Welcome

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Career Episode 1

❖ Introduction

CE 1.1

My first project is about Advanced Drilling Machine that I completed as a Mechanical Engineering student at University… The project was started in Month/ Year and executed all the activities in Month/ Year. The project was based in City/ Country.

❖ Background

CE 1.2

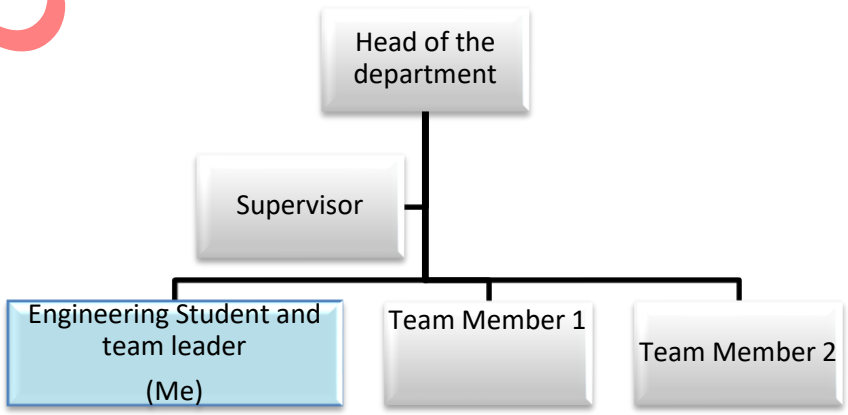
Drilling is a major necessity in the modern world. It has a vast number of uses like in household work as well as in construction sites for drilling large holes in the earth. Drilling can be performed by 3 types of inventions. It was invented around 4000BC and has become vastly important in the last 100 years. Drilling plays amajor role in petroleum, medicine, engineering, construction, and experimentation.

CE 1.3

The objective of the project was to build an accurate machine which could be used by an individual to drill holes up to a bore size of 12 mm. The aim was also to build a time-saving, low-cost three-axis drilling machine which would run on a micro-controller program. The machine would be user-friendly and should operate easily. A large quantity of work should be handled efficiently,and anumber of components machined by the machine should be more than components machined within any specified time–frame. The machine should be precise in its operation. With least maintenance, the machine should be able to deliver high output. There should be flexibility in dimensions of drilling holes,and the coordinates of the holes and its bore size could be changed according to the requirement.

CE 1.4

Project Hierarchy



CE 1.5

During the project, I have executed following tasks

- Conducted detailed study to understand the project scope
- Complete the design activities following the design standards
- Resolved the technical issues, analyze those, and implemented the solutions
- Calculated the required movement, length of lead screw, size, pitch, major diameter, and mean diameter
- Coordinated with the team, involved in group discussions
- Compiled the final report and give presentation

❖ **Personal Engineering Activities**

CE 1.6

In the initial stages of the project, I studied the theory behind the project and the important components to make it work. After conducting my literature review, I was able to select appropriate components for this project. For this purpose, I divided the system into two parts; mechanical system, electrical system, and microcontroller system. The mechanical components included the structure of the drilling machine,i.e., the base, support pillars, lead screw, bearing, bush, gears, beams, telescopic channel, dowel, bearing housing, and lead screw bush. The electrical system consisted of the motor, microcontroller, power input,and relay. The microcontroller system contained embedded incremental programming and Intel 8051 Family microcontroller. This positioned the tip of the drill bit at the required position and provided the depth of cut.

CE 1.7

I proceeded with the work considerations for the design of this project. As a basis for further development of the drilling machine, I selected the maximum component size (maximum travel along the axis) as X = 250 mm Y = 250 mm Z = 75 mm. I considered the different configurations from afabrication point of view, and it was found that the Cartesian configuration was most suitable because of the following qualities; better accuracy, better rigidity, and ease of operation and programming. I divided the drilling machine into three subsystems; the mechanical structure, the electrical system, and the program.

CE 1.8

I divided the mechanical structure into following subassemblies; Frame subassembly, X-axissubassembly, Y-axissubassembly, and Z axis subassembly.For the frame subassembly, I welded together four ‘L’ cross section beams to from each of the top and bottom part of the frame. Four more such beams are welded at each corner of both the parts which acted as vertical pillars to form the frame structure. I selected the size of L bar which was 50 mm in breadth and 4 mm in thickness for rigidity and stability. Initially, the L beams were welded in a square shape of the dimension of 40x40 cm. Two such structures were welded and kept aside. Then, I cut the pillars of the required height,i.e., 600 mm. The L shaped pillars acted as support for the machine. They were supposed to be welded between each of the square structure which was welded earlier. One of the square structures formed the bottom part of the machine on which the machine rested. The other square structure was at the top of the pillars. The pillars were placed at the four ends of the square structure.

