Exploitation plan for

problem-based learning laboratory

Kathmandu University

Nepal

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1. Name of the lab

The name of the Lab is **Active Learning Lab.** It is situate in Department of Computer Science and Engineering, School of Engineering, Block-9, Room 307.

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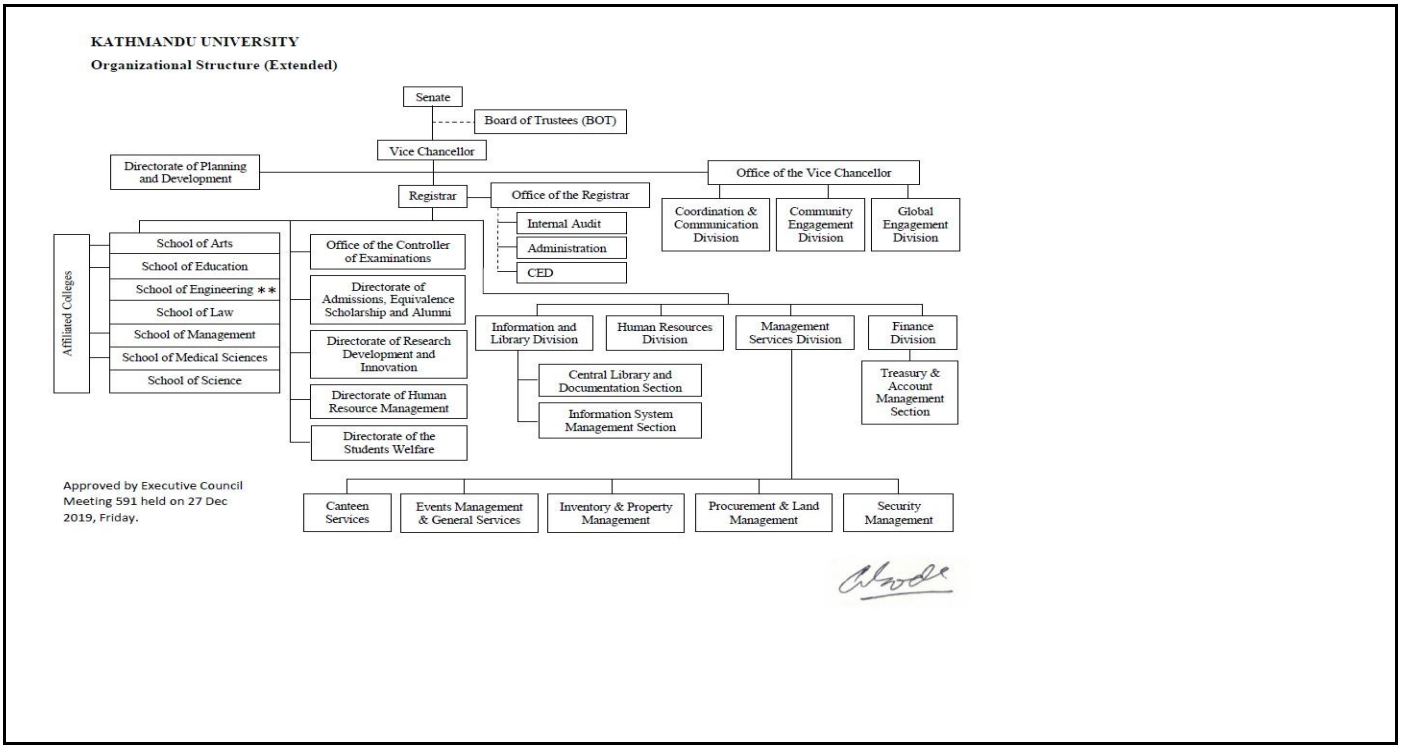
2. Faculty in which the lab belongs

The Active Learning Lab is in the Department of Computer Science and Engineering, School of Engineering and the department has assigned Mr. Dhiraj Shrestha, Assistant Professor, Department of Computer Science and Engineering , School of Engineering as the Lab Head. Mr. Shrestha will manage the resources available in the lab and report to the department.

The following organogram shows that the lab belongs to the School of Engineering of Kathmandu University.



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3. Purpose of the lab

The Active Learning Lab will be used by the School of Engineering, School of Science, and School of Management located in the Dhulikhel Premises. The Active Learning Lab will be used for the following purposes:

- Conducting the various courses offered by the school of Engineering, School of Science, and School of Management Dhulikhel Premises through problem-based learning
- Facilitating groups discussions among students enrolled in the school of Engineering, School of Science, and School of Management Dhulikhel Premises in the context of projects implemented through problem-based learning
- Conducting tutorial sessions of courses that require group discussions among students enrolled in the school of Engineering, School of Science, and School of Management Dhulikhel Premises
- Conducting instructor training sessions

3.1 Guidelines for use

The active learning practitioners in Kathmandu University are allowed to use the lab for conducting their courses. The faculties are required to take permission from the Lab Head before conducting a course. The faculties who are willing to use the resources of the Active Learning Lab need to follow the following instructions:

- The faculties need to take permission from the Lab Head before conducting the course
- The faculties should send the plan and timing 2 weeks before class delivery
- If found mishandling or harming the lab resources students and faculty will be penalized

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- The lab resources should be used within the formal university activities time schedule

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4. Examples of the use of the Active Learning Lab equipment in specific courses

4.1 Course title: Computer Graphics (Comp 342)

4.1.1 Engineering curriculum where it belongs

This is a 3rd year undergraduate course offered to students of Bachelor of Computer Engineering and Computer Science.

