CAREER EPISODE 1

a) Introduction:

1.1 The aforementioned career episode is created to provide a detailed explanation of an innovative engineering project "Design, Fabrication, and Testing of the Kitchen Waste Module". This project was conducted to fulfill the requirement of the 7th-semester Group Project at Thapathali Engineering College, which is situated in Thapathali, Kathmandu, Nepal. Here, I worked along with three other group members performedunder the guidance of Er. Sudan Neupane. All project activities were carried out in the Department of Industrial Engineeringfrom November 2016 to May 2017.

b) Background:

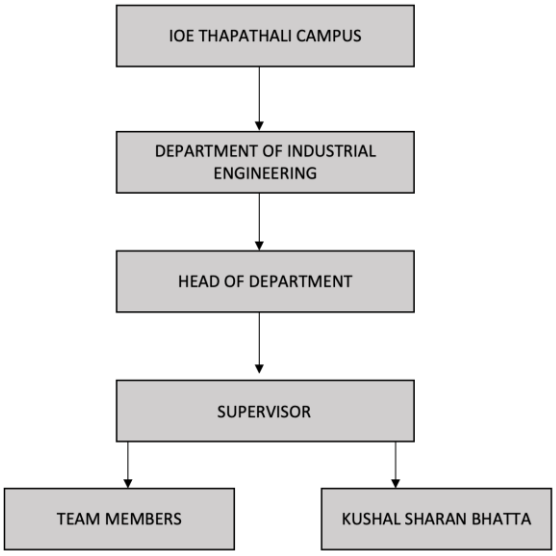
1.2 Research has shown that kitchens and households consume around 87% of the total energy for various operations. The most common resources utilized are charcoal, firewood, crop residual, petroleum products, and cow dung to produce approximately 0.3-0.5 kg of LPG gas per daily depending on the family size. No doubt, LPG gas has become an extreme waste of non-renewable energy and huge money. In this need of the hour, we have to propose a unique and sustainable solution to reduce energy consumption and cost. Thus, to overcome this global rising issue, an alternate option was proposed i.e. development of hybrid biogas.

1.3 This biogas project was performed by combining a sealed-floating type of digester with a fixed dome type digester. To carry out designing work, food wastage from the university's canteen and some cow dung was collected. This waste was used as a digester to produce gas. Furthermore,a 200-liter drum was also used to make a sealed type digester, and it was connected with a 12.5-liter floating type digester and covered by 7.5 liters of water displacement tank on the top. After this,a water displacement tank was placed on top to allow upward movement of waterafter the generation of gas in the floating type digester. Furthermore, this hybrid sealed–floating type digester was assembled to fix the dome-type digester.

1.4 The whole process was performed in a warm environment for better production of gas. Insulation, temperature control, regular feeding and stirring, high concentration of

slurry, and desulphurization were other major factors that were kept into consideration for effective and efficient outcomes.

1.5 To represent my position, I made the following figure:



1.6 I was tasked to perform the following duties:

- Conducted a detailed background study on my project and proposed a research methodology.
- Designed the series combination of sealed- floating bio-digester with the fixed dome of bio-digester using Solid Works software.
- Constructed the sealed-floating types of bio-digesters assembled with fixed dome type of bio-digester.
- Collected kitchen wastes from the kitchen for biogas generation
- Procured the required materials needed for the overall project.
- Prepared the report and slides for the group project presentation.

c) Personal Engineering Activities:

1.7 At first, I underwent comprehensive research on biogas digesters for industrial purposes, their significance, designing procedures, etc. I studied different research articles on the recovery of energy from kitchen waste to reduce around 30 to 40 % cost. Furthermore, I studied energy recovery projects proposed and implemented in Nepal, and how they proved to help generate electricity in industries. Besides these, I also reviewed several research papers to understand findings in past years regarding bio-gas.

1.8 After this, I attended the group meeting to discuss different processes of the project,

i.e. materials selection, domes type selection, dimension, cost range, designing, calculations, and analysis. For that, I studied various recommended engineering books such as material, science, metallurgy; metrology and measurement, and maintenance engineering. Moreover, I also proposed a research methodology that covered both qualitative and quantitative methods.

1.9 After the kick-off meeting, I conducted a market survey to select the most economical mechanical shops to buy required items. For this purpose, I visited different vendors' shops and communicated with them to check their rates for each item. Then, after discussion with my teammates, I selected the vendor which was providing cost-effective and quality items, i.e. I selected 200 litersof gallon drum, 120-liter drum, 1/2" CPVC pipe, CPVC tank nipple (1 inch), CPVC female elbow (1½ inches), CPVC M socket (1½ inches), CPVC Ball valve (1½ inches), gram M-seal (25 inches), Buckets, Epoxy and jar, plastic foam (3m), gas pipe, regulator, gas nozzle male, gloves, paintbrush, pressure gauge, C.I tee, and tee connector.

1.10 After this, I collected the specific amount of kitchen waste from the university's canteen and cow dung from Maitighar, which was very crucial to select the proper type of waste and mix it with water at a proper ratio of volume. Thus, I carefully measured the volume required. For this purpose, I studied energy, technology, and power subjects to identify the C:N ratio of food waste and cattle manure, which was selected as 15:1 and 25:1 respectively.Afterward, I removed the impurities from the waste, and then I dissolved the feeding into the water. I considered the feeding ratio of kitchen waste and cow dung as 1:3and 1:1 respectively to the volume of water. After mixing them, I steered it properly with the steering rod.

Figure 1 Steering of feeding

1.11 Now to start the slurry removing process, I decided to combine sealed type-fixed dome and floating dome types of digesters. For that, I connected 200 liters of sealed type digester with the floating type of digester. However, there was a chance of movement of undesired impurities into the digestor, which is called a slurry. For removal of this slurry, I used a slurry flow pipe in a sealed type digestor. Thus, it removed slurry from sealed type digestor. According to the research, 80% of energy is contained in digester while the remaining 20% of energy is contained in slurry. Thus, I connected two of these digesters so that energy contained in the slurry could be utilized. Moreover, to produce additional gas, I connected a 20-liter water jar which was operated by generating hydraulic pressure related to the difference in columns level.

1.12 Next, I designed the 3D model of overall bio-digester in Solid Works software by selecting anaerobic process(hydrolysis, acidogenesis, acetogenesis, and methanogenesis), which included both sealed-floating type and fixed dome type digester.