CE 1.9

Similar placement was done at the top square structure. Initially, small weld joints were done so as to check for any errors or faults. After reassuring that there are no faults and errors, thefull weld was put into practice,and the frame structure got sufficient strength to face any forces and vibrations. After this, the basic structure of the machine was ready. Assembly of other components was followed likewise. The x-axis of this machine was the bed which moved linearly. It was moved with the help of a lead screw. The bed was mounted on the bottom part of the frame with telescopic channels in between for providing obstruction free movement to the bed. A lead screw bushing is mounted beneath the bed which has internal threading,and the lead screw rotates within it. The motor is fixed on the motor support plate. The shaft of the motor is coupled to the lead screw which in turn moves the bed in a linear way. The X-axis bed was constructed in such a way that it rested on the base,i.e., the square structure. It was made up anumber of metal strips of 20 mm length and 3 mm thickness which is placed in aperpendicular direction to the axis. Its ends are made to rest on an 'L' section which was of a height of 40 mm. The thickness of 'L' section was 6 mm which ensured that no bending occurred and resulted in providing better accuracy while machining.

CE 1.10

There was alignment problem while assembling X-axis bed. So, to ensure that there was complete alignment and no uneven surfaces present, I performed milling operation on the bed which made sure that the upper surface and bottom surface were in thecomplete parallel state. Milling also made sure that the hole drilled by the machine was perfectly in 90 degrees. Therefore, after the bed underwent through the milling operation, it was completely parallel,and the hole that was drilled wasalso in perpendicular. After milling operation on the bed, the bed was fixed to the upper metal plate of the telescopic channel. It was again checked that the bed was aligned. After eliminating the errors, the bed was firmly fixed,and the movement is checked.

CE 1.11

The Y-axis subassembly was similar to construction to the X-axis in terms of telescopic channels and motor. It is mounted on the top of the frame. The Y-axis lead screw was in aperfect right angle with the X-axis lead screw. A plate was placed between the channels on which the Y-axis bushing is provided. The Z-axis assembly was placed below this plate. One side of the Y-axis leadscrew was paired with a motor,and the other side was supported by a bearing bush. The motor gave rotation to the lead screw. The lead screw eventually moves the Y plate in reciprocating manner.

CE 1.12

During this project, there was a problem of keeping Y-axis aligned with X and Z axes. It was necessary to ensure that the Y-axis leadscrew was perfectly perpendicular to the X-axis lead screw. I arranged a small discussion with my group members and picked a suitable solution. I took a plate of size 250x120 mm and fitted it between the telescopic channels. Here, the Y-assembly was made to rest on the topmost structure of the frame. The telescopic channels were placed in between a C-section whose breadth was 50 mm and had a thickness of 6 mm. A C-section was used because it could provide abase for the plate as well as prevent it from uplifting due to the reaction force during the machining

operation. It was formed by welding three plates which are perpendicular to each other. Between the C-sections, a plate of thickness 10 mm was fitted which was sandwiched between telescopic channels on both sides. Between the telescopic channel and the Y-plate, there was a metal strip present on the telescopic channels. I welded this strip to the plate so that the load distribution was uniform. I attached the bottom slider of the channel to the lower plate of the C-channel, while the upper slider was connected to a strip which was helpful for better load distribution. Above the metal strip, one end of Y-plate was placed. On the other side, same construction was made where the other end of the Y plate is placed. Now after the Y-plate, another metal strip was fixed to the Y-plate on which the upper slider is placed. The lower slider was placed beneath the upper plate of the C-section. In this way, the Y-plate was sandwiched properly.

CE 1.13

I mounted the Z-axis subassemblybeneath the Y-plate. It consisted of four plates including the Y-plate. The bottom three plates were welded together. The second plate hadinternally threaded bush through which the Z-axis lead screw passed. The third plate acted as a support for the armature. The bottom-most plate had a bore to fit the armature. The chuck of the drill machine was right beneath this plate. The Z-axis lead screw was supported by a bearing,and the Y-plate acted as a bearing housing. All these plates were guided with the help of dowels which provide rigidity and accuracy. I used four M16 dowels which were positioned at each corner of these plates. The motor which provided rotation to the Z-axis lead screw is mounted on the Y-plate. The rotational motion of the lead screw was converted into linear motion with the help of the bush. The upper end of the lead screw is coupled to the motor. The provision was made to support the motor. The coupling done in this assembly was same as it was done in X-axis and Y-axis. In this manner, the Z-axis subassembly was manufactured.

