Laboratory Set-up Process and Key Factors Involved to Set-Bench Marking for University

Hardeep Kumar, Mohammad Nadeem Khalid

Abstract— Laboratory set-up plays a significant role in the college in light of the fact that the greater part of the mishaps occurred because of carelessness of faculty defensive gear (PPE), poor wellbeing standards and absence of legitimate direction to understudies about utilization of machines and synthetic concoctions so there are many factors which are to be considered like health and safety for users, maintain OSHA standards[1-5], set bench marking among university, cost cutting, maximum utilization of lab's area, power saving etc. In this paper we have done complete study on lab infrastructure and also implemented in our university. As Dubai is very strict on health and safety so one more important thing is that we have followed all compliances of Dubai monitoring authorities like Dubai municipality, education department, police department and health department.

Keywords—Laboratory set-up, wastage disposal, recycling of materials, health and safety.

I. INTRODUCTION

Laboratory experiment work is nothing but to gain knowledge by looking at reality is a trial approvals of the hypothetical ideas conveyed in the talks. Understudies have a chance to confirm a portion of the thoughts for themselves, data analysis, experimental uncertainties, get a new concept.To get all expectations, lab should be set-up in such a way that it fulfills all factors i.e. segregated according to equipment, mapping with course structure, furniture set-up plan, space utilization, selection of equipment for more hands on practice, training of lab staff, environmental friendly, health and safety issues, proper lab disposal plan, cost cutting, recycling of raw materials used in labs, compliances with local governing authorities.

II. SEGREGATION OF LABS

In a university, the lab's segregations are very important as health and safety, consumptions of power utilities and mode of operations are different for each lab. There are mainly five categories for labs-

1. Labs with heavy duty machines: engineering workshop (Figure-1), aerospace lab and civil lab- in this lab, we will be installing equipment like lathe machine, drilling machine, CNC, welding machines, UTM etc.

Figure.1 Engineering Workshop

2. Hazardous chemicals lab: chemistry lab (Figure-2), forensic lab, nanotechnology lab- where analytical instruments are to be used and chemicals stored.

Figure. 2 Chemistry Lab

3. Hygienic lab: Hospitality lab (Figure-3)- here hygienic issue are involved.

Figure.3 Hospitality lab

4. High voltage 3-Pahse lab: electrical lab (Figure-4).

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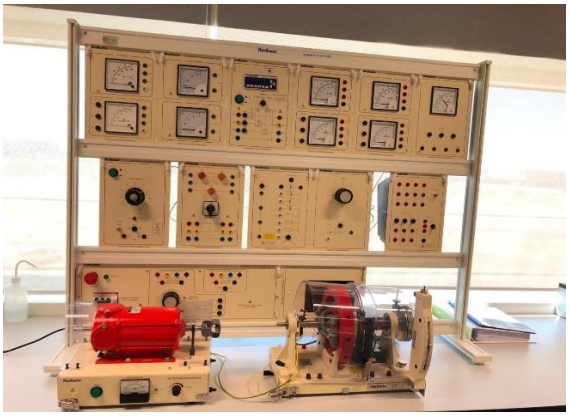

Figure.4 Electrical lab

5. Basic engineering lab: electronics lab, engineering communication lab, physics lab, solar lab, computer lab etc.

So, using proper segregation we can avoid chance of accident and proper utilization of space,

III. SELECTION OF LAB'S FURNITURE

Selection of furniture will be very important for lab users to make them comfortable and it does cost cutting as well. It is done as per the equipment and type of experiment to be performed. There are two type of experiment: few labs where students will be mostly time in standing positions like in chemistry lab and hospitality lab and in other lab proper seating is required like for computer lab, electronics lab etc.

Figure.5 Chemistry lab

As shown in above figure 5, this lab furniture set-up for chemistry lab where working in standing position. Here few things need to be considered-
Table top- 16 mm Trespa Sheet (chemical resistant material)
Table height- 90 cm (enough height for standing position)
Flooring- epoxy (non- slippery)
Sink-Polypropylene (good for chemical wash out)
Electrical socket-pedestal box (with plastic cover as water to be used nearby)
Distance between work tables- 2 meter is required for safety
Maximum capacity- 25 students
Ventilation- separate ducting is required

Figure. 6 Electronics lab

As shown in figure 6, this lab is used in seating position as experiments would be long duration. Here furniture set-up is different with below information-
Table top- 24mm thick melamine laminated plywood
Table height- 70 cm (enough height for standing position)
Flooring- normal
Sink- not required
Electrical socket-pedestal box (with plastic cover to protect from sock)
Distance between work tables- wall side arrangement
Maximum capacity- 25 students
Ventilation- normal ducting is required

