IPENZ
ENGINEERS NEW ZEALAND

# KNOWLEDGE ASSESSMENT SELF REVIEW (FORM KA02)

**Name of Applicant:** ______________________

**Membership number or date of birth:** 31/05/1983

## Section One

## Important Instructions and Guidance



**Carefully read the following instructions and guidance. They are designed to assist you in providing in providing a portfolio of evidence that best demonstrates the comprehension and application of your engineering knowledge to Washington Accord equivalence.**

### Section One – Instructions and Guidance

- Familiarise yourself with the definition of ‘*complex engineering problems’* (Appendix One) as you are required to demonstrate you can apply your engineering knowledge to solve complex engineering problems.
- Identify the ‘*engineering discipline and field’* (Appendix Two) you will provide evidence of your comprehension and application of engineering knowledge in.
- The knowledge assessment is based on Washington Accord knowledge profile. This form is designed to capture information to assist the evaluation of your evidence

### Section Two – Knowledge Profile

- As you do not have a formal engineering qualification that formally benchmarks to a Washington Accord accredited degree, it is essential that you demonstrate that you have acquired an equivalent level of knowledge.

- The Context and performance indicators provide guidance on the evidence to be provided
- Consider each element of the knowledge profile, including the context statements and performance indicators. Summarise key aspects of your knowledge under each element and how this has been developed through academic study, on-job learning and/or continuing professional development. It is important you use the performance indicators and complexity definitions to enable you to describe your knowledge and how it has been developed.
- When describing how your educational program contributed to your development, focus on the more advanced pieces of work you did, the knowledge you needed in order to perform that work, and the abilities you needed in order to apply your knowledge in an engineering context.
- The word document is formatted to allow you expand a text box if required.
- Write your material in the first-person using 'I' or 'me' instead of 'we' or 'us'. This makes it easy for the assessors to see what your personal contribution was.

## Section Three – Evidence of Application of Knowledge

- Describe 3-4 engineering projects or activities (Work/Study Episodes) that you have been involved with, which demonstrate your ability to apply your engineering knowledge to solve complex engineering problems. Think of activities where you have had to apply a high level of engineering knowledge – such as some analysis that you have done, work you have done in scoping a problem and then developing a solution or design. What engineering models did you use? What assumptions were made in the development of the model and how did you test the model was relevant in the way you used it?
- For engineers with limited practical experience post-graduation, project work undertaken during your study is likely to be one of the best ways of illustrating the application of your knowledge. As well as projects conducted within university or college, you may be able to draw on any industry experience required as part of the educational program.
- You are required to include actual samples of your work – calculations, analyses or reports that you have personally undertaken - to substantiate your work/study episodes.
- Write your material in the first-person using 'I' or 'me' instead of 'we' or 'us. This makes it easy for the assessors to see what your personal contribution was.
- The word document is formatted to allow you expand a text box if required.



## Section Four – Supplementary Evidence

- You are required to submit a certified copy of your academic transcript(s) (formal record of papers taken and grades received) if you have not submitted to IPENZ already.

- Summarise your work history but include a representative sample of specific engineering projects or activities that evidence the development or application of the knowledge profile.
- Rather than listing all your CPD activities, provide details of those activities that have extended your professional engineering knowledge in your discipline and field and have assisted you to develop the knowledge profile of a professional engineer. A summary of all relevant activities – including those going beyond the most recent 6 years - will assist knowledge assessors in assessing your engineering knowledge. Assessors will be looking for how any gap between your qualification and a Washington Accord qualification has been bridged by your CPD.
- The word document is formatted to allow you expand a text box if required.

### Section Five – Payment

- The fee for a knowledge assessment is NZ$1,351.25 GST incl. Please complete your credit card details.
- Send all documentation to address advised

## What happens next?



The knowledge assessor will review your portfolio of evidence to determine the need for further challenge tests. This will involve an interactive assessment, that you will need to make yourself available for, either via tele or video conference and may also involve a series of challenge tests that may include one or a combination of:

- an oral and/or written examination
- a work simulation
- a case study

Your knowledge assessor will be in touch with you to discuss the next steps.