CE 1.14

I performed numerous design calculations throughout this project that challenged my basic mechanical engineering knowledge. For each axis, I calculated the required movement, length of thelead screw, size, pitch, major diameter, and mean diameter. I also performed power calculations. The load on Y-axis was maximum. So, the power required at Y axis subassembly would be maximum. Hence, the power required at Y-axis lead screw was considered for selecting the motor. The power required was calculated by using thecoefficient of friction and mass on lead screw in Y-direction. I calculated external force, Fey = mv × g and frictional force, Ffy = μ × mv × 9.81. The total force came out to be 98.2475 N.I calculated thetangential force required at thecircumference of thescrew,and on its basis, thetorque required for screw rotation was determined.I also calculated thespeed of lead screw, angular speed, and power.

CE 1.15

Drilling machine worked in aCartesian coordinate system which was thesimplest form of automation, configuration machine which consisted of movement of bed in X-axis direction and drill bit movement consisted of Y-axis and Z-axis vertical movement. For drilling process to initiate, I had to give theposition of holes to be drilled on LCD screen with the help of number on thekeypad. In theworkpiece, 4 holes were needed to be drilled with thedepth of 8mm and hole size of 10mm. Programming method was incremental programming. First I gave hole positions on the screen with the help of akeyboard, and

when the start button was pressed, aprogram executed those positions information on Cartesian configuration.

CE 1.16

For operator safety and the safety of others, I read and understood the safety recommendations and operating instructions supplied with the tools. I made impact resistant eye protection necessary while operating the machine and recommended my teammates to wear personal hearing protection while operating the machine. Loose fitting clothes, long hair, gloves, ties or jewelry were strictly prohibited. Cutting tools used with the Advanced Drilling Equipment tools were sharp and handled with care to avoid injury. Stressful postures were avoided,and the tools appropriate for the job and work location were selected. Some non-ferrous metal chips (or dust) were combustible like aluminum, magnesium, titanium, and zirconium. The material safety data sheets were followed for combustibility of materials drilled and spark generation was avoided.

CE 1.17

I applied my project management skills in coordinating an efficient team. I assigned duties to them according to the project schedule, and we worked together to finish the project in time. All the problems were communicated, and mismanagement was avoided. Weekly meeting of the team was held with the project supervisor to update him on the problems and progress of the project. We were a strong team of mechanical engineering students and were devoted to complete this project successfully.

- **Summary**

CE 1.18

The aim of our project Advanced Drilling Machine was to achieve a balance between a normal drilling machine and a sophisticated CNC drilling machine, which gave same accuracy, machinability, and fast production rates as CNC machines and at the same time was very cheap for being an automated machine. The Advanced Drilling Machine provides the accuracy of 0.1 mm while the cost of production is Rs 17000. Hence we have achieved the aim of designing this drilling machine. The time required to achieve may vary from person to person as well as comparing to the other market products, but we tried and achieved satisfactory results with the machine prepared at the end of the day.The drilling machine is equipped with three-dimensional movements and considered to produce good precision accuracy for a competitive development cost. There are still some refinements,and improvements need to be done in this machine concept design.

CE 1.19

There can be some improvements in advanced drilling machine for achieving the best possible outcome. Asthe drilling operation takes place, use of automatic coolant on/off can be implemented for achieving better machining so that the workpiece doesn't overheat because of the heat generation and heat can be well dissipated from the metal as well as chips can be flown away. Using guide ways instead of telescoping sliders will give better stability to the machine which will improve accuracy. Making the machine lightweight and

compact will make it portable. Using better co-ordinate configuration system can allowbetter machining of complex parts as well as drilling at various positions and angles. The current system can be improved to reach higher axis speeds. The developed system can also be built up for milling.

Career Episode 2

❖ **Introduction**

CE 2.1

My second career episode is based on the production of self-repairing high speed doors. This project was assigned to me by Gandhi Automations Pvt. Ltd. I joined Gandhi Automations on 19th November, 2015 as a production engineer and worked for 1.2 years in the high speed Door manufacturing section. All the activities were conducted in the area of

_____

❖ **Background**

CE 2.2

Gandhi Automations Pvt. Ltd is an ISO: 9001:2008 Company that marks as one of the leading production companies in India with a 70% market share. It provides services of loading bay equipment and entrance automation equipment. With a promising commitment to provide product efficiency, quality, and safety, Gandhi Automations is present in over 23 major cities of India. It has a vast experience of performing more than 100,000 installations worldwide.

