A Proposal for Basics of Electrical Engineering Lab

Dr. Ashutosh Tiwari
Department of Physics, REC Banda,
ashutosh.tiwari@recbanda.ac.in, 9670000024
Prof. Kantesh Balani
Department of Material Science and Engineering, Indian Institute of Technology, Kanpur
kbalani@iitk.ac.in, 9198228798

I.   **Objectives of the Virtual Lab**

- Student will be able to explain the Basics of Electrical Engineering.
- Student will be able to predict the variation of various measurable Electrical Parameters such as Current and Potential Difference.
- Student will be able to analyze the Basic laws of Electrical Engineering.

List of experiments

1. Measurement of power and power factor in a single-phase ac series inductive circuit and study improvement of power factor using capacitor.
2. Connection and measurement of power consumption of a fluorescent lamp (tube light).
3. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
4. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.
5. Measurement of Operational Amplifier Parameters: Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.
6. Study of Instrumentation Amplifier.
7. To plot V-I characteristics of SCR.
8. To plot V-I characteristics of TRIAC.
9. Calibration of AC voltmeter and AC ammeter.
10. Verification of Superposition and Thevenin Theorem.

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**
-    Measurements and Instrumentation Laboratory , PCC-EE22

IV.   **Mapping of proposed lab with universities** (minimum 3 universities)
- Dr. A.P.J Abdul Kalam Technical University Lucknow; KEE 351; B. Tech 1st year
- University of Delhi; FC003; B.Tech: Electrical Engineering
- Visvesvaraya National Institute of Technology; EEL101; B. Tech: Electrical Engineering

- Jawaharlal Nehru Technological University: Kakinada; EE103ES; B. Tech: Electrical Engineering
- Maulana Abul Kalam Azad University Of Technology, West Bengal; EE-402; B. Tech: Electrical 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 <Electrical Engineering Lab>

S. No.	Equipment/Activity	Budget # (In Rupees)
1	Laptop / Machine(computer/laptop, weighing machine, ball-mill-jars, etc)	2.70
2	Manpower(*project engineer/scientist*)	4.80
3	Consumables (various materials including polymers, metals and ceramics, set-up, test-bed, chemicals, glassware, diamond polishing, gold-coating, sample mounting, etc)	4.00
4	Contingency (die-making, cast-material, crucible machining, indenter tip, heat treatment, material processing, repair, incidentals, miscellaneous, etc)	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
Will require a dedicated microscope (with imaging capability) for metallography observations. If required, a grinding/polishing wheel may also be needed. In addition, an associated laptop/computer

will be required for data-keeping. Further, sample preparation may require tumbling mill, jars for ball mill and furnace

(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 materials (mainly metals) for sample preparation, sectioning blades/saw, and mounting consumables, grinding papers, polishing material, chemicals/etchants, machining, heat treatment, incidentals, etc

(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 (microscopy characterization, phase evaluation, surface characterization/treatment, etc)

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