## SECTION TWO – KNOWLEDGE PROFILE

| |
|---|
| **ELEMENT ONE**<br>**A systematic, theory-based understanding of the natural sciences applicable to your discipline (e.g. calculus-based physics)** |
| **Context**<br><br>All engineering fields are rooted in one or more of the natural sciences. In a broad context, natural science is separated into physical and biological sciences. Physical sciences include chemistry, calculus-based physics, astronomy, geology, geomorphology, and hydrology. Biological sciences involve living systems and include biology, physiology, microbiology, and ecology. Washington Accord graduates are expected to be able to apply this knowledge of the natural sciences to solve complex engineering problems in their discipline. |
| **Performance Indicators**<br><br>Knowledge of mathematics, statistics and numerical methods that supports the development or application of models that replicate 'real world' behaviours<br>• An understanding of the assumptions behind theoretical models and their impacts in the development and use of those models<br>• Ability to organise and analyse a data set to determine its statistical variability;<br>• Knowledge of trigonometry, probability and statistics, differential and integral calculus, and multivariate calculus that supports the solving of complex engineering problems<br>• Ability to apply differential equations to characterize time-dependent physical processes |

| | |
|---|---|
| **Summarise your knowledge of the natural sciences relevant to your discipline and how it has been developed through formal study, on-job learning and/or continuing professional development.**<br><br>As I am an Electronics Engineer, I studied numerous subjects related to circuit designing and machine maintenance. There were numerous concepts involved related to developing the understanding of Engineering concepts. I also studied subjects like Circuit Designing while pursuing my Electronics Engineering degree.  In all the projects, I exhibited my electronics engineering knowledge and expertise thereby underlying physical science which I achieved through various training program, self-learning, and continuous self-development plan. During the project, I used my advanced engineering mathematical knowledge and estimated various crucial factors which worked effectively for the perfect project execution. | 1.1.4, 1.2.1, 1.3.1, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 2.9, 2.10, 2.11, 2.12, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15 1.13, 3.9 1.13, 4.1.2, 4.1.3, 4.1.4 |

| |
|---|
| **ELEMENT TWO**<br>**Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to your discipline** |
| **Context**<br>Branches of mathematics applied in engineering include arithmetic, algebra, geometry, trigonometry, calculus, differential equations, numerical analysis, optimization, probability and statistics, simulation, and matrix theory. Engineers apply mathematics in a wide variety of functions typically carried out in engineering organisations such as planning, design, manufacturing, construction, operations, finance, budgeting, and accounting. |
| **Performance Indicators**<br>• Knowledge of mathematics, statistics and numerical methods that supports the development or application of models that replicate 'real world' behaviours<br>• An understanding of the assumptions behind theoretical models and their impacts in the development and use of those models<br>• Ability to organise and analyse a data set to determine its statistical variability;<br>• Knowledge of trigonometry, probability and statistics, differential and integral calculus, and multivariate calculus that supports the solving of complex engineering problems<br>• Ability to apply differential equations to characterize time-dependent physical processes |

| | |
|---|---|
| **Summarise your mathematical knowledge relevant to your discipline and how it has been developed through formal study, on-job learning and/or continuing professional development.**<br><br>I solved complex engineering problem related to the power quality management while working at SIEMENS. I collected motor performance data while working as Electronics Engineer. I even studied various subjects related to the Electric Motor analysis to develop the understanding related to solving the mathematical problems. I discussed three work episodes in this report and all of them required mathematical calculations for successful solving of the complex problems. | **Provide annotations to your supplementary evidence (document and page number)**<br><br>**1.4.1, 1.4.2, 2.1.2, 3.1.4, 3.1.2** |

## ELEMENT THREE

**A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline**

### Context

Engineering fundamentals provide the knowledge base for engineering specialisations and represent a systematic formulation of engineering concepts and principles based on mathematical and natural sciences to support applications. The core areas of engineering fundamentals knowledge include fluid mechanics, statics and dynamics, electric circuits, solid mechanics, thermodynamics, heat transfer, mass transfer, and properties of materials. Washington Accord graduates are expected to be able to apply this knowledge of engineering fundamentals to solve complex engineering problems.