CE 2.3

This goal of this project was simple i.e. to develop a high speed door with low profile and a modular design that meets customer requirement. The two major features of this product were the self-repairing feature and tight sealing to keep contaminations like dust and odours away from the concerned area. The challenge was to optimize the size of the door so that it does not take too much space and create a long-lasting self-repairing door. This project provided a safe an efficient entrance automation solution.

CE 2.4

I was involved in a number of activities throughout this project;

- Considered the technical specifications and studied them in order to design an optimal product
- Conducted a literature study to get an idea from the designs of a similar product
- Used a modelling software to model the tasks of this project
- Assigned duties to the members of this project based on their strong skills

- Implemented engineering standards to validate the design of the product
- Performed monitoring tasks to see whether or not the team members are executing their activities properly
- Evaluated and selected the dimensions of the product after conforming with the technical specifications
- Implemented safety rules during the production process to secure the life and health of the workers
- Prepared a cost analysis report in which I estimated the total cost of the project and proposed the project budget
- Documented and submitted the report for complete project to keep as a company record

CE 2.5

In the project team chart shown below, I am designated as a Production Engineer.

❖ **Personal Engineering Activities**

CE 2.6

As a production Engineer, I designed the technique to manufacture the self-repairing high-speed door. I used fabric welding machine to manufacture the fabric door made up of PVC. I used the movable on track HF welding machine to achieve this task. The welding heads moved on two rails over a fixed table which was modular and provided lengths in 2 meters and its multiples. I aligned the fabric and placed it using a LASER device for alignment. Due to the programmable operation of the machine, welding parameters were automatically assigned. I controlled the output power by selecting a program feature and controlled the positions of the welding die using membrane switches that were provided on the handles present at each side of the front panel.

CE 2.7

This door then needed some flexible weight at the bottom to provide self-weight to the door to assist the downward motion of motor. So, I used the perforation scrap that was produced in the other department of company, i.e. rolling shutters to produce perforated strips. This provided the perfect application in the flexible bottom of the door. My design prevented door system's downtime. I moved the curtains without damaging them in the case where the curtains were impacted in an unwanted manner. I designed the movement of the door in a way that a simple operation of open and close was enough to recover it.

CE 2.8

I installed a low-profile side frame with a specific width and projection that I calculated earlier for the most optimal values to promote easy installation of the product. I designed a

captured panel to avoid noisy operation and used a light curtain so that it did not come in contact with the objects in the doorway. I kept a standard roll-up to facilitate both, indoor and outdoor use of the product. I kept the relay control unit at a standard reading to control the speed of the door. I provided an emergency opening in my design using a crank handle for safety purposes.

CE 2.9

I got into a bit of complex situation during this project. I had to setup meetings with local vendors to outsource the guides that were used to run the fabric door and provide them the design to manufacture the same. With the help of design team, a guide of Aluminium and PVC was decided to be manufactured and since the manufacturing machinery was not available within the company, these components were outsourced. I had to visit and help the vendors to explain the desired component to save the time and resource of our company.I also had to manage shifts of workers to manufacture this product within less period of time so that high productivity can be assured. The workers were distributed in 2 shifts of morning and evening with an overlap of 2 hours to provide better insight of work done in the previous shift.

CE 2.10

Two technical issues and solutions:

CE 2.11

I participated in the weekly meetings that were held among the project team to discuss the progress, problems, and improvements of the project. All the tasks carried out in the respective week were discussed and I recorded all the important details of the meetings. I requested the presence of the project manager once a week as his guidance was crucial for the completion of this project. I also got the tasks approved from him to prevent any inconvenience in the future. The outcome of each meeting was implemented throughout the next week and I was involved in the task planning. This project would not have been completed on time if I hadn't conducted an elaborate study on the related topic. Even before starting this project, I browsed the internet in search of new and creative ideas to implement this product design. I went through similar projects and saw the techniques that were implemented. Moreover, discussion with my team helped me a lot to attain new tactics and develop a proper plan for the project. I implemented the production standards and followed ASME and CEMA for further guidance on designing the product.

CE 2.12

I held myself responsible for ensuring that the tasks were carried out safely throughout the project. For this purpose, I requested the company to provide safety training to the project

team to acquire awareness regarding the related machinery. I mastered the use of fabric welding machine before implementing it to achieve everything securely. I provided protective garments to my fellow workers and made it compulsory while dealing with heavy machinery. I supervised the activities of my team fellows and guided them through difficult stages. I ensured that my designs were not affecting the environment in a negative way. I worked in accordance with the OSHA standards and the work safety rules that were listed by Gandhi Automations Company.