IV. LAB WASTAGE DISPOSAL AND RECYCLING PLAN

This is the most important and critical plan which has to be planned during construction of building. There are many wastes coming out from lab-

1. Hazardous chemical waste for lab:

In university, chemical waste will be there wherever using the chemistry lab. There are many hazardous chemical wastes which we are not supposed to dispose with main drainage system as per government restrictions because these are not environment friendly. If there should be an occasion of any compound spills, our lab staff are set up to tell the best specialists and the pioneer of the labs comparably as use adsorbents and marvelous packs to contain such spill and reduce the time of vapors. In spite of containing and covering the spill, we increment ventilation in the zone by opening the entryways and windows to the smoke hoods. We guarantee that the labs are not squeezed for one session of primer to keep up a key decent way from catastrophes.

In determination for a secured and strong condition in labs and outside the labs, a suitable waste exchange as per UAE principles is set up and deliberately sought after. A bit of the debilitated courses of action are hurled truly to drainage as a Dilution Chamber (Figure-7) is made for the exchange [2]. While distinctive engineered creations are properly set into waste containers with names and are verified.

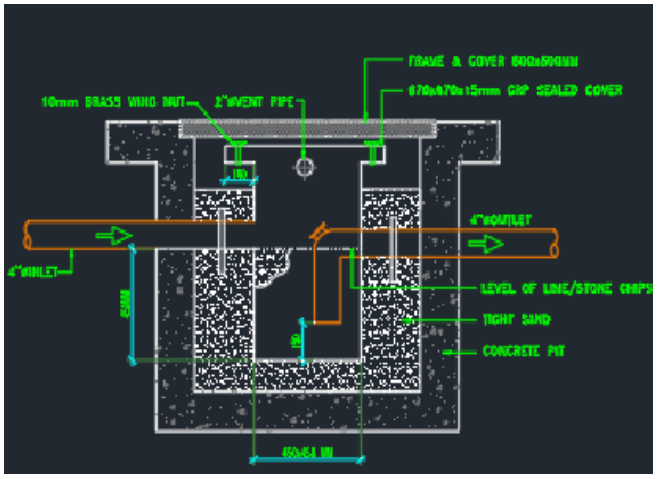

Figure.7 Chamber of dilution

The equality framework happens when solid acids, in close contact with limestone chips, respond with Calcium Carbonate (CaCO3, the crucial constituent of limestone) to shape water, carbon dioxide, and calcium salts. The going with frameworks the balance of hydrochloric dangerous by limestone [9].

$$CaCO3 + 2HCl \rightarrow CaCl2 + CO2 + H2O$$

(Equation.1)

As indicated by equation.1, in light of the closeness of other calcium things in the limestone chips regularly utilized it is altogether helpful for limestone to apply fundamental ramifications for the wastewater. The pH equity technique occurs as strong acids react with the calcium carbonate in the limestone through pleasant contact with little limestone chips. A high surface territory is vital as is adequate long contact time. The reaction isn't convenient and requires great time. Moreover, the acidic plans must be in learning contact with the limestone. Genuine upkeep of evening out is fundamental for fitting equality of squanders in the frameworks. It ought to be cleaned and put the new lime stones once it is isolated in the chamber. Oil trap for disposal of waste oily substance.
An oil trap (generally called oil interceptor, oil recovery contraption and oil converter) is a channels device (a sort of catch) planned to square most oils and solids before they enter a wastewater move system. Fundamental wastewater contains restricted amounts of oils which go into septic tanks and treatment workplaces to outline a floating refuse layer. This garbage layer is continuously prepared and isolated by microorganisms in the anaerobic assimilation process. A great deal of oil from sustenance game plan in diners can overwhelm a septic tank or treatment office, causing appearance of untreated sewage into the earth. High-consistency fats and cooking oil, for instance, fat solidify when cooled, and can get together with other masterminded solids to square exhaust channels [3].