**Performance Indicators**

- Ability to define key factual information in core areas of fundamental engineering knowledge relevant to your engineering discipline
- Evidence of sufficient depth of knowledge of engineering fundamentals to demonstrate an ability to think rationally and independently within and outside a chosen field of specialisation
- Evidence of sufficient breadth of knowledge of engineering concepts and principles to allow subsequent professional development across a broad spectrum of engineering
- Ability to apply knowledge of engineering fundamentals to solve complex engineering problems relevant to your discipline

| **Summarise your knowledge of the core engineering fundamentals (as listed above) and how they have been developed through formal study, on-job learning and/or continuing professional development.** | **Provide annotations to your supplementary evidence (document and page number)** |
| --- | --- |
| • I applied systematic theory while working on the management of the power quality.<br>• I analysed the failure of exhaust motors while working on the feasibility.<br>• I learnt numerous subjects related to Electronics Engineering such as Semi-conductors, Electronics Circuits to get an in-depth knowledge associated with the technical concepts involved.<br>• I even attended numerous sessions held in the university and at my workplace related to the Electronics Circuit system designing which developed the comprehend understanding related to Electronics Engineering. | 1.9, 1.10, 1.11, 1.12, 1.13, 2.9, 2.10, 3.8, 3.9, 3.10, 1.9, 1.11, 1.13, 2.11, 2.13, 3.8, 3.9, 3.10 2.9, 2.11, 3.7, |

## Element Four

**Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline**

**Context**

In addition to a broad understanding of fundamental engineering principles, professional engineers are required to develop specialised engineering knowledge to support their practice. This may be aligned with traditionally defined fields of specialisation such as structural, industrial or geotechnical engineering; coherent combinations of such traditional areas; or more recently emerging fields such as software, biomedical or mechatronics engineering.

Advancing technological knowledge and complexity means that technical specialisation is increasingly necessary for an engineer to remain abreast of technological development throughout their career.

Washington Accord graduates are expected to be able to apply this engineering specialist knowledge to solve complex engineering problems.

### Performance Indicators

- Evidence of sufficient depth of knowledge to support practice within one or more recognised field of engineering
- Evidence of a systematic understanding of the coherent body of knowledge related to a particular field of engineering; its underlying principles and concepts; its usage and applications; and analytical and problem solving techniques
- Ability to apply specialist engineering knowledge to solve complex engineering problems

| **Summarise your specialist engineering knowledge and how it has been developed through formal study, on-job learning and/or continuing professional development.** | **Provide annotations to your supplementary evidence (document and page number)** |
|---|---|
| I worked on the power quality management project while working at SIEMENS and in which I learnt to analyse technical concepts related to the motor analysis. I noted the faults and reasons of faults in different exhaust conditions and then utilized my Electronics Engineering skills to cater the issue and finally consulted with the project manager to broaden my horizons in this regard. I similarly utilized my Electronics Engineering skills in other projects which I completed at my university. | 1.11 2.7, 2.8 3.11, 3.12 3.13,3.14, 3.15, 3.9, |



## ELEMENT FIVE

**Knowledge that supports engineering design.**

**Context**

The design process – the root of engineering – is the process of devising a system, component or process to meet desired needs. Engineering design is a systematic process that involves problem definition and scoping, research, analysis, option development and selection, modelling to predict future performance, detailed design and testing. Importantly, it also involves communication of the outcome in a way that enables the design solution to be realised.

Washington Accord graduates are expected to be able to apply this knowledge of the design process to solve complex engineering problems.

**Performance Indicators**

- Ability to undertake research and analysis to support the design process
- Ability to investigate a situation or the behaviour of a system and identify relevant causes and effects
- Ability to develop from first principles and construct mathematical, physical and conceptual models of situations, systems and devices, with a clear understanding of the assumptions made in development of such models
- Application of technical knowledge, design methods and appropriate tools and resources to design components, systems or processes to meet specified criteria
- Ability to analyse the pros and cons of alternative design options to support the development of an optimised design alternative
- Ability to analyse the constructability or manufacturing feasibility of a project or product
- Experience of personally conducting a significant design exercise, providing evidence of the consideration of various realistic constraints, such as safety, reliability, ethics, economic factors, aesthetics and social impact.
- Ability to apply appropriate design methods in solving complex engineering problems

| Summarise your knowledge that supports engineering design relevant to your discipline and how it has been developed and applied through formal study, on-job learning and/or continuing professional development. | Provide annotations to your supplementary evidence (document and page number) |
| --- | --- |
| In all the projects, I strictly followed various international standards and codes which helped me to achieve quality results. I referred to the IEEE specs for preparing the diagrams. I adopted DEK solder paste Printer for which I learnt special training program. I used the AutoCAD tool for modifying the various technical drawings. I used the Microsoft Excel and developed the special excel sheet template for budgeting and estimation purpose. During the flow analysis, I used the wave soldering technique for completing the soldering processes in the design. | 1.14, 2.11, 3.8, 3.13 3.9 3.10 3.10 3.8 2.14 1.9 2.13, |

## **Element Six**

**Knowledge of engineering practice in the engineering discipline**

**Context**

Engineers require knowledge of a broad range of tools and techniques relating to technical (measurement, modelling, drawing, design), business (financial management, project management) and interpersonal (communications, teamwork) aspects of modern engineering practice.