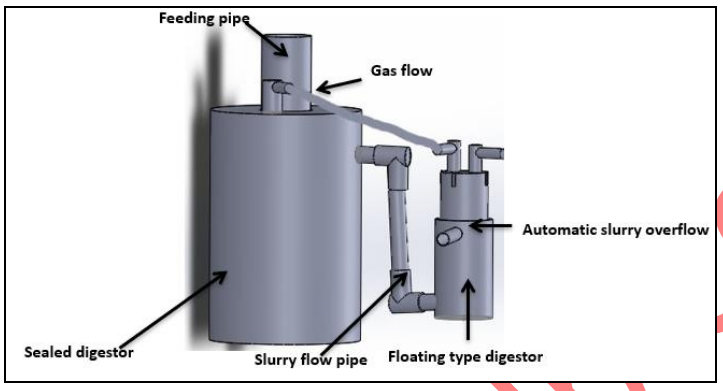


Figure 2 Sealed and floating hybrid digestor

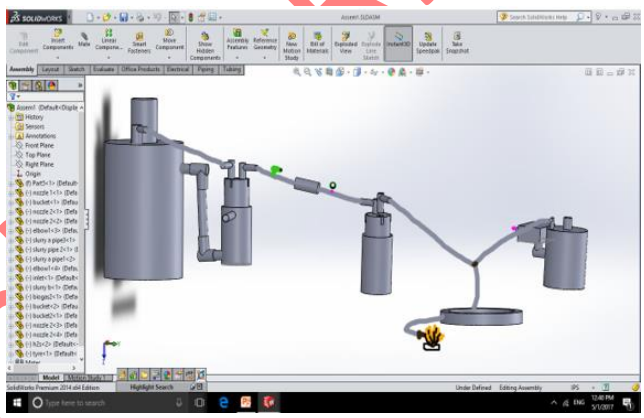


Figure 3 3D model of Bio-digester

It consisted of a water tank as a digestion chamber, with a smaller tank inverted and placed inside the larger tank that acts as a reservoir chamber, rising with gas production. I also installed a floating-drum bio-digester consisting of a digester and a moving gas-holder. The gas-holder floated either directly on the fermentation slurry or in a water jacket of its own. The gas was collected in the gas drum, which moved according to the amount of gas stored. Then, I attached the guiding frame by installing it to avoid tilting the gas drum. If the drum floats in a water jacket, it cannot get stuck, even in a substrate with high solid content.

1.13 During this type-1 stage, I performed a few mathematical calculations to determine feed requirements. I first determined the volume of sealed type digester with the equation: $\pi*r^2*h = \pi*(29)^2*90/1000 = 240$ liters. Then, I calculated the volume of small[4]

floating type digester (Vs) and volume ofsealed type digester left for gas storage, which were obtained as 12 litersand 40 liters respectively. I subtracted these two obtained values (20 – 40) to obtain the usable volume of sealed type digester (V_b)i.e. 200 liters, Thus, I obtained the total volume of digester used for feeding slurry (V_d)as 212 liters. After volume calculations, I assumed the weight of kitchen waste, cow dung & water (1:1 ratio), the weight of water used in the kitchen (1:3 ratio), and the weight of bacteria culture to be 32 kg, 76 kg, 96 kg, and 1 kg respectively.Then,I added all these weight values to calculate the mass of feedstock used in type-1 (Fs = 76 +32 + 96 +1 = 205 kg). Hence, the overall gas yield in type-1 bio-digester was determined from the formula: Gy = V_d/Fs =212/205= 1.034 litre/ kg.

1.14 In the type-2 stage, I attached a fixed-dome plant consisting of a digester with a fixed, non-movable gas holder, which was placed on top of the digester. When gas production started, the slurry was displaced into the compensation tank. Here, gas pressure was increased after storing gas volume in the digesterand the height difference between the slurry level in the digester and the slurry level in the compensation tank.

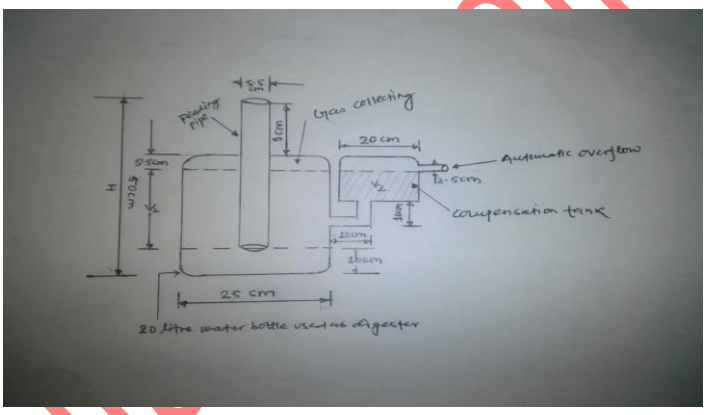


Figure 4 Fixed dome type digester

After installation, I determined the volume of sealed type digester (V_1) to be used for decomposition which was 0.012517 m^3. Then, I also determined the volume of the collecting tank to be used for activating the slurry in the sealed type digester (V_2) by assuming 60% of V_1. Since the Consumption of biogas stoves in Nepal is 250 liter/hr.Therefore, I obtained the consumption of active volume as 1.802 min. After this step, I computed the total usable volume of type-2 bio-digester by using the equation:

Vs = Volume of digester + Volume of compensation tank

Now by considering the weight of feedstock used in type-2 bio-digester, Fs (1:1) as 22 kg, I obtained a gas yield (Gy)of 0.9276 liter/kg.

1.15 After construction, I was instructed to calculate overall energy reduction and cost-saving, so that we can prove it as a cost-effective and innovative industrial project. For this, I first calculated the amount of heat required to boil 1 kg of water which was 2594.88 KJ. Then, I determined the volume of biogas required to boil 1L of water and the volume of LPG

gas required to boil 1L of water (0.1128 m^3 and 0.03126 m^3 respectively), so from these calculations, I noticed that the stove efficiency of LPG gas is 53% and biogas is 44%. After this, I conducted energy calculations, i.e. sincethe energy produced by 0.05898 $m^3$of LPG gas is equivalent to that by 0.25636 m^3 of biogas, so LPG gas cylinder contains 14.2 kg of gas i.e. 27.83 l of LPG (calculated using a standard conversion of LPG gas). Then, according to the calculations, I obtained an overall gas yield of 1.9616 liter/kg. Next, I applied the unitary method to calculate the requirement of the LPG cylinder. As total waste collected from our campus (ThapathaliEngg. Campus) canteen was 10-12 kg/day and by assuming 10kg/day of average waste collection, I came across that an industry can save up to 5 cylinders of LPG gas per month through implantation of this model.

1.16 During the time of formation of gas in the Sealed-floating dome digestor, it was very important to purify it from H_2S. Desulphurization was very essential to prevent corrosion of the metals. For that,the ferrous absorbing agent was needed at the bottom to leave the container with purified gas at the top. However, it was challenging for me to get a ferrous absorbing agent in the sealed pipe. Finally, after research, I came to know that an aluminum dishwashing cloth can work as a ferrous absorber. But it was necessary to keep an aluminum dishwashing cloth in any closed bucket. To sort out that issue, I made a hole in two corners of Horlicks plastic bottle, and an aluminum dishcloth was kept inside it. Then, I connected pipes in two corner holes of Horlicks bottle in such a way that gas would only pass after leaving H_2S gas behind.