CE 2.13

During the course of this project, I was actively involved in technical report writing tasks. My command over English language is quite strong so I used this skill for the benefit of my company. I prepared a detailed yet clear report that demonstrated all the processes of the project, starting from specification study to calculations, design, production, and installation of the final product. The report was important to keep a company record. I also traced the expenses of this project and made sure that they resided within the budget boundaries of the project. For these tasks, I used Microsoft Word and Microsoft Excel programs.

CE 2.14

My social nature helped me to develop friendly bonds with the project team. I was able to maintain mutual trust and display friendliness with all the members throughout the project. I worked with them in harmony which simplified the complications of this project. We stood by each other's side and assisted each other when needed. I arranged a success party after the completion of this project to recognize the individual efforts of each member.

❖ **Summary**

CE 2.15

My core technical knowledge of mechanical engineering and manufacturing processes played a key role in success of this project. I was able to achieve a high quality self-repairing door that met the flexibility requirements of the clients. Moreover, I was able to make my company proud. The high-speed door with PVC was an optimal solution in field industries as it lowered transportation time and any chance of human error. The probability of causing damage to the door was also reduced due to the automated features. I successfully implemented the anti-crash system and exhibited my innovativeness. The product was proved to be cost-efficient, highly-functional, and completely secure.

Career Episode 3

❖ **Introduction**

CE 3.1

In this career episode, I have discussed my company project regarding Fire Rolling Shutters. At that time, I was employed as a Production Engineer at the Gandhi Automations Pvt Ltd. I worked on this project from _____ to _____ and all the activities were based in the Mumbai, India.

❖ **Background**

CE 3.2

Fire Rolling Shutters are quite useful in the situations where security is required for the room that is in a premium area. The requirements of these rollers include; durability, strength, elegance, and low maintenance. Therefore, in this project, all these requirements were kept in mind to design a low-cost rolling shutter that can be used for external as well as internal purposes. The construction of this component was strong and the standard of IS 6248 was followed for designing purposes. Furthermore, the scope included the selection of rolling shutter type and curtain profile that suited the client's demands.

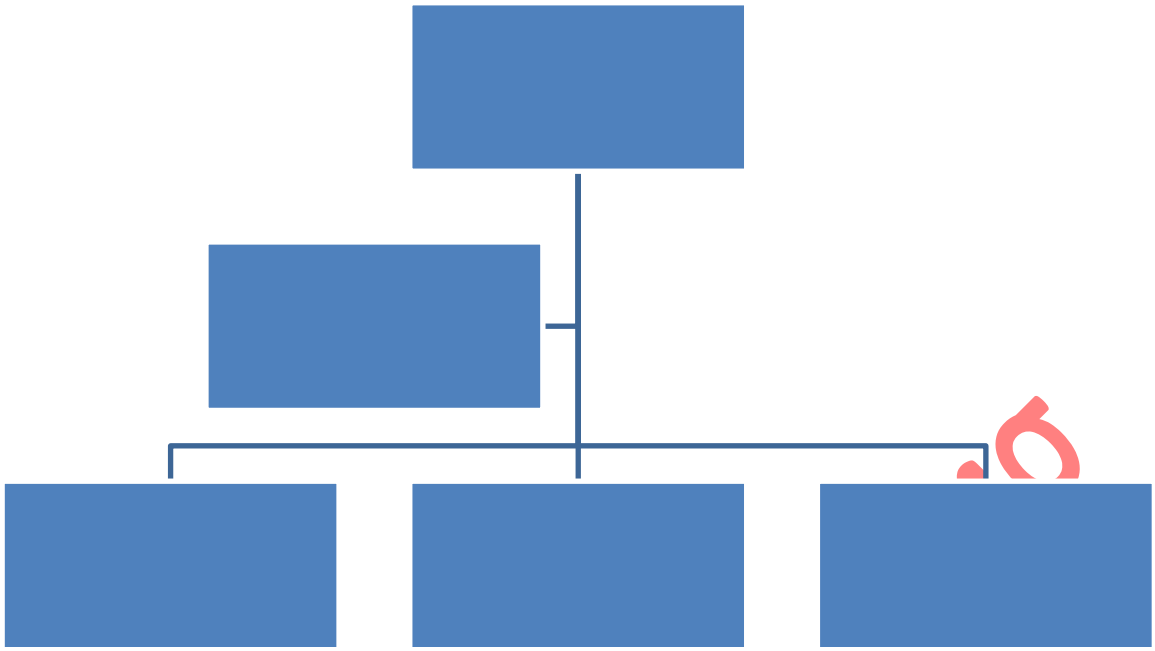
CE 3.3

During this project, I carried out the following tasks as per the client's requirements;