Washington Accord graduates are expected to be able to:

- Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations.
- Apply knowledge of management principles and economic decision making as part of the management of engineering projects
- Function effectively as an individual and as a member or leader in diverse teams
- Communicate effectively with both technical and non-technical audiences

**Performance Indicators**

Tools and technologies:

- Awareness of critical issues affecting current technical and professional practice
- Awareness of current tools of analysis, simulation, visualisation, synthesis and design, particularly computer-based models and packages, and competence in the use of a representative selection of these
- Appreciation of the accuracy and limitations of such tools and the assumptions inherent in their use
- Knowledge of materials and resources relevant to the discipline and their main properties and ability to select appropriate materials and techniques for particular objectives
- Knowledge of a wide range of laboratory procedures relevant to the discipline and a clear understanding of the principles and practices of laboratory safety
- knowledge of current types of systems, equipment, information technology, and specifications that accomplish specific design objectives

Communication:

- write correspondence that clearly and concisely communicates facts and circumstances related to a project, product or process
- plan, prepare and deliver an oral presentation, with appropriate visual aids and other supporting materials
- communicate effectively with both technical and non-technical individuals and audiences

Engineering management principles and economic decision making:

- apply  appropriate tools and techniques to monitor project schedules and costs

Team work:

- Operate as an effective team member or leader of a multidisciplinary team

| Summarise your knowledge in each of these core areas underpinning engineering practice and how it was developed through formal study, on-job learning and/or continuing professional development. | Provide annotations to your supplementary evidence (document and page number) |
| --- | --- |
| I managed to achieve quality results in my projects by efficiently using the diverse software tools. Using the Primavera tool, I prepared the S-curve and level 1 and level-2 schedule. I used the Microsoft Excel tool to develop a special template which I used for the budgeting and estimation purpose. I modified the technical drawings and layout using the AutoCAD tool. I adopted professional and structural approach while working on the projects where I took part in regular team meetings which enabled me to monitor the overall status and progress of the project. During the projects, I presented my work methodologies and key results using the Microsoft PowerPoint tool. | 1.9, 2.9, 2.13, 3.8 2.13 2.14 2.9, 3.8 3.10 1.15, 1.7, 2.6, 2.15, 3.6, 3.18 1.18, 2.16, 3.19 |

## ELEMENT SEVEN

**Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability**

### Context

Engineers design artefacts (facilities, structures, systems, products and processes) that are intended to meet a societal need, but which typically impact on individuals or groups in different ways. As a result, design and decision-making processes must take account of often conflicting stakeholder needs. An understanding of this societal context and the ethical obligations that the engineer has in service of society are critical components of engineering practice.

- Washington Accord graduates are expected to be able to:•Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
- Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.

**Performance Indicators**

Demonstration of ethical behavior in accordance with ethical codes of conduct and established norms of professional conduct•Evidence of making ethical decisions and regulating one's own professional conduct in accordance with a relevant code of ethical conduct

• Implementation of appropriate health and safety practices

• Application of safe practices in laboratory, test and experimental procedures

• Awareness of the social and environmental effects of their engineering activities

• Awareness of sustainable technologies and sustainable development methodologies

• Ability to identify risks as a consequence of engineering compromises made as a result of projector business constraints, and understanding of techniques to mitigate, eliminate or minimize risk

• Knowledge of appropriate risk management techniques used to assess the accuracy, reliability and authenticity of information