1.17 Even after desulphurization, I found out it was very crucial to remove other impurities like carbon dioxide. To solve that issue, I researched and figured out that a floating type of filtration is necessary. Thus, I used a floating type filtration tank made from a bucket. For that, I made two holes at the top of the small bucket and fitted a nozzle and pipe on both sides so that from one hole a desulphurized gas could enter. Next, from other holes, decarbonized filtered gas could pass. I learned from the chemical engineering subject that methane doesn't dissolve in water whereas carbon dioxide can easily dissolve. Thus, in the bottom bucket, I filled water so that carbon dioxide could be absorbed and methane could easily pass through. In this way, I along with group members completed the filtration phase. After this, I kept all the produced gas in the Car tyre tube.

1.18 During the time of model design, using Solid Works, I faced issue while assembling joints like the slurry pipe and pipe fittings/connector. As several elements were needed to be connected, during the time of design, it was necessary to join all the elements properly. However, specifically when I was trying to connect slurry pipe with fittings, it became complicated and time consuming. I was having trouble in adjusting ends of several parts consisted of different ending corners. I discussed with other team member, read the Design of machine book, and watched YouTube videos; concluded that Mat expert tool was important to sort out the mating affected region. After applying Mat expert tools, and then followed by Feature manager, I observed red cross sign. These cross points meant to be a fixed point, which had stopped the further mating process. I then used the View mates to sort out mater. Moreover, I also found the possible unsuppressed mates by observing the freedom degree. Later. I found the fixed joints by putting unlinked part temporarily suppressed. After that I finally joined them by shifting the fixed joint to connecting points.

1.19 This project required time management, therefore, I prepared a time scheduling plan in the MS-Excel sheet containing information like activities, actual duration, starting & ending dates, and proposed duration. Moreover, I also participated in preparing the Gantt Chart report of the whole project schedule. I created the Excel file recording all the data of the estimated time. Then, based on recorded data, I used the same Excel app to create the Gantt chart report.

1.20 I also developed a communication plan intended to ensure coordination and communication between each project member. I obeyed ethical regulations while dealing with my teammates and equally distributed each task among them. I arranged weekly meetings to check our work and discussed solutions to the issues which were encountered while performing our tasks. I listen to all the valuable suggestions given by each member, and then we mutually selected the best option. I also helped my team in their tasks. It was a group project so I tried my best to coordinate with each member.

1.21 I submitted weekly progress reports to provide the status of ongoing tasks and results of accomplished tasks. Then, I discussed the reports in detail in weekly meetings with my supervisor. I carefully listen to each suggestion given by the supervisor to show myself as a responsible team member. Then, I finally made a thesis document to fulfill the project requirements.

d) Summary:

1.22 The project helped me to learn about the biogas project in an extreme manner, which includes its types and benefits. After doing the project not only did I build up my team collaboration habit but also learned critical thinking. Moreover, I also got the opportunity to sharpen my design and mechanical skills. Besides these, it also provided inner confidence to tackle the risk and grew my quality of research and identification.

1.23 The project was completed within the time frame and was later submitted to the Department of Industrial Engineering. Moreover, I participated in a group presentation, which helped me further to raise my communicating and presenting skills. Not only the response from the examiner was brilliant but the research even got published in Engineers for Nepal.

CAREER EPISODE 2

a) Introduction

2.1 The aforementioned career episode is based on my internship training program named OJT which stands for "**On the Job Training**" and it is one-on-one training located at the job site. I performed my training work at Trade Strategy Nepal (TSN) PlastcarePvt. Ltd, which is located in Patan Industrial Area, Lalitpur, and it was carried out to fulfill the requirements of a Bachelor's degree in Industrial Engineering. During this training tenure, I acted as aninternal auditor for ISO 9001:2008 for the TSN Plastcare and assessing in machine operations in the production department.The duration of OJT was 90 days, which means it was commenced inMay2017 and completed inSeptember2021.

b) Background

2.2 TSN CORPORATION is one of the major organizations in the corporate sector of Nepal and it works in various sectorslike manufacturing, agriculture, technology sales, international trading/FMCG, education, healthcare, and energy.It mainly focuses on the production of PET plastic bottles by using three main machines: injection mold machine, film blowing machine, and blow molding machine.TSN Products provides protective barriers in both ways by stopping the oxygen to enter from outside and keepingthe carbon dioxide frommottled the end product. In Nepal, the TSN provides the best packaging products like bottles, containers, jars, closures, and packaging films. I worked as an Engineering Intern for 90 days in TSN Plastcare. At the start of my internship, sufficient training was provided related to organization operation, industrial safety, quick check, file reporting, and inventory/ stock management.

2.3 In 2017, TSN Plastcare got its ISO 2008 certification, however, despite this certification, there were a few problems identified by the company's manager, such as:

1. Inadequate and poor maintenance of infrastructures in a few places.
2. No record of inspection of procured material
3. No record of employee training
4. Unavailability of monitoring and measuring equipment,
5. The breakdown schedule for different machines is still missing,
6. Targets were not set for improving the effectiveness of the maintenance process in the organization,
7. Unavailability of proper record of raw materials ratios, etc.

Hence, it was required to rectify all the identified problems to create a new QMS model for the next 25 years. For this purpose, it was decided a create a revision of ISO 9001 (by upgrading the ISO 9001:2008 to ISO 9001:2015), starting with the new QM principles. Besides, this internship also provided training on assessing machine operations in the production department.

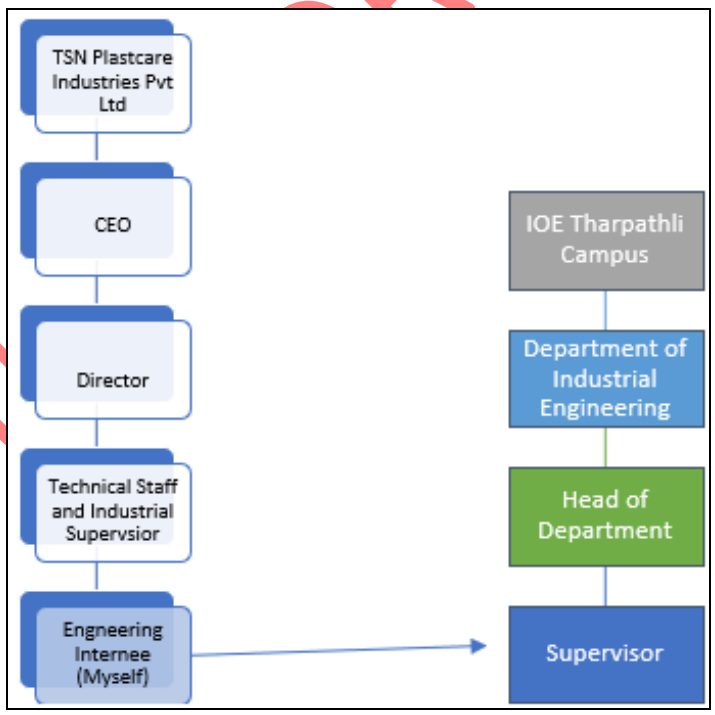
2.4 The primary purpose of this internship was to train, acquire skills and make acquainted

students with the real industrial working environment before they begin their professional careers. Also, to get information about the production process, maintenance, and manufacturing process. To get a clear understanding ofthe Quality Control and assurance system.

