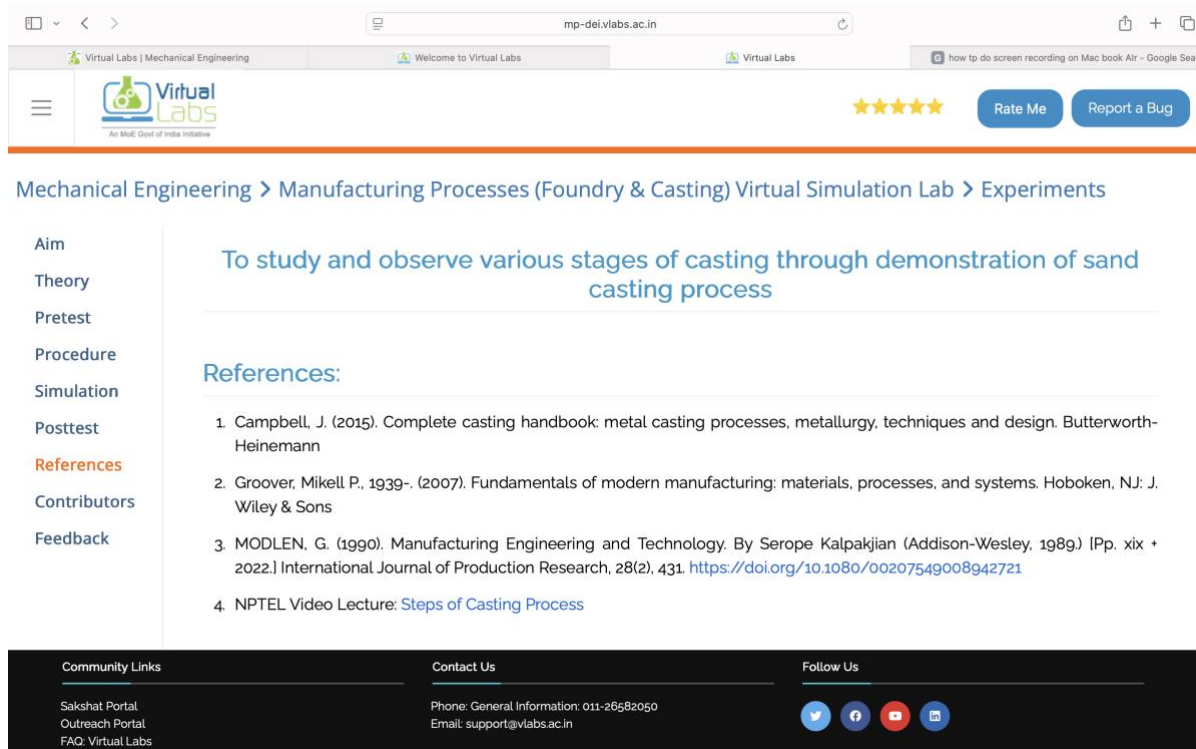
What is the function of a riser in sand casting? (LO2)

- ☐ a: To trap impurities in the metal
- ☐ b: To increase the mould's strength
- ☐ c: To supply additional molten metal to compensate for shrinkage
- ☐ d: To act as a vent for escaping gases

What is the final step in the sand-casting process before the casting is used? (LO3)

- ☐ a: Removing the casting from the mould
- ☐ b: Heat treatment and surface finishing
- ☐ c: Shaking out excess sand
- ☐ d: Cooling the molten metal

8.5.1 References



The screenshot shows the Virtual Labs website interface. The breadcrumb trail is: Mechanical Engineering > Manufacturing Processes (Foundry & Casting) Virtual Simulation Lab > Experiments. The left sidebar contains links: Aim, Theory, Pretest, Procedure, Simulation, Posttest, **References** (highlighted), Contributors, and Feedback. The main content area has the title "To study and observe various stages of casting through demonstration of sand casting process" and a "References:" section with four entries:

1. Campbell, J. (2015). Complete casting handbook: metal casting processes, metallurgy, techniques and design. Butterworth-Heinemann
2. Groover, Mikell P., 1939-. (2007). Fundamentals of modern manufacturing: materials, processes, and systems. Hoboken, NJ: J. Wiley & Sons
3. MODLEN, G. (1990). Manufacturing Engineering and Technology. By Serope Kalpakjian (Addison-Wesley, 1989.) [Pp. xix + 2022.] International Journal of Production Research, 28(2), 431. <https://doi.org/10.1080/00207549008942721>
4. NPTEL Video Lecture: [Steps of Casting Process](#)

The footer contains three sections: "Community Links" (Sakshat Portal, Outreach Portal, FAQ: Virtual Labs), "Contact Us" (Phone: General Information: 011-26582050, Email: support@vlabs.ac.in), and "Follow Us" (social media icons for Twitter, Facebook, YouTube, and LinkedIn).

9. Conclusion

Virtual Labs are powerful educational tools that help bridge the gap between classroom theory and real-world application. By providing an interactive and flexible learning environment, they allow students to explore, experiment, and understand complex concepts at their own pace. Especially in situations where access to physical laboratories is limited, virtual labs offer an effective alternative to ensure continuous and practical learning. Their role in building foundational skills, enhancing safety, and promoting digital literacy makes them an essential component of modern education