• Understanding of the role of quality management systems tools and processes



| Summarise your knowledge of the role of engineering in society and how it has been developed through formal study, on-job learning and/or continuing professional development. | Provide annotations to your supplementary evidence (document and page number) |
|---|---|
| Being an engineer, I inherent interaction with society and societal needs, leads naturally to my responsibility to society. Engineering education has made significant impact in me related to progress in strengthening the basic sciences in engineering, including mathematics, chemistry, and physics. I got recent trends toward increasing discussion of professionalism in the classroom notwithstanding. Being an Engineer, I demonstrated the following responsibilities towards the society:<br>• Safety and Welfare of the Public and of Clients<br>• Professional Ethics<br>• Legal Liabilities<br>• Environmental Responsibilities<br>• Quality | 1.9, 2.9, 2.13, 3.8 2.13 2.14 2.9, 3.8 3.10 1.15, 1.7, 2.6, 2.15, 3.6, 3.18 1.18, 2.16, 3.19 |

| | |
|---|---|
| • Communications | |

## ELEMENT EIGHT

**Engagement with selected knowledge in the research literature of the discipline**

**Context**

Research and broader lifelong learning capabilities are essential if the engineer is to remain up-to-date with rapidly evolving scientific knowledge, technology and engineering tools critical to engineering practice

Washington Accord graduates are expected to be able to use research-based knowledge and research methods as part of the investigation of complex problems in their discipline

**Performance Indicators**

- Advanced knowledge in at least one area within your discipline, to a level that engages with current developments in that area
- Understanding of how new developments relate to established theory and practice and to other disciplines with which they interact
- Describe advancements in engineering research and technology and science in a particular area of engineering practice;
- Review research articles pertaining to a project component typically encountered in a specific area of engineering design;
- Choose topics most appropriate for continuing education to increase depth of technical knowledge pertinent to the specific area of engineering practice
- Commitment to lifelong learning.

| **Summarise your research knowledge and how it has been developed through formal study, on-job learning and/or continuing professional development.** | **Provide annotations to your supplementary evidence (document and page number)** |
|---|---|
| I pose advanced knowledge of the Electronics Engineering softwares such as PROTEUS & AUTOCAD tool which I used for modifying the technical drawings. While making the suitable corrections in the technical drawings, I also provided the critical feedback to my team members which helped them to enhance their software tool knowledge. While working on the projects, I completed the course via class room and practical training on SIPLACE. All these courses and training program contributed to my overall knowledge. During the projects, I focused on self-development for which I carried out self-study, used the internet resources and also had technical discussion with senior colleagues. All these practice enabled me to broaden my existing knowledge. | 1.4, 1.5, 1.6, 2.6, 2.7, 2.8, 3.8 1.6 1.16, 3.7 |

# Section Three - Evidence of Application of Knowledge

In this section you are required to provide evidence of the application of your engineering knowledge using 3-4 engineering projects or activities (Work/Study Episodes) that you have been involved with.

Provide a general overview of the scope or parameters of each project or activity, your role in it and the particular challenges or complexities involved. Then describe, in narrative form, how it provides evidence of the application of different aspects of your engineering knowledge. Cross reference to the relevant elements of the knowledge profile in the right hand column.

You are also required to complete the Knowledge Matrix to summarise the contribution to knowledge demonstration made by each project. The work/study episodes are expected to provide at least 2 examples of the application of each knowledge element.



| **Work/Study Episode 1** | **Element** |
|---|---|
| **WE 1.1 Overview of the project** | |
| **WE 1.1.1** Siemens AG is a German conglomerate company headquartered in Berlin and Munich and the largest industrial manufacturing company in Europe with branch offices abroad. The principal divisions of the company are *Industry*, *Energy*, *Healthcare*, and *Infrastructure & Cities*, which represent the main activities of the company. The company is a prominent maker of medical diagnostics equipment and its medical health-care division, which generates about 12 percent of the company's total sales, is its second-most profitable unit, after the industrial automation division. The company is a component of the Euro Stoxx 50 stock market index. Siemens and its subsidiaries employ approximately 379,000 people worldwide and reported global revenue of around €83 billion in 2018 according to its earnings release. | **One** |
| **WE 1.1.2** The project was based on the machining components analysis for which I was nominated as Executive Engineer to sort out the issue and proposed the optimum solution. I figured out the technical issues in two different machines designed and solved them accordingly and as per the set standards practiced by SIEMENS. | **Two** |

## WE 1.2 Your role and responsibilities

**WE 1.2.1** Below were my roles;

- Identifying the two main problems along with the regular Executive Engineering work.
- Proposed and implemented the solutions.