2.5 My main duties related to the project are the following:

- Conducted an industrial visit to understand its manufacturing process.
- Performed internal auditing by collecting primary and secondary data to check out the root cause of the issues.
- Carried out systematic inspection of equipment to detect potential problems in root cause analysis and corrected to prevent equipment failure.
- Calculated the stocks of products.
- Surveyed productiondepartment to analyze machine operations and maintenance work
- Implemented quality assurance strategies for product and breakdown maintenance.
- Implemented store management policies and managed logistics.
- Provided recommendations to overcome the encountered problems.

2.6 The followingchart is the visual description of my position.



c)Personal Engineering Activities:

2.7 In the first week of the training, I attended kick-off meetings where all internees were invited by the supervisor to explain to us the company's different manufacturing processes, department, vision, mission, etc. Moreover, I also surveyed the whole industry to observe the packing process of performing, bottles, Jar/containers, closures & packaging Films.Also, during the week, the supervisor assigned mea few tasks which were necessary to be done for a defined duration to complete the training program requirement. I attentively listen to the tasks assigned to me and also discussed them with operational staff to develop a good friendly relationship with them.

2.8 During the initial meetings, the supervisor explained the ISO certification advantages, however, I found out that despite the latest ISO 9001:2008 certification process, various problems were still left which were affecting the industry's reputation in the market. Therefore, in this OJT program, it was required to identify all the problems by carrying out internal auditing and then propose a suitable solution to close earlier ISO lacking statements and to study different terms, properties, and functions of ISO 9001:2015. Moreover, I was also tasked to learn aboutthe working of different machines and assisted in the machine's operation as per the supervisor's instructions.

2.9 My first task was to collect primary data by direct observation, i.e. I observed different machines present in the plant for several days and tried to figure out the mechanical process and related problems. Moreover, I also communicated with personnelinthe industry from machine operators to plant managers, and asked different questions relating to manufacturing & packaging to get a clear understanding. Furthermore, I studied machine manuals which help me to understand the process and the principles lying within it. I thoroughly went through the maintenance manuals, records, and reports to gain overall knowledge about the plant.

2.10 Hereafter, I collected secondary information by carrying out internet research. I studied different case studies on internal auditing, ISO certification, and root cause analysis. I also read out the solutions proposed in these case studies to increase industry profits and productivity.

2.11 After the data collection, my next task was to conduct a physical examination of the products to check if the products produced were of good quality or not. For this, I had to check the diameter and lengths of the products along with temperature variation and error for temperature calibration of the machines with that of the valid thermometer.I was also given the responsibility to count the number of stocks of products produced. Products include caps, preform, and plastic thin film. Caps were mostly of two types; TSN and GP printed in different colors. Then, I prepared preform of different diameters; mostly 11mm diameter and 12.5mm diameter according to demand and did stocks of Product calculation after every hour.

Table 1Potythine Film record.

Miti	Date	Production Detail	Unit	Voucher No	Lot No:	Raw Material Used	Quantity Production	Batch No:
2074-04-17	01/08/2017	Polythine Film (Rc	Kg/Pcs	84	38/17	419.29	410.90	0417R
2074-04-17	01/08/2017	Polythine Film (Rc	Kg/Pcs	86	38/17	273.67	268.20	0417R
2074-04-18	02/08/2017	Polythine Film (Rc	Kg/Pcs	90	38/17	401.94	393.90	0418R
2074-04-18	02/08/2017	Polythine Film (Rc	Kg/Pcs	92	38/17	263.88	258.60	0418R
2074-04-19	03/08/2017	Polythine Film (Rc	Kg/Pcs	95	38/17	392.45	384.60	0419R
2074-04-19	03/08/2017	Polythine Film (Rc	Kg/Pcs	97	38/17	289.59	283.80	0419R
2074-04-20	04/08/2017	Polythine Film (Rc	Kg/Pcs	100	38/17	396.53	388.60	0420R
2074-04-20	04/08/2017	Polythine Film (Rc	Kg/Pcs	101	38/17	383.16	375.50	0420R
2074-04-22	06/08/2017	Polythine Film (Rc	Kg/Pcs	103	38/17	234.39	229.70	0422R
2074-04-22	06/08/2017	Polythine Film (Rc	Kg/Pcs	104	38/17	280.71	275.10	0422R
2074-04-23	07/08/2017	Polythine Film (Rc	Kg/Pcs	108	38/17	161.73	158.50	0423R
2074-04-24	08/08/2017	Polythine Film (Rc	Kg/Pcs	116	38/17	273.16	267.70	0424R
2074-04-25	09/08/2017	Polythine Film (Rc	Kg/Pcs	119	38/17	382.76	375.10	0425R
2074-04-25	09/08/2017	Polythine Film (Rc	Kg/Pcs	123	38/17	286.43	280.70	0425R
2074-04-25	09/08/2017	Polythine Film (Rc	Kg/Pcs	124	38/17	212.35	208.10	0425R

Table 2 Bottle cap production data

Miti	Date	ProductionDetail	Unit	Voucher No	Lot No:	Raw Material Used	Quantity Production	Batch No:
2074-04-17	01/08/2017	Bottle Caps(28mm)	Kg/Pcs	82	4/9k	255.00	170,000.00	0417
2074-04-18	02/08/2017	Bottle Caps(28mm)	Kg/Pcs	88	4/9k	150.00	100,000.00	0418
2074-04-19	03/08/2017	Bottle Caps(28mm)	Kg/Pcs	93	4/9k	270.00	180,000.00	0419
2074-04-20	04/08/2017	Bottle Caps(28mm)	Kg/Pcs	98	4/9k	240.00	160,000.00	0420
2074-04-22	06/08/2017	Bottle Caps(28mm)	Kg/Pcs	102	4/9k	105.00	70,000.00	0422
2074-04-23	07/08/2017	Bottle Caps(28mm)	Kg/Pcs	105	4/22k	255.00	170,000.00	0423
2074-04-24	08/08/2017	Bottle Caps(28mm)	Kg/Pcs	111	4/22k	255.00	170,000.00	0424
2074-04-25	09/08/2017	Bottle Caps(28mm)	Kg/Pcs	117	4/22k	195.00	130,000.00	0425

2.12 Then, I reviewed the daily checklist of the machines which contained the following details, i.e. CLIT- cleaning, lubricating, inspection, and tightening of each machine needed. Similarly, I checked the temperature of the machines. Also, I studied the current preventive maintenance schedule to check the details related to cleaning, lubrication, oil changes, adjustments, repairs, inspecting and replacing parts, and partial or complete overhauls that are regularly scheduled. From this, I found out that the following calibration data was done during ISO auditing.

- Name of the Thermometer: Digital Thermometer
- Location of the Thermometer: Hopper of Pets mold machine M2
- Date of Calibration: 2074/02/25 B.S
- Certificate number of Master Thermometer: TERRIS 8038
- Validity of Master Thermometer.