- Designed the fire resistant rolling shutters in accordance with the IS 6248 standard
- Carried out extensive research to study the design in depth
- Fabricated the rolling shutters as per the client's requirements and location specifications
- Provided correct material profile, color, and dimension that suited the client's building
- Determined the suitable dimensions of the shutters fit the targeted location
- I implemented efficient solutions to reduce cost and heat loss from the building rooms
- Supervised the members of the taskforce and reviewed their performances at the end of the week
- Recorded the project data and prepared a project work report for the company
- Attended meetings with the project manager and the client and discussed the problems, improvements, and progress of the project
- Implemented the standards of workplace safety to ensure that no life was endangered during the construction activities

CE 3.4

The organizational hierarchy highlights my designation as shown below;



❖ **Personal Engineering Activity**

CE 3.5

For the design of the rolling shutters, firstly, I designed the drive unit to install it to the shutter shaft directly. In case of heavy rolling shutters, I implemented chain transmission. I designed the drive unit or otherwise known as sideone, using a worm gear containing a hollow shaft. I integrated safety brakes and limit switches. I also incorporated a manual operating mode for emergency cases. The final component used in the design was an electric motor. There was no need for an electric brake in this design as I used the worm gear with the self-braking feature. I performed a few calculations to determine the desired parameters such as duty rating, overload safety factor, manual operating load, holding torque, and output speed. I used European safety standards for the implementation of this design. For emergency manual options, I installed hand crank and hand chain override. I set mechanical and digital limits for the limit switches.

CE 3.6

I determined the dimensions of the system in millimeters and determined technical details like output speed, absorption, power, protection rate, weight, duty rating, etc. The project also included designing heavy assembly of shutters. For this purpose, I designed torque enhancement system. For these heavy fire rated rolling shutters, I used chain transmission for driving mechanism. This setup was designed using a Sidone motor that was equipped with a mechanical limit switch, safety brakes, specific brackets, sprockets, chain, screw set, etc. I installed the safety brake without springs in the system design. This was done to accomplish two things; for the shutter shaft's bearing support and for the blocking of mechanical brake in case acceleration occurred suddenly.

CE 3.7

To select the most appropriate safety brakes for the proposed design, I developed a good understanding of the data of the safety brakes. I considered the shutter's weight and tube's diameter for this purpose. I made sure that the operator's torque was less in value than the nominal torque for the suitable selection of the brakes. I also considered the locking torque of the brakes and the working speed. I ensured that all the parameters were within the safety limits. I selected the control units for the three-phase motors used in the circuit. Then, I moved on to choosing the compact gear operators for the design. These devices also played their part in the safety mechanism of the rolling shutters. I set up the control and operation options for the system. These included; manually-operated controls, remote controlled options, and safety equipment. The components used were pushed buttons, 1-channel and 4-channel polyvalent transmitters, infra-red photocells, bottom safety edge, key selector, rotator switch, flashing light, receiver, etc.

CE 3.8

I used the fire-resistant material to design the rolling shutters in order to make it fireproof. I installed an automated mechanism for fire protection where the shutters closed automatically in the case of fire. For the integrity and stability of my designs, I complied with the BS-476 standards. I designed the curtains of these shutters using cold rolled galvanized steel with a thickness of 0.9 mm. I designed the profile ends to hold the interlocked profiles securely. They prohibited their lateral movement and aligned the curtain. I used mild steel angles as side guides with a suitable size and thickness and attached them with support angles. They supported the side guides and kept them secured. Depending on the width of the door and welded back the bottom rail was produced from a flat bar of mild steel. I constructed the roller barrel out of a tube of mild steel and calculated its external diameter and thickness of the wall as per the shutter application. It was un-sprung depending on the application. I also designed a barrel bracket with a thickness of 4 mm. It was fitted with appropriate anchor fasteners and fixed to the steel structure. I designed a hood box using galvanized steel with a thickness of 0.9 mm. I used the reinforced bracket with it as per the width of the shutter.