Below were my responsibilities;

- I prepared and submitted Pre-qualification / EOI (Expression of Interest) documentation for obtaining Tender Invitation.
- I prepared and raised RFQ's for all Materials and equipment's as required for the Project upon reviewing the Tender documents.
- I prepared and updated RFQ register.
- I prepared comparison statement for all quotations received.
- I prepared and evaluated Technical & Commercial compliance of all quotes & subcontracts.
- I raised pre-bid queries
- I compiled Technical and Commercial bids for tenders.
- I attended mid-tender meetings / site visit and prepared reports.
- I prepared Project Estimates which consist of:
  - Direct cost (Manpower, Equipment, Materials, Consumables & Subcontracts)
  - Indirect cost (Project team and facilities).
- I prepared Tender schedule coordinating all departments, phases and milestone of the Project.
- I generated preliminary design calculations & drawings which is required to verify and ensure data provided as part of Tender documents are reliable.
- I prepared and do presentation for the Client / End user with the Execution plan of the Project.
- I collected and arranged for handover of bid documentation for the execution of awarded projects.
- I ensured Occupational Safety at work place.
- I observed Quality in every maintenance job with best tools and knowledge. Provide best machine availability for production.
- Technical modification on machine in cooperation with technology partner. Collaborate with Global / Local support functions including IT support.
- I created consistent and traceable records for maintenance activity.
- Evaluation, Procurement and management of spare parts and production aids.
- I conducted Site AcceptanceTest.

**One**

**Five**



## WE 1.3 Complexities (using the complexity definitions) and challenges of the project

**WE 1.3.1 (Problem 1)**

1. Line2 S20-1, S20-2, S20-3, S20-4 and F5 Machines all components are placing XY- offset.

**WE 1.3.2 (Problem 2)**

2. S20-2 machine shows Error" RV /Z axis I rms current limiting". in Gantry-1

## WE 1.4 How does this project demonstrate application of your engineering knowledge?

**WE 1.4.1 Calculations carried out**

1) Found component placement shift in following machines. **Two**
S20-1, S20-2, S20-3, S20-4, F5.
Observed the problem thoroughly.
Test run ALU board placement has been done.

2). The Flat cable between intermediate board and head board was NOT OK. in S20-2 Gantry-1

**WE 1.4.2 Engineering Testing:** **Two**

1). There are two cause for component shift problem as mentioned below.
a. Machine calibration was NOT OK.
b. Fiducial data in cad import is NOT OK.

2). The flat cable from intermediate board to head board was faulty in Gantry-1 of S20-2 machine

1). After doing the ALU board placement found that machine calibration is NOT OK. Done the complete calibration (PCB camera, Machine zero point, RV head) in all machine.
Then again test run ALU board and found all the placement are OK in all machines. Then run the customer product but we still found placement shift in Y axis of board for all components. Understood that the fiducial data in particular placement program need to be corrected. **Four**

2). Replaced both flat cable in Gantry-1 of S20-2 machine and found working fine.
Result: All the machines are running fine.
Suggestion: Please calibrate the machines whenever ditaching and attaching of parts related to gantry and head.
There is no fixed period for periodic calibration, but still we can suggest you to do calibration once in 6 month for all machine since these machines are from old series.

**WE 1.4.3 Project management** **Four**

I was involved in meetings with Project Manager weekly to discuss the progress and material delivery status. Moreover, any changes or modification required to optimize the task was also discussed.

I used to have everyday meeting with my subordinates to discuss technical concerns and issues related to progress, man-hours and necessary man power requirement.

I also had weekly meetings with other discipline engineer like instrumentation, piping, civil so that we can find solutions to any concerns during execution.

My leadership skills were clear as I was proactive and noticed problems in advance. This approach helped project to complete within schedule. I ensured that there was no overrun in terms of schedule and the budget. Secondly, I also provided solution to suppliers so that they can meet the necessary delivery dates.

I was involved in preparation of Electrical Datasheet, Material Requisition and Technical Bid Evaluation report for the electrical equipment. Besides this, site survey report was also prepared so that missing information from tender documents were duly incorporated.

Furthermore, I prepared necessary Technical Queries and Engineering Change Notes so that any changes or modifications are documented officially.

**WE 1.4.4 Software's used**

- Microsoft Word, Excel, PowerPoint
- AutoCAD 2D & 3D
- Google Sketch up

**WE 1.4.5 Engineering Standards**

- IEEE
- IET Standard Engineering Practice
- ISO 8573-1: 2010



**WE 1.4.6 Resource Usage**

Extensive research was carried out in internet for coming with an alternative solution to solve the power quality management issues.