Table 3 Temperature calibration record table

Date	Thermometer Reading	Master Thermometer Reading	Result(+/-)	Action to be taken
2074/02/25	130°c	132	-2	
2074/02/25	131	133	-2	
2074/02/25	132	134	-2	
2074/02/25	132	134	-2	

2.13 After this, I checked the breakdown record of the injecting machine. In the pet injection molding machine, there was a neck breakdown in the preform. I found out its main water supply pipe was blocked. To find its root cause, I came across this water pipeline that was blocked due to excessive heat in the water. The excessive heat was caused by the insufficient cool air provided by the chiller. Moreover, this chiller was taking more amount of hot air from the atmosphere. Hence, the root cause was the lesser number of ventilation available in the room. Thus, I suggested ventilation should be installed or the roof of tin should be lifted a bit higher. But, after inspecting other machines, I noticed thatthe breakdown schedule for different machines was missing, and because of this, I didn't inspect the calibration or working of the machines. I collected the following results from breakdown analysis of the machine:

1) Corrective Measures Taken for Maintenance of Machinery Record of Machine Break-down

- Name of the machine: Pet Injection Moulding
- Date & Time of Break-down: 2073/11/02
- Reason for Break-down: Because the fan stopped working properly

Solutions applied: New fan was installed in hoper
Duration of Breakdown: 5 days.

2) Corrective Measures Taken for Maintenance of Machinery Record of Machine Break-down

- Name of the machine: Plastic film blow machine
- Date & Time of Break-down: 2073/12/20
- Reason for Break-down: Because of relay defect due to variation in voltage in the main line

Solutions applied: New relay was installed
Duration of Breakdown: 3 days
Measurementswere taken for its maintenance: New relay must be installed

2.14 Afterward, I did stock management based on the FIFO (First in and First out) "FIFO" stands for first-in, first-out, meaning that the oldest inventory items were recorded as sold first but did not necessarily mean that the exact oldest physical object was tracked and sold. In other words, the cost associated with the inventory that was purchased first is the cost expenses first, and also based on FEFO (First expired first out). I properly checked the batch numbers during supplying and lot numbers while receiving raw materials. In addition, I checked the condition of the room floor, wall, light, temperature, and moisture.

Figure 5 Stock Management

2.15 Then, my next task was to visit the logistics department. Here, I came across that various materials like sample products, goods were needed to be sent to the receiver by airways or roadway. Also, I prepared and sent confidential letters to the cargo officers which were needed to be sent to foreign countries, especially China. However, during this process, I found out that the record of the maximum material was not kept in the form of any report due to negligence of the workers and auditing persons, which caused a lot of issues during the delivery of the material. Also, no proper inspection was done to check the quality of procured materials.

2.16 After completing the above-assigned tasks, I arranged a meeting with the supervisor to discuss the auditing results and problems which were identified during this process. I explained that during my internal audit of the ISO 9001:2008, I found various lacking.

1. Employees of different levelswere not provided scheduled training.
2. There was no good management of keeping different records of maintenance, quality, CLIT, and batch-lot number.
3. There were still missing high-level techniques required to keep records
4. There was no proper duty and responsibility divided for the specific employee and post.
5. There was lacking an HVAC system in the production area. So, I recommended proper HVAC installation and there were only a few meetings held between employees regarding various topics.
6. The proper security management was still missing like the use of identity cards, and sensor registration machines.

2.17 Hence, based on the above-identified problems, I provided the following recommendations:

1. CMMS stands for "computerized maintenance management system". A CMMS is software that helps maintenance teams keep a record of all assets they are responsible for, schedule and track maintenance tasks, and keep a historical record of work they perform. CMMS software must be used for proper maintenance breakdown records and implementation.
2. Since ISO 9001:2008 was going to expire till 2018 AD, I recommended the upgrading of the current ISO to ISO 9001:2015. For that proper teamwork and training from a consultant,the auditor is needed.
3. Development of systematic preventive maintenance schedule (weekly, monthly) for different machine schedules.
4. Internal audit training to be carried out by trained auditors. The auditor schedule should be available.
5. Proper test report of preform, caps, plastic.
6. The breakdown Report checklist should be done every day.
7. A laser sensor temperature measuring device should be bought for proper calibration of temperature.
8. Supplier grading should be done properly and customer complaints should be solved and recorded.
9. During Root cause analysis, I found that due to fluctuation of the mainline various parts of machines got damaged, thus Automatic voltage regulator should be installed underthe proper guidance of an electrical engineer to avoid huge loss in production and money.
10. The status label should be put into finished products and not be kept directly on the floor.

2.18 I submitted the list of recommendations to the supervisor and also discussed it with my teammates. The supervisor appreciated my efforts. During my internship,I communicated with the team regularly to create a friendly environment. I also interacted with maintenance staff and observed their working strategies, which increased my knowledge relating to the maintenance of products and equipment.

2.19 After completion of every week, I attended a meeting where I presented the progress of my tasks and possible outcomes. Moreover, in the questioning and answering sessions, I gave answers to all questions asked by the supervisor and industrial expert with confidence by giving logical reasoning. I submitted a weekly progress report covering all the details of my auditing work.

2.20 After completing the internship, I prepared a report to jot down my experience and learnings.I understood the measures for the improvement in current production, quality control, ISO auditing and assurance, and maintenance system. I learned different technical and managerial skills required to tackle problems occurring in the plant.

d)Summary

2.21 This internship was very helpful to enhance my professional skills and knowledge. By interacting with different professionals and experienced persons I got a lot of knowledge and information related to different machines. This work increased myconfidence and self-esteem. I learned about the documentation root cause analysis,and breakdown analysis, which provided me the opportunity to find out the faultsby doing this I also learn about how to find faults and how can I minimize the impact of that fault.I also learned procedures of ISO internal audit, quality check, machine operation, logistics, etc.This project was a great opportunity for me to act as an internal auditor for ISO 9001:2008 for TSN Plastcare.

CAREER EPISODE 3

a) Introduction:

3.1 The aforesaid career episode is created to illustrate my roles and duties as a Project Supervisor to conduct and monitor industrial construction and machine installation work for "**Prefab Mechanical Industrial Plant Construction**" at Pharmapack Pack, situated at Chunikhel, Lalitpur. For this big project, the CEO of TSN Corporation collaborated with the CEO of Lomus Pvt Ltdand aimed to construct a factory that could manufacture Plastic bottles for pharmaceutical purposes. While performing On the Job training in TSN Plastcare, the CEO of TSN corporation got impressed by my technical industrial skill and assigned me to monitor all ongoing activities in the Pharmapack project. I worked on this project from September 2017 to January 2019.

b) Background:

3.2PharmaPackis a two-stored steel-structured prefabricated building. This company was constructed to manufacture the bottles needed for medicine and pharmaceutical products. In this project, it was my responsibility to assure the quality of cement, gravels, stones, steel, rods, the volume of the mixture, etc. concerning with the site civil engineer from the contractor side and to perform machine installation work and electrical work for the industrial plant where the bottle and other products were going to manufacture.

