A Proposal for Fluid Mechanics Lab

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I. Objectives of the Virtual Lab

1. To develop an understanding of fluid statics and dynamics in chemical engineering
2. To understand and use differential equations to determine pressure and velocity variation in fluid flows.

List of experiments

1. To determine the local point pressure with the help of pitot tube
2. To find out the terminal velocity of a spherical body in water
3. Determination of Cc, Cv, Cd of orifices
4. Verification of impulse momentum principle
5. To study the characteristics of a centrifugal pump
6. Determination of metacentric height
7. To find out the pressure drop when a fluid is flowing through a packed bed

II. Target group of users

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

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

- Fluid Mechanics, PCC- CS106

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

- Dr. A.P.J Abdul Kalam Technical University; KCH-351; B. Tech: Chemical Engineering
- Biju Patnaik University of Technology, Odisha; PCCH 7201; B. Tech: Chemical Engineering
- Annamalai University; CHCP 407; B. Tech: Chemical Engineering
- Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal; CM-403; B. Tech: Chemical Engineering
- Guru-Gobind Singh IP University, New Delhi; CT 252; B. Tech: Chemical Engineering

V. 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

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

Table I. Budget for < Fluid Mechanics Lab>

S. No.	Equipment/Activity	Budget # (In Rupees)
1	Laptop / Machine(computer/laptop)	2.70
2	Manpower(*project engineer/scientist*)	4.80
3	Consumables (B.P. Rubber bulb with metal valve; glass balls required, gland packing for pumps, pressure gauge etc.)	4.00
4	Contingency (set up for experiment : 1. verification of impulse momentum principle and 2. determination of pressure drop when fluid is flowing through a packed bed)	4.00
5	Honorarium for Lab Developer (Rs 20k per experiment; Ceiling of Rs 2 Lakhs per lab)	2.50
6	Miscellaneous	2.00
TOTAL		20 **Lakhs**

To be released based on the recommendation of the review committee
Note: Institute overheads not to be included in the budget

VII. **Justification of the budget requirements**

(a) Details of Laptop/Machine
A laptop/computer will be required for data-keeping.

(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
Honoraria for Faculty developing the Virtual Lab: (A maximum of Rs. 2 lakhs honorarium for the developers & Rs. 25k for reviews)
Honoraria for Other staff associated with the project

Rs. 25k honorarium for the associated staff

(c) Details of Consumables

Procurement of various equipment like Test tube for chemical reaction, beaker, Boiling tube, Funnel, Conical flask, Burette etc.

(d) Details of Miscellaneous cost

i. Internal Review (Optional, Rs 1000 per experiment)
ii. Field Trials - N.A.-
iii. Others - N.A.-

VIII. **Student Feedback and Learning**

- 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
- What is the actual learning component provided by the Virtual Lab?

  The learning component includes that student will study the analytical procedures for characterizing the properties of foods constituents and their interactions that affect the quality and stability of foods

- 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 can perform the experiment in the real lab

ANNEXURE-I

Important information for the development of Virtual Labs

(A Virtual Lab consists of 7-10 experiments)

IX. **Link to some sample virtual labs**

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

X. **Technology Used**

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

XI. **Required Components for virtual experiments**

- Step by step procedure similar to a physical lab will be drafted for the virtual lab
- Online manual with aim/objective and underlying theory
- Pre-test for understanding current status of user
- Simulator for learning the concept of food technology
- Post-test questions to check the understanding of student after using virtual lab
- Related resources (web & NPTEL lectures)
- Additional help/feedback