CE 3.9

I made sure that the shutters were electrically operated. For this purpose, I required the assistance of an electrical engineer. I made sure that the operations of 'up', 'down', and 'stop' was carried out perfectly with the use of the gear motor and push-button mechanism. Then, I implemented auto-closing mechanism and equipped the fire shutters with a mechanism of the fusible link. A soon as 74degrees Celsius was sensed, I released the motor brake and allowed the gravity to descend it. I used a double fusible link to activate the fire rolling shutters with the help of a fire alarm signal. On receiving the signal, it released the motor's brake. To reapply the motor's brake, I used a reset pull mechanism. I used some components for the accurate working of fire rolling shutters, these included; solenoid with an auto-reset feature and fusible link, polyurethane, RAL colors to paint polyurethane, and control panels for audio and visual controls for smoke, photo beams, and heat detectors. They allowed the control for descending the shutter in the cases of fire.

CE 3.10

While operating the fire shutter, I encountered a problem related to the shutter which used to rise harder and got easily close. It caused insufficient counterbalance. I reduced

this problem by providing initial revolutions which were evaluated during the installation drawing. I slightly adjusted the point according to the requirement because of variation in spring, steel, and friction. When the shutter was in up position the spring was also at the amount of tension in this phase. I evaluated the neutral side of the tension shaft by slightly rotating the adjusting wheel in both directions. I used a winding bar and inserted the winding rods into the holes of the adjusting wheel. I carefully fitted the winding bar into the holes to prevent any injury. I also avoided implementing the loose fitting bars. Using the number of turns of the spring, the curtain was held in the open position. During the handling of the curtain, I faced another issue because curtain ran into one side only. I checked and replaced it.

CE 3.11

I used American standards to verify the fire rolling shutter design and test the system for up to four hours. I carried out the fire shutter test and recorded the response of the design after every 60 minutes. I recorded the results in a final report that was held at the company's record. All the outputs of the tests and design details were conveyed to the client and approved by him. I used MS Excel Sheet and MS Word Document to prepare the documents for this project. I employed the OSHA and ASME standards to develop a strong and safe design and also took concern of the safety of the taskforce.

CE 3.12

I implemented the safety policies of my company to protect my colleagues and co-workers. I provided them with safety wear helmets and heavy-duty boots to protect the sensitive areas and keep them away from any harm. As my team had to deal with heavy machinery, I supervised them closely to make sure that they were using the equipment properly. I guided the taskforce through all the challenging processes of the project and advised them to follow the rules and guidelines of the company. I coordinated with the project manager and approved the tasks from him to make sure that there was no danger associated with the tasks.

CE 3.13

I arranged project discussion sessions with the team including the project manager as well as the client. Any changes made in the design were discussed and the progress was updated. If there was any issue imposed in the project, it was discussed and solutions were suggested. The outcomes were approved by the supervisor and implemented in the project. I prepared solution proposals and discussed them with the manager. Normally, I intended to devise a cost-effective and time-saving solution that would not put my company in the loss. I was appreciated for my efforts and behavior with the team.

❖ **Summary**

CE 3.14

I designed the structure for fire rated rolling shutters and constructed them as per the requirements of the client. I determined all the mechanical parameters and performed calculations to evaluate the required dimensions. The proposed system was tested and the outcomes were positive. I was awarded a company bonus and words of praise by my employer. Other than that, this project was itself quite rewarding as I got to learn new

tactics of dealing with structural issues and strengthened my mechanical capabilities. This project provided me with lifelong learning.

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 designed the system and production processes by employing my Mechanical engineering skills that I gained during my academic and professional years	CE 1.6, CE 1.7, CE 1.8, CE 1.9, CE 1.10, CE 1.11, CE 1.12, CE 1.13, CE 1.14, CE 1.15, CE 2.6, CE 2.7, CE 2.8, CE 2.9, CE 2.10, CE 3.5, CE 3.6, CE 3.7, CE 3.8, CE 3.9, CE 3.10
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline	I determined the parameters of the proposed systems and calculated suitable dimensions for the installation of the system	CE 1.5, CE 1.14, CE 1.15, CE 2.8, CE 3.3, CE 3.5, CE 3.6
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	I kept the budget in control by using MS-Excel to prepare the component list. I also prepared various reports using MS-Word Document program	CE 1.15, CE 2.4, CE 2.13, CE 3.11
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	I browsed the internet daily in search of new and creative ideas for implementing the design of the products. I went through similar projects and studied the techniques that were implemented	CE 1.5, CE 1.6, CE 2.4, CE 2.11, CE 2.12, CE 3.3, CE 3.13, CE 3.14
PE1.5 Knowledge of contextual factors impacting the engineering discipline	I followed the standards of ASME and CEMA and used these standards as guiding tools in this project	CE 1.5, CE 1.16, CE 2.4, CE 2.8, CE 2.11, CE 2.12, CE 3.3, CE 3.5, CE 3.11
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering	I designed the products using modeling software and engineering tools and implemented basic rules of	CE 1.6, CE 1.7, CE 1.8, CE 1.9, CE 2.4, CE 2.6, CE 2.7, CE 2.8, CE 3.3, CE 3.5,