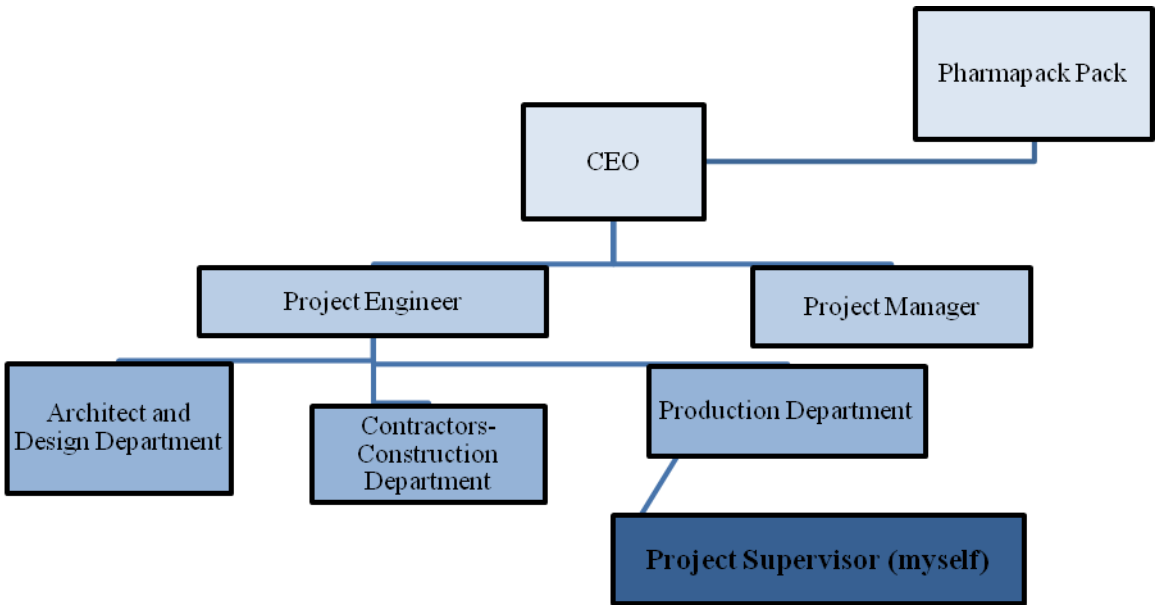
3.3 The purpose of this projectwas to construct a metallic prefab mechanical industrial plant construction. In this project, 30% of work was consisted of metallic fitting, raw material inspection, contractor performance evaluation, public/official relationship, whereas 40% of work comprised of HVAC and machine installation, pipe fitting, electrical wiring (2phase/3phase), maintenance breakdown/root cause analysis, and solution. Lastly,the remaining 30% includesinitial personal training of machine operation from the experienced trainer of the machine supplier company, testing of the machine,procurement, daily checklist, logistics supervising, CLIT(Cleaning, Lubricating, Inspection, and Tightening of Machine), and production of pharmaceutical bottle.

3.4 The key objectives were to acquire learning about steel structured building construction, costs, different governmental&nongovernmental official work, and consultancy office involved during the process of building construction.

3.5 My roles and duties are as follows:

- Ensured effective management of assigned internal and external resources towards the common goal of quality and timely delivery of services.
- Inspected plant layout and checked design for factory construction at the real site and certification at the Metropolitan office.
- Installed HVAC (Heating, Ventilation, and Air Conditioning), machines, electrical wires, pipes, water storage, and sanitary system.
- Worked in coordination with the government offices, and assist different engineers (Electrical, Architect, Civil) in the completion of project work.
- Inspected and observed the mechanical activities, such as welding, Not-bolt, fitting, tightening, etc.
- Identified the risk and determined the strategic solution- troubleshooting.
- Assisted in legal and logistic documentation.
- Inspected the quality of the raw material used by the contractors.
- Prepared progressive reports and compared contractor's bills with the Bill of Quantities (BOQ).

3.6 I made the following hierarchy to show my designation as a supervisor.



c) Personal Engineering Activities:

3.7 In the initial phase, I interacted with the associated engineers, senior-level officials, and staff to gain an understanding of the layout of the building and the project's nature. Moreover, I studied the published and processed materials reports collecting the necessary information, i.e. I reviewed various forms of official documents and books onprefabricated metallic building construction. I did internet surfing to understand techniques to maintain the quality

of the construction site.

3.8After this, I arranged a meeting with the contractors (Yuwa Construction Company) because I was accountable to inspect all the work done by them. In this meeting, I also invited government officials and architectural engineers to finalizetheindustrial plant layout designs. For this purpose, I first reviewed the 2D and 3D designs of industrial plant layout and compared them with the technical guidelines mentioned in the documents as land surface, i.e. land border and local official land rules were a major concern, Moreover, I also kept in mind social/public values since the industry was going to be constructed in their area. I made sure that there would be no sound pollution, air pollution, or any environmental pollution that could trouble the public and surroundings. Then, I submitted the final plant layout to the project engineer for final approval.

3.9After getting approval of the layout, I checked the quality of construction materials, i.e.cement, marbles, aggregates, steel, etc. to ensure concrete meets the required specifications and quality standards. I physically checked the material and then sent their samples to the testing laboratories where different experimental work was performed to check their quality.

3.10 My next important task was to carry out HVAC installation work at the industrial plant.But before this,I first checked the performance of the wielder, mechanics, and machine operators, and communicated with the employee who used to perform arc welding and fitting nut/bolts. I ensured that there was no error as mentioned in the provided construction design. Similarly, I also ensured that all the work performed during the aluminum door/ glass fitting was according to the quality standards. Furthermore, I also checked the quality of the materials for HVAC work, i.e. suction pipes and airflow pipes.

3.11 Then, before commencing the installation work, I arranged frequent meetingswiththe logistics team for machine procurement from India. I requested them to send the desired motor for pumping out the water of the whole company. For raw materials, I selected MS mild steel pipe fitting in High compressor and low compressor and pipeline of the high compressor and low compressor. Furthermore, I selected galvanized iron (GI pipe) installation for the water. These pipes were fitted to the ASB 50 MB Machine at their respective points. Here, I suggested fitting a filter in the connecting points of these pipes for filtering any kind of debris. I also fitted gauge to measure water pressureand also bought hose pipe for flexible and fast flow of water communicated with contractor.