4.1.2 Course description

The course covers the basic concepts, mathematical foundations, fundamental theory and algorithms, software techniques, hardware and system issues, and application examples on computer graphics.

4.1.3 Number of students engaged

60.

4.1.4 Problem-based learning activities integrated in the course

Students develop mini-projects in groups of 3-4. Students select the topics that they will work on. The selected projects must include concepts from computer graphics.

4.1.5 Equipment, software and educational material used

Equipment

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- Multimedia projector
- Smart TV
- 6 workstations and3 laptops

Software

- C / C++,
- Python compiler
- OpenGL

Educational material (books, scenarios, and other sources)

- Computer graphics by Donald Hearn and M. Pauline Baker
- Computer graphics: Principles and Practices by James Foley,S.K Feiner and J.F Hughes
- OpenGL tutorials available on Internet

4.1.6 How the ALIEN equipment is used

Multimedia projector, Smart TV

The projector and Smart TV are used by students for discussion and conducting brainstorming sessions among team members. The equipment is also be used by students for the presentation of their project progress and final work.

6 workstations and 3 laptops

The 6 workstations are used by students working in groups for collaboration on their project work and for programming. The laptops are used by students for the presentation of their work.

C / C++, Python compiler, OpenGL

This open source software is used for the development of student mini-projects.

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4.2 Course title: Operating Systems (Comp 307)

4.2.1 Engineering curriculum where it belongs

This is a 3rd year undergraduate course offered to students enrolled in the Bachelor of Computer Engineering, Computer Science, and Computational Mathematics programs.

4.2.2 Course description

The course aims to build knowledge on:

- Fundamentals of operating systems
- The mechanisms of operating systems on handling processes, threads, and communication
- The mechanisms involved in memory management in contemporary operating systems
- Distributed operating system concepts including architecture, mutual exclusion algorithms, deadlock detection algorithms, and agreement protocols
- Components and aspects of concurrency management
- Programming simple operating system mechanisms

4.2.3 Number of students engaged

75.

4.2.4 Problem-based learning activities integrated in the course

Students are given a problem based on the concepts of operating systems and are asked to solve it in groups through simulations. Simulations are implemented using the C/C++, Python, or Java programming languages.

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4.2.5 Equipment, software and educational material used

Equipment

- Multimedia projector
- Smart TV
- 6 workstations and 3 laptops

Software

- C / C++,
- Python compiler

Educational material (books, scenarios, etc. and sources)

- Andrew Tanenbaum, “Modern Operating Systems”, 3rd edition, Pearson/Prentice Hall, 2008
- Avi Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 9th Edition, John wiley & Sons, Inc.

4.2.6 How the ALIEN equipment is used

Multimedia projector, Smart TV

The projector and Smart TV will be used by students for discussion and conducting brainstorming sessions among team members. The equipment will also be used by students for the presentation of their project progress and final work.

6 workstations and 3 laptops

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The 6 workstations will be used by students working in groups for collaboration on their project work and for programming. The laptops will be used by students for the presentation of their work.

C / C++, Python, Java Compiler

This open source software will be used for programming simulations

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5. More activities and courses taking place in the lab

The establishment of Active Learning lab has initiated the use of problem-based learning in the School of Engineering. The students' attitudes towards problem-based learning are very positive. Due to the pandemic, the use of Active Learning Lab was not possible, but faculties took the initiative and implemented the concept of problem-based learning in virtual mode. Seven courses offered from the department of Computer Science and Engineering have already utilized the concept of problem-based learning.

In course Computer Graphics (Comp 342), students were asked to do the mini projects for implementing graphics concepts. Students selected the project of their choice, implemented it, and presented the work to the course instructor.

In course Operating Systems (Comp 307), students were assigned problems related to different topics of process management, memory management, and deadlocks. Students were asked to simulate the problems by coding them in a programming language of their choice. Through the developed programs and simulations students demonstrated the concepts taught in lecture classes. Practical activities helped students develop a clear understanding of the subject matter.

In course System Analysis and Design (Comp 321), students were asked to work on a case study of their choice, in which they developed documents such as requirements definitions, feasibility analysis, system design, and more. Students worked in groups of 4-5 to prepare the case documents. After completing the documents, students presented their work in an oral exam. This hands-on methodology helped the students implement in practice theoretical concepts.

