

A Proposal for
Mechanical Metallurgy Laboratory
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I. Objectives of the Virtual Lab

The virtual lab on Mechanical Metallurgy will provide insights of various mechanical properties on testing various materials. Effect of material microstructure and various classes of material will be directly evidence on the mechanical properties.

II. List of experiments

1. Tensile Test and Stress Strain Curve of Steel
2. Stress-Strain Curve of Various Materials
3. Strain Ageing and Yield Point Phenomenon in Steel
4. Strain and Work Hardening in Materials
5. Charpy and Izod Impact Testing of Materials
6. Creep High Temperature Test of Materials
7. Fatigue Cyclic Load Test of Materials
8. Bulk and Micro Hardness Test of Materials
9. Age Hardening in Aluminium Alloys
10. Instrumented Indentation of Materials

*Alternatively, 3-4 additional experiments (minimum) may be developed to augment existing labs (www.vlab.co.in).

Note: Please list all related experiments available on the web (vlab.co.in) and compare your proposed experiments with them. Please justify why the proposed experiments are needed and exactly what gaps they fill.

III. Target group of users

- UG (1st Year/ 2nd Year) [highest priority for development]
- UG (3rd Year/ 4th Year) [next higher priority for development]

IV. Mapping of proposed lab with AICTE courses as per attached list of potential labs

- Materials Engineering, PCC-ME 205

V. Mapping of proposed lab with universities (minimum 3 universities)

- National Institute of Technology Warangal; MM201; B.Tech: Metallurgical And Materials Engineering
- Veer Surendra Sai University of Technology Burla; MM 15 025; B.Tech: Metallurgical And Materials Engineering
- Malla Reddy College of Engineering & Technology; R18A0383; B.Tech: Metallurgical And Materials Engineering
- JadavPur University; Met/T/225; B.Tech: Metallurgical And Materials Engineering
- JadavPur University; Met/Chem/S/22; B.Tech: Metallurgical And Materials Engineering
- Biju Patnaik University of Technology Odisha; Professional core; B.Tech: Metallurgical And Materials Engineering

VI. Expected timelines

Presentation of proposal to domain experts' committee – 31st March 2022

Demo of First 3 Expts and Review – 30th June 2022

Demo of 5-6 Expts and review – 31st August 2022

Demo of 7-10 Expts and review – 31st October 2022

Final demo of 7-10 Expts – 15th November 2022

Hosting of lab (7-10 Expts) – 30th November 2022

Note 1: The [LDC](#) will coordinate the [reviews](#) and [hosting](#)

Note 2: The lab is supposed to be developed and hosted within 6 - 9 months from the date of approval

VII. Budget (Max. Rs 2 Lakhs per experiment with a ceiling of Rs 20 Lakhs per Lab)

Table I. Budget for Mechanical Metallurgy Laboratory

S. No.	Equipment/Activity	Budget # (In Lakh Rupees)
1	Hardware, software and other equipment (computer/laptop, etc)	1.70
2	Manpower (<i>project engineer/scientist</i>)	4.80
3	Consumables (various materials including polymers, metals and ceramics, indenter tip, load cell, grip, strain-gauge, chemicals, glassware, cutting blade, diamond polishing, gold-coating, sample mounting, etc.)	4.70
4	Contingency (standard calibration samples, heat treatment, material processing, repair, incidentals, miscellaneous, etc)	3.50
5	User testing charges (mechanical testing, electron microscopy, optical profilometry, phase characterization, etc)	2.80
6	Miscellaneous (review/honorarium)	2.50
TOTAL		20 lakhs

To be released based on the recommendation of the review committee

Note: Institute overheads not to be included in the budget

VIII. Justification of the budget requirements

(a) Details of Laptop/Machine

Will require a dedicated computer/laptop for simulation, data keeping and concerted work.

(b) Details of Manpower (number, cost per man-months etc.)

i. Total man-months required

1 project staff

ii. No. of project staff, cost per man-months

1 project engineer/scientist (~ Rs 40k per month)

iii. Honoraria for other staff associated with the project

(A maximum of Rs. 2 lakhs honorarium for the developers & Rs. 25k for reviews)

Rs. 25k honorarium for the associated staff

(c) Details of Consumables

Procurement of various materials including polymers, metals and ceramics, grips, strain-gauge, indenter tip, chemicals, glassware, sectioning blades, diamond polishing, gold-coating, sample mounting, etc. will also eat away fund under this head.

(d) Details of Miscellaneous cost

i. Internal Review (Optional, Rs 1000 per experiment)

ii. Field Trials - N.A.-

iii. Others User testing charges for Material characterization (tensile test, fatigue, creep, instrumented indentation, microscopy, etc)

IX. Student Feedback and Learning

1. How will you collect feedback and use them?

i. We will collect feedback through feedback (online/offline) form and workshops

ii. There is also an associated email id for providing feedback

iii. An expansion or additional explanation will be added if the need arises.

2. What is the actual learning component provided by the Virtual Lab?

i. Learning is through 'pre-test' and 'post-test' along with schematics, strong theory and simulations

ii. The simulations and prompts will help the user appreciate and understand the underlying mechanisms

iii. The mechanical properties with respect to various materials as learning outcome.

3. After the Virtual Lab experience, would the student be able to perform the experiment in the real lab?
- Yes, after the Virtual Lab experience, the student will have confidence to perform the experiment hands-on in the real lab.

ANNEXURE-I

Important information for the development of Virtual Labs

(A Virtual Lab consists of 7-10 experiments)

X. Link to some sample virtual labs

<https://python-iitk.vlabs.ac.in/> <https://cs-iitd.vlabs.ac.in/> <https://plchla-coep.vlabs.ac.in/>

XI. Technology Used

- We will use HTML, CSS and Java Script (open source software) for front-end design
- For Back-end we will use JSON (open source software)

XII. Required Components for virtual experiments

- Step-by-step procedure of mechanical testing of materials
- Online manual with aim/objective and underlying theory
- Pre-test for understanding current status of user
- Simulator for assisting the learning on procedural steps and outcomes on mechanical metallurgy of materials
- Post-test for observing learning outcome after learning through virtual lab
- Related resources (web & NPTEL lectures)
- Additional help