3.12 Then, I installed the chiller, cooling tower, machines (ASB 50MB MACHINE), high &low compressor, and water pump fitting. During this installation phase, I assisted the HVAC installing contractors during the installation of suction and air-flowing duct on the roof of the building. I also assisted them in finding the exact location by comparing it to the building architecture design and then installing the suction pipe. Moreover, I assisted in assembling all the parts of the ASB 50 MB Machine (hooper and nozzle) by connecting them with all the pipelines and wires. After this, I fitted filters in between the inflow pipes of the high compressor and low compressor to filter the debris. Also, under the guidance of a Technical Officer, I assembled all the parts of the 50 MB V3 machine with a Dehumidying resin dryerAPD-25-IN (Machine Mounted), and MTC Mold temperature controller AML2-55-IN,CHILLER Model AMT-3AC-IN. Then, I ordered the required hydraulic oil, spray, and grease for the machine, checked their quality, and then put them inside the oil tank. Next, I fitted the fin, cold stamping mold, injection molding, jig, spare parts, accessories, and semi-automation equipment in the machine. Afterward, I checked the required size of the nozzlerequired for MS and GI pipe and then

placed it at the end of pipe terminals to fit properly into the respective flow ports of the molding machine.

3.13 After completion of early major portion of project, me along with respective contractors of different areas start to test overall work. During testing, I used to check the quality of the materials, suction pipe, and airflow pipes. And helped them to find the exact location compared to the provided 2Ddesign for placing the pipelines. While testing firstly, I compared overall work with provided 2D design and I make sure the cold line of HVAC is insulated properly by an aluminum cover. During the inspection, I noticed that there was water leakage in the false ceiling and it was damaging it. Being project supervisor, I inspected that area and removed the damaged false ceiling board. After removing it, I came across that the water was coming from the surface of the Air duct pipes. To inspect in-depth, me and my team jumped above the false ceiling and looked carefully at the surface of the airflow pipe. I noticed that water was coming from the wall of the building, (soaking rainfall water) where the contractor had made an opening/hole to support and pass the pipe, outside the building. However, there was some location tolerance issue in the hole and pipe fitting. So, I along with the contractor covered the surrounding corner holes with cement again, making sure that no water came inside.

3.14 The next issues were identified relating to different room sizes of a factory. The main hall, where the machines were kept, was big, whereas the room for raw material and offices were small. At the beginning of the design, the engineers had placed the same big size Aluminium vent grille for all big and small rooms. However, as the need for the airflow was different, I suggested that they keep a small size white aluminum vent grille, which not only reduced the cost of equipment, and airflow but also gave more space for lights, wires, etc. in the ceiling. The senior engineer appreciated &approved my idea. So, based on the current vent size [24" * 24" inch square with 500 CFM (cubic feet per minute)], I suggested usinga smaller vent size, i.e. 445mm * 445mm with 400 CFM.

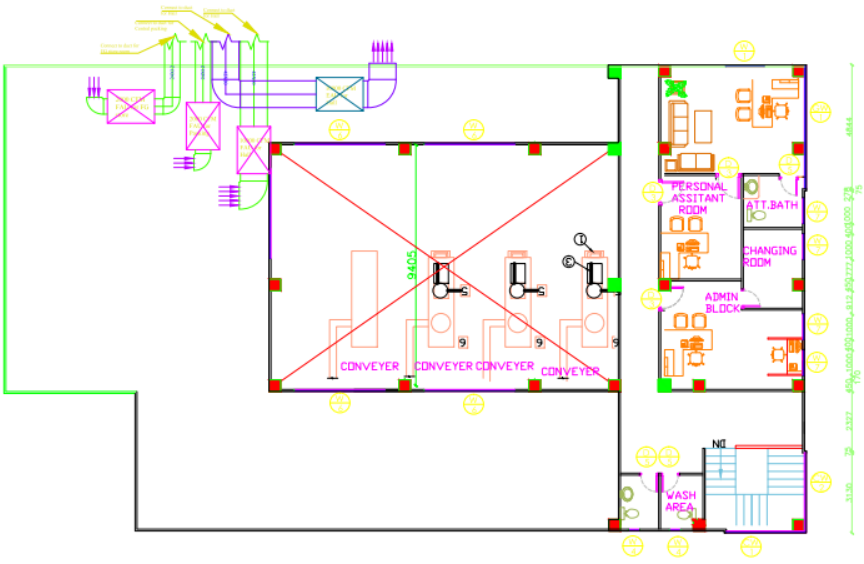


Figure 6 First Floor Plan

3.15 Moreover, I performed a breakdown analysis during installation many times to

find out the solution to arising problems. Once the machine was not startingseveral internal wires connected to the relays were broken. Thus, I arranged a discussion meeting with the technical officer to discuss this issue. After brainstorming, I decided to replace these wires with new ones and then fit them properly. Moreover, I made sure that a cooled and hot water pipeline is added to the chiller and I insulated the cold line with a mat cover.

3.16 I encountered another issue relating to the high compressor which was not only starting but also wasn't producing high compressed air to the machine. After route cause analysis, I noticed that this problem was occurred due to the incorrect connection of the three-phase wire to the High Compressor, and also R,Y, and B color wires were wrongly connected because which high compressor was not working properly.

3.17 During the breakdown analysis, I noticed that the liquid motor was not running properly, i.e. the fan was running in the opposite direction because of which water was not coming up from the water storage tank. After analyzing the motor, I noticed that this issue might be occurred due to any debris in the motorwhich is blocking the intake. However, after inspection, I found out that there was no debris or any waste inside the motor. Afterward, I checked the wires connection and observed that the positive and negative wires were not correctly joined. After resolving the problem, I kept the chiller outside in the open environment and ata higher level than the chiller and Machines to prevent the water backflow when the pump is OFF.

3.18 Also, I was involved in project management. If the project wasn't going on based on Cost analysis (Bills of Quantities, I informed the senior engineers to avoid delays in the project. Moreover, to manage each task, I designed a Gantt chart report, PERT (Program Evaluation Review Technique (PERT)), and CPM (Critical path method CPM) to compare with the work performance of hired contractor's Civil engineer. In addition, I checked the ratio of water, quality of cement, and the work performance of the hired employees. Moreover, I also used to measure the site layout (based on provided design) using theodolite, Auto-level and I checked heights, precise measurement, angles, and coordinates on the real field. Similarly, I also inspected the work of the excavator, and dozers while cleaning the area. I made sure that all employees were wearing PPE and following work, occupation, health and safety properly.

3.19 I was assigned various legal documentation during OJT, for instance,Naksapass, Rokka-Jukka, Blueprint-trace, bank account opening, Jagga Pass authority, certification letter, pan certification, industrial certification, renew of industry, etc. I thoroughly read these documents and reported them to the manager. It was the main part of my jobto understand the legal documentation process. Also, I remained in contact with different lawyers who helped me throughout this process.

3.20 I had to demonstrate my team building and leadership skills and for this purpose, I worked with different members belonging to different departments (production, electrical, contractors, etc.). I communicated with them by arranging weekly meetings to discuss issues occurring while inspecting HVAC installation work and breakdown analysis by following ethical standards. Moreover, I worked with different individuals to diagnose the faults in the machine and find out a cost-effective solution. In the production department, I worked with different section members and we worked together on various issues of construction, the client, contractor, complaints or service. Similarly, in site engineers, legal personnel, employee, and

labor relationship was a great experience as a multi bridge connection.