In course Computer Architecture and Organization (Comp 315), students were asked to design a mini computer. Upon completion, students submitted an implementation report. The project was focused on design and helped students build a clear understanding of the subject matter.

In course Embedded Systems, students were assigned a variety of projects at the end of the semester. Projects were implemented through problem-based learning approaches. Most projects focused on socket programming, but other themes of particular interest to students

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were also welcomed and considered. There was an active participation of students despite the pandemic, with project presentations and demonstrations being conducted online.

In course Algorithm and Complexity, students were asked to develop an efficient approach to solve a problem in the computer. Students used pseudocode. Students were divided into a number of different groups. The solution of every group was thoroughly discussed and explained by group members for the benefit of the whole class. The instructor discussed possible improvements and enhancements which could make the work more efficient, providing valid reasoning. The same approach was deployed in analyzing problems in terms of time and space.

In course Object Oriented Programming, each student was provided with a dedicated computer that run the LINUX operating system. Theoretical knowledge was developed through in depth discussions on probable implementations of specific problems related to the content of each course chapter in the context of problem-based learning.

The positive experience developed through the above courses led faculty members plan for the wider deployment of problem-based learning in additional subjects. The university administration decided that classes will resume in physical mode, which allows the deployment of the Active Learning Lab. An active learning workshop was conducted targeting faculty members, which resulted in higher demand by instructors from different departments on using the Active Learning Lab. In the coming semester, the following courses will deploy problem-based learning:.

Course Name	Year	Semester	Program	Teacher
Computer Programming	1	1	BE in Mechanical Engineering	Mr. Sameer Tamrakar
Computer Programming	1	1	BE in Geomatics Engineering	Mr. Amrit Dahal
Software Dependability	4	2	BSc in Computer Science	Prof. Dr. Manish Pokharel

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Engineering Economics			BE in Computer Engineering	Mr. Bibhu Ratna Tuladhar
Data Structures and Algorithm	2	1	Bachelor in Business information system	Ms. Praynita Karki
Microprocessor and Assembly Language	2	2	B.SC in Computer Science	Dr. Gajendra Sharma
Human Computer Interaction	3	2	BE in Computer Engineering	Mr. Sushil Shrestha
Software Engineering	4	2	Bachelor in Business Information System	Mr. Sushil Shrestha
Emerging Technologies	1	1	ME in computer Engineering/ MTech in Information Technology	Prof. Dr. Manish Pokharel
Machine Learning	4	1	BE in Computer Engineering	Dr. Bal Krishna Bal

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6. Resources

6.1 Equipment

The lab equipment was bought in 3 batches:

1st batch

The 1st batch of equipment was bought following a needs analysis performed by faculty members involved in the project with an interest in problem-based learning. Apple products were brought in this batch because the Apple products are typically sold by dedicated vendors.

2nd batch

The 2nd batch of equipment was bought following a needs analysis performed by faculty members involved in the project. Products from brands other than Apple were purchased.

3rd batch

A 3rd batch of items was bought based on the requirements set by new subjects integrated into the ALIEN problem-based learning intervention.

The equipment purchased is described below.

S.N	Equipment	Quantity
1	All in One PC - HP EliteOne 1000 PC	1
2	Workstation - HP Z4 Gr	1
3	Projector - EPSON EB-X05	1
4	Television set - LG 55in UHD 4K TV (55UJ652T)	1

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5	All in One Computer (MNDY2ZP/A-iMac	4
6	Dell i7 Laptop 16GB RAM DDR4	2
7	Dell i7 Laptop 8GB RAM DDR4	1

6.2 Staffing

The Department of Computer Science and Engineering, School of Engineering owns the Active Learning Lab. The Department has assigned Mr. Dhiraj Shrestha as the Lab Head. His responsibilities include the lab maintenance, arranging the schedule for conducting courses in the lab, fixing technical issues with the support of department's Lab Assistant, reporting to the department regarding the functioning of lab, reporting to the department of any necessary maintenance.

The department provides Lab Technicians for managing and maintaining the resources of Active Learning Lab when required. The department's Lab Technicians are Mr. Rajendra Banjara and Mr. Bibas Neupane. They will be supporting the Active Learning Lab.

6.3 Financial support

The main expenses required for the regular functioning of Active Learning Lab are as follows:

- Electricity
- Internet connection
- Regular lab maintenance
- Lab management
- Upgrading of Lab equipment
- Purchasing additional equipment for problem-based learning

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The Department of Computer Science and Engineering, School of Engineering owns the lab and all the costs related to the lab will be covered by its regular budget. The Active Learning Lab will be used for the conduction of courses in problem-based learning mode. The department will not hire separate staff for but assign existing staff members for supporting the lab. The department will allocate funds for lab maintenance and, when required, additional resources for purchasing new equipment.

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