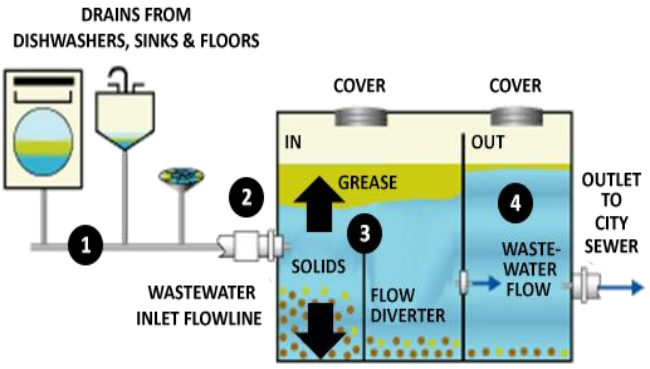

Figure.8 Oil trapper

A grease trap (Figure-8) is a long, rectangular box that is installed in the sewer line of a commercial kitchen. The point of a grease trap is to filter out harmful substances that should not make it into the sewer main. The most damaging of these substances is FOG (Fats, Oils, and Grease)

1. Recycling/ Reuse of raw materials in workshop (Figure-9):

The optimum utilization in terms of recycling and reusable is very important in the labs. By doing this we can minimize lot of wastage and cost as well [4].

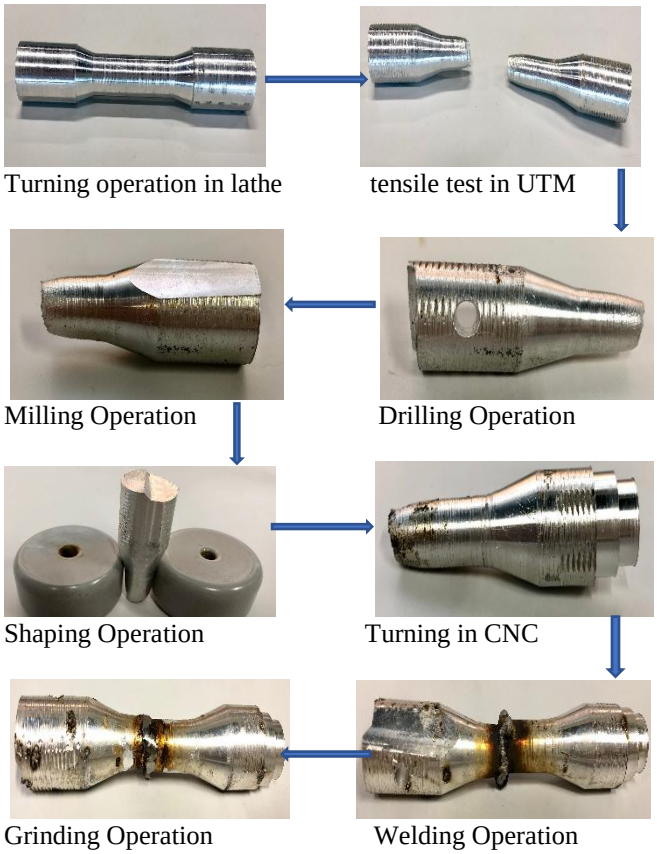

Fig.9 testing process

Our aim is to minimize the material consumption as well as the cost associated with this.

We are using the same material specimen for different practical's in mechanical and construction lab starting from turning operation where we remove the material from the specimen in such a way that the same specimen will be used for the tensile test once the tensile test is done and the specimen will break down into two pieces the same pieces will be using for welding operation where we join both the pieces together [7]. Once welding is done the specimen will go for the finishing operation where we give super finish to the specimen and the same will be using for drilling operation with specific dimensions after drilling operation the specimen will go for the shaping operation once shaping operation is done the same specimen will be using for CNC turning operation after CNC turning the specimen will go for cutting operation where we cut the specimen into two pieces and again the same specimen will be using for welding operation again[6]. In this way of using the same specimen for different set of operations in workshop we can actually save a lot with respect to time, money and obviously the material as adequately.

V. CONCLUSION

In this paper, we have considered all technical issues which are important to set up labs where all compliances are fulfilled to make labs environmentally friendly and proper waste disposal and reduce, recycling, reuse of raw materials can be utilized in a proper way. Moreover, considering the lab security is our most need so lab set-up is finished by need and endeavored to constrain any accident inside the lab. Some researchers have also discussed the use of drones for such purpose to monitor the area of the waste. This can be used in larger areas and proper planning can be done accordingly [8]. It is believed that the amount of accident in school or school can be reduced with the proper set up of labs.

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AUTHORS PROFILE

Mr. Hardeep Kumar currently working as a Lab Manager at Amity University Dubai UAE and previously worked with BITS Pilani Dubai having more than 20 years of experience in the field of Academics and Lab set-up. I have done my Masters in Microelectronic

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