3.21 I also showcased my time management and software skills. For instance, I developed the required application for layout design by using AutoCAD software. Similarly, I made different legal document files regarding the construction project process Furthermore, I prepared a report showing maintenance breakdown analysis, human resource analysis, customer, supplier documents, fishtail, root cause analysis, CLIT paper, internal auditing paper,different governmental, non-governmental, and consultancy offices involved during the process of building construction. Also, I understood proper documentation, and the legal process for the building construction. I came to know about the proper laws rules and regulations formed by the government for industrial building construction.

d) Summary:

3.22 This internship helped me to understand many working scenarios, and increase my knowledge and skill of real working conditions. This made me realize that I learned the theory not applied 100% in a real-life situation. There are vast differences between theoretical knowledge and practical work due to many facts. The knowledge of AutoCAD helped me to draw and sketch layouts, design, etc. In addition, I carried out quality auditing which helped me to find the possible area of energy-saving opportunities. Furthermore, I coordinated with maintenance engineering who helped me in finding ways to increase the performance and productivity of machines or equipment, failure causes, and mitigation measures.

PROFESSIONAL ENGINEER

Summary Statement

Competency Element	A brief summary of how you have applied the element	Paragraph in the career episode(s) where the element is addressed
PE1 KNOWLEDGE AND SKILL BASE		
PE1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	I was involved in different engineering tasks in the industrial training OJT program where I applied industrial engineering technical skills gained from studying university courses to identify issues that occurred during machine installation and maintenance and provided solutions. Moreover, I also did breakdown analysis, root cause analysis, ISO auditing, etc. Moreover, I also showed my engineering skills by designing the Kitchen Waste Module.	1.10, 1.11, 1.12, 1.13, 2.9, 2.10, 2.11, 2.12, 3.10, 3.11, 3.12, 3.13

PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	I performed a few mathematical calculations to determine feed requirements I determined the stock of the products available in the factory.	1.13, 1.15 2.11
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	I used my in-depth knowledge to develop a sketch of a fixed-dome plant consisting of a digester with a fixed, non-movable gas holder, which was placed on top of the digester. I utilized my industrial engineering knowledge to analyze the problems that occurred in the machine by carrying out a breakdown analysis. I performed a breakdown analysis during installation many times to find out the solution to arising problems	1.14, 1.15 2.12, 2.13 3.15, 3.16, 3.17

PE1.4 Discernment of knowledge development and research directions within the engineering discipline	I collected data on the use of biogas digester in the industries and its benefits by studying different research articles. I collected secondary data by surfing internet websites and studying case studies showing ISO internal and external auditing. I studied the published and processed materials reports collecting the necessary information	1.7, 1.8 2.10 3.7
PE1.5 Knowledge of contextual factors impacting the engineering discipline	I collected the specific amount of kitchen waste from the university's canteen and cow which was an important element to mix properly waste with the water's accurate ratio. I identified the factors contributing to affecting the industry's reputation despite ISO 9001:2008 certification process. I selected appropriate materials and pumps for pumping out the water of the whole company for the HVAC system	1.10 2.8, 2.9, 2.10, 2.11 3.11, 3.12

PE1.6 Understanding of the scope, principles, norms, accountabilities, and bounds of contemporary engineering practice in the specific discipline	I understood ISO 9001:2008 standards and then performed auditing to analyze the quality issues. I ensured that all the work performed during the aluminum door/ glass fitting was according to the quality standards	2.8, 2.16, 2.17 3.10
PE2 ENGINEERING APPLICATION ABILITY		
PE2.1 Application of established engineering methods to complex engineering problem solving	During biogas digester design, I found out it was very crucial to remove other impurities like carbon dioxide, therefore, I suggested using a floating type filtration tank made from a bucket. It was very crucial to provide the ongoing inner bio-process warm temperature. I resolved this problem using my engineering research skills. I identified the issues by carrying out internal auditing as per standards and proposed a solution lacking ISO lacking statements. I identified many problems during breakdown analysis and then provided preventive measures using engineering knowledge.	1.17 1.18 2.12, 2.13, 2.14, 2.15, 2.16, 2.17 3.13, 3.14, 3.15, 3.16, 3.17, 3.18

PE2.2 Fluent application of engineering techniques, tools, and resources	I designed the series combination of sealed floating bio-diester using SOLIDWORK software. I used CMMS which is software that helps maintenance teams keep a record of all assets. I developed the required application for layout design by using AutoCAD software.	1.11, 1.12 2.17 3.21
PE2.3 Application of systematic engineering synthesis and design processes	I designed, fabricated, and tested the kitchen waste module. I enrolled in industrial training to assess machines operations and checked the industrial problems. I was involved in mechanical industrial plan construction and supervised the HVAC installation and testing process.	1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16. 3.17

PE2.4 Application of systematic approaches to the conduct and management of engineering projects	I was responsible to ensure management from cost management to time management to avoid delays. I did cost management by conducting a market survey and selected the cost-effective equipment. To manage each task, I developed a Gantt chart report	1.19 1.9 3.18
PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES		
PE3.1 Ethical conduct and professional accountability	I obeyed ethical regulations while dealing with my teammates and equally distributed each task among them. I communicated with them by arranging weekly meetings to discuss issues occurring while inspecting HVAC installation work and breakdown analysis by following ethical standards.	1.20 3.20

PE3.2 Effective oral and written communication in professional and lay domains	To communicate with the supervisor and groupmates, I arranged technical meetings to discuss design and calculations work.	1.8, 1.9, 1.20, 1.21
	I attended meetings with different company representatives and members of different departments to discuss the work.	2.7, 2.8, 2.19, 3.8, 3.11, 3.15, 3.20
	I submitted weekly progress reports to provide the status of ongoing tasks and results of accomplished tasks	1.21

PE3.3 Creative innovative and proactive demeanor	During the time of formation of gas in the Sealed-floating dome digestor, it was very important to purify it from H_2S. So, I used I aluminum dishwashing cloth as a ferrous absorber. I performed stock management based on the FIFO (First in and First out) "FIFO". I noticed that the fan was running in the opposite direction because of which water was not coming up from the water storage tank which was resolved by keeping the chiller outside in the open environment and at a higher level	1.16 2.14 3.17

PE3.4 Professional use and management of information	I collected both primary and secondary data before starting industrial auditing. I collected data on my project by studying 2D and 3D drawings of the system and then analyzed the HVAC system. I prepared a progress report and final documents to manage the information in a written form	2.9, 2.10. 3.8 1.21, 2.19, 2.20, 3.21
,PE3.5 Orderly management of self, and professional conduct	I created the Excel file recording all the data of the estimated time. I developed a Gantt chart, PERT, and CPM to compare the work with the performance of hired contractors	1.19 3.18

PE3.6 Effective team membership and team leadership	I developed a communication plan intended to ensure coordination and communication between each project member.	1.120
	I communicated with the team to create a friendly environment	2.18
	I demonstrated my team building and leadership skills byworking with different members belonging to different departments	3.20