I used the drafting personnel appropriately wherein productive and consistent set of drawings and ideas were delivered as output.

**Work/Study Episode 2** — **Element**

**WE 2.1 Overview of the project**

**WE 2.1.1** PLC Based Conveyor Control System was the project which I completed for the degree fulfilment in the Electronics Engineering. The project "PLC Based Conveyor control system" is an electronic circuit consisting of PLC module, sensors and motor to automate the conveyor of a production line in an industry. This system will support the movement of unfinished product to processing machine and finished products to packing area using a simple and trouble free PLC controller. This system will serve the following objectives:- **One**

(a) Save the time of goods waiting at the input of processing machine.
(b) Saves additional man power.
(c) Consistent flow of goods to machine and packing area.
(d) No complicate circuits.
(e) User friendly and programmable.
(f) Cost in economy range.
(g) Contribute for total save in production time.

**WE 2.2. Your role and responsibilities**

**WE 2.2.1** Below was my role;

Electronics Engineering Student

My responsibilities were:

(a) Analysis of the present system and technology followed in industry where not fully automated line conveyors are not present.
(b) Study of existing production work flow in industries.
(c) Studying the problems arising out of existing system.
(d) Proposing the solution by completing the design objectives.

**WE 2.3 Complexities (using the complexity definitions) and challenges of the project** — **Four**

**WE 2.3.1 (Problem 1)**

The objective of project planning was to provide a framework that enables the developer to make reasonable estimate of resources, cost, and schedule. In addition, estimates should attempt to define best-case, average-case, and worst-case scenarios so that project outcomes can be bounded. Therefore, the plan must be adapted and updated as the project proceeds. While preparing project planning I kept the following points:

1. Safety of operator during operation
2. Procurement of components
3. Schedule planning
4. Develop the system as requirement
5. Achieve the result.

While developing a project, it is very important to define the category of such project. As for as this system is concern, It contains hardware and software combination to automate the system.

**Two**

One must know what the problem is before it can be solved. General approaches for determining user requirements are:

- Preliminary investigation – asking general questions
- Analysis of existing system – getting information from existing system
- The Proposed system

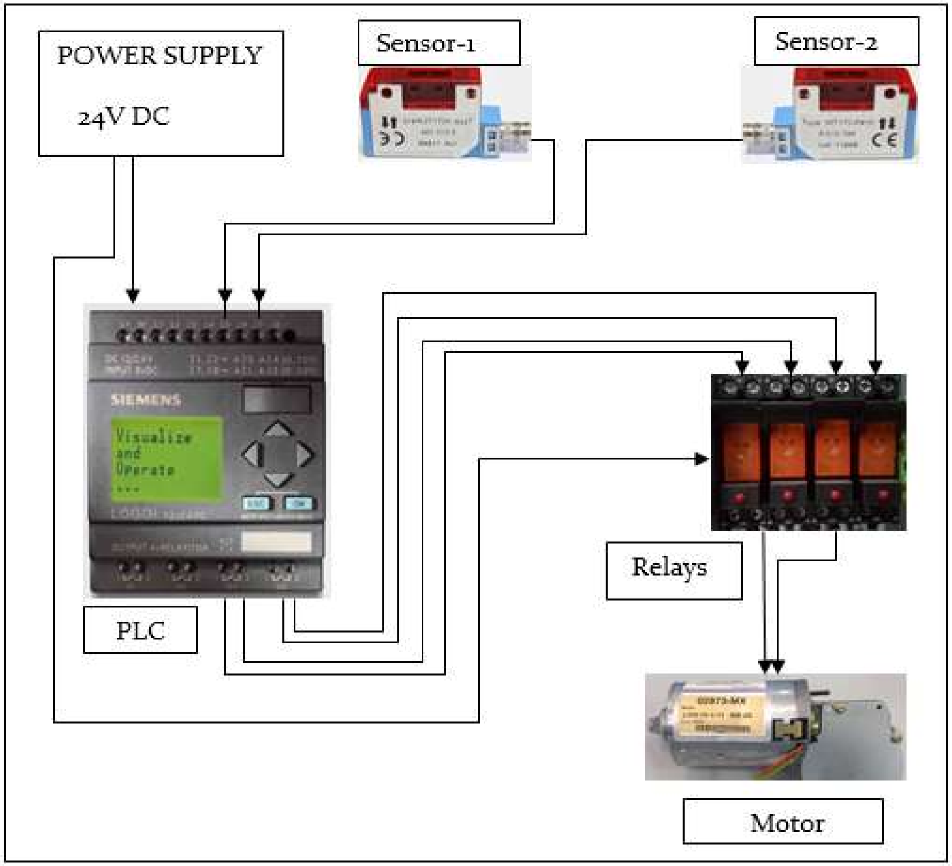
In the case of conveyor system, user required a fully automated system which will save time and error free transport of work piece.