practice in the specific discipline	engineering I implemented the European standards to produce safe designs and conformed with engineering norms I followed safety rules during the production process for the life and health security of the workers	CE 3.6, CE 3.7, CE 3.8, CE 3.9 CE 1.5, CE 1.16, CE 2.4, CE 2.8, CE 2.11, CE 2.12, CE 3.3, CE 3.5, CE 3.11 CE 1.16, CE 2.4, CE 2.8, CE 2.12, CE 3.3, CE 3.5, CE 3.6, CE 3.7, CE 3.12
PE2 ENGINEERING APPLICATION ABILITY		
PE2.1 Application of established engineering methods to complex engineering problem solving	I resolved technical complexities by applying my engineering knowledge and thorough research. I also required the assistance of my team for eliminating project related problems	CE 1.5, CE 1.10, CE 1.11, CE 1.12, CE 1.13, CE 2.9, CE 2.10, CE 3.3, CE 3.10
PE2.2 Fluent application of engineering techniques, tools and resources	I used computerized tools to prepare product models, design verification, recording useful values, etc	CE 1.15, CE 2.4, CE 2.13, CE 3.11
PE2.3 Application of systematic engineering synthesis and design processes	I developed flexible and safe designs that were beneficial for domestic and commercial purposes	CE 1.6, CE 1.7, CE 1.8, CE 1.9, CE 2.4, CE 2.6, CE 2.7, CE 2.8, CE 3.3, CE 3.5, CE 3.6, CE 3.7, CE 3.8, CE 3.9
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	I managed a strong team of mechanical engineers and ensured that they devoted themselves to complete this project successfully I recorded the cost of these projects from the production to installation stage to keep a check on the project budget	CE 1.4. CE 1.5, CE 1.17, CE 2.4, CE 2.5, CE 2.9, CE 2.11, CE 2.12, CE 2.14, CE 3.3, CE 3.4, CE 3.13 CE 1.18, CE 2.4, CE 2.8, CE 3.3, CE 3.13
PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES		
PE3.1 Ethical conduct and professional accountability	I abided by the rules of engineering and took reference from various national and international engineering standards	CE 1.5, CE 1.16, CE 2.4, CE 2.8, CE 2.11, CE 2.12, CE 3.3, CE 3.5, CE 3.11

	I ensured operator and worker safety in this project by using the right equipment and safety wear during work	CE 1.16, CE 2.4, CE 2.8, CE 2.12, CE 3.3, CE 3.5, CE 3.6, CE 3.7, CE 3.12
PE3.2 Effective oral and written communication in professional and lay domains	I ensured proper flow of information by arranging team meetings in which discussions were held regarding the project. I also demonstrated my fluent communication skills during these activities	CE 1.5, CE 1.17, CE 2.4, CE 2.9, CE 2.11, CE 2.13, CE 3.3, CE 3.11, CE 3.12, CE 3.13
PE3.3 Creative innovative and proactive demeanour	I studied the theory and working behind the project and considered important components to make it work. Sometimes, I went to my instructor for guidance	CE 1.5, CE 1.6, CE 2.4, CE 2.11, CE 2.12, CE 3.3, CE 3.13, CE 3.14
PE3.4 Professional use and management of information	I concluded all these projects with the compilation and submission of project reports and project presentation	CE 1.5, CE 2.4, CE 2.13, CE 3.3, CE 3.11
PE3.5 Orderly management of self, and professional conduct	I applied effective skills of project management for the coordination of my team and project tasks. I prepared a detailed schedule for the execution of project tasks I sparked learning and decision-making ability as a result of these projects. I took training on safety processes and coordinated with the instructor to improve my learning	CE 1.5, CE 1.6, CE 1.17, CE 2.4, CE 2.11 CE 1.5, CE 1.6, CE 2.4, CE 2.11, CE 2.12, CE 3.3, CE 3.13, CE 3.14
PE3.6 Effective team membership and team leadership	I demonstrated my leadership qualities and tactics by successfully managing a team of mechanical engineers	CE 1.4. CE 1.5, CE 1.17, CE 2.4, CE 2.5, CE 2.9, CE 2.11, CE 2.12, CE 2.14, CE 3.3, CE 3.4, CE 3.13

Reach to our executive for your report to be done at below
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