**Five**

**WE 2.3.2 (Problem 2)**

I got another issue while working on the system designing and it was related to the implementation of the input data structure and I implemented the following points:

1. Develop a system to collects the work piece from previous machine and transfer it to the next machine.
2. During the process of transport and function of next machine, PLC must inform the previous station to wait till next requirement request come from the next station.
3. This process continue for all the work piece in line for production




**Three**

**WE 2.4 How does this project demonstrate application of your engineering knowledge?**

**Four**

**WE 2.4.1 Calculations carried out**

As per design, verification and testing “PLC Based Conveyor Control system” was working as expected and meeting the requirement of user.

| Base modules (BM) | LOGO! 12/24RC[1)], LOGO! 12/24RCo[2)] |
|---|---|
| Inputs | 8 |
| of these usable as analog inputs | 4 (0 to 10 V) |
| Input/supply voltage | DC 12/24 V |
| Permissible range<br>On “0” signal<br>On “1” signal<br>Input current | 10.8 V DC to 28.8 V DC<br>Max. 5 V DC<br>Min. 8.5 V DC<br>1.5 mA (I3 to I6), 0.1 mA (I1, I2, I7, I8) |
| Outputs | 4 relays |
| Continuous current | 10 A for resistive load;<br>3 A for inductive load |
| Short-circuit protection | External fuse required |
| Operating frequency | 2 Hz for resistive load;<br>0.5 Hz for inductive load |
| Power consumption | 0.7 to 2.1 W (12 V)<br>1.0 to 2.4 W (24 V) |
| Connecting cables | 2 x 1.5 mm² or 1 x 2.5 mm² |
| Ambient temperature | 0 to +55 °C |
| Storage temperature | −40 °C to +70 °C |
| Radio interference suppression | To EN 55011 (limit-value class B) |
| Degree of protection | IP20 |
| Dimensions | 72 (4 WM) x 90 x 55 mm (W x H x D) |



**Five**

**WE 2.4.2 Engineering testing**

I tested all the circuit components and I successfully carried out the service test while it was very important to carry out all the components selections appropriately which I did for obtaining the appropriate project outcome.

**WE 2.4.3 Project management**

I was involved in meetings with Project Supervisor fortnightly to discuss the progress and material delivery status.

| | |
|---|---|
| Moreover, any changes or modification required to optimize the task were also discussed.<br><br>I used to have everyday meeting with my Subordinates to discuss technical concerns and issues related to progress, man-hours and necessary man power requirement.<br><br>I also had weekly meetings with other discipline engineer like instrumentation, piping, civil so that we can find solutions to any concerns during execution.<br><br>My leadership skills were clear as I was proactive and noticed problems in advance. This approach helped project to complete within schedule. Moreover, I ensured that there was no overrun in terms of schedule and the budget. Secondly, I also provided solution to suppliers so that they can meet the necessary delivery dates.<br><br>**WE 2.4.4 Software used**<br><br>● Microsoft Word, Excel, PowerPoint<br>● PLC<br><br>**WE 2.4.5 Engineering Standards**<br><br>● NEPA<br>● IEEE<br>● Underwriter Laboratories (UL)<br><br>**WE 2.4.6 Resources Allocation**<br><br>During execution of this project, I took guidance from my Project Supervisor and Project Guide to resolve challenges which came across. As part of this in order to record the utilization of manpower and materials, I established an allocation sheet which was prepared per engineer listing his responsibilities and relevant works carried out. This daily allocation sheet was signed off by Project Supervisor on weekly basis, this helped me to claim several works as part of delay analysis and prolongation cost. | **<u>Seven</u>** |

| Activity list | 20-23 Dec-2016 | 23-30 Dec-2016 | 01-20 Jan-2017 | 25-27 Jan-2017 | 28-30 Jan-2017 |
|---|---|---|---|---|---|
| Preparation of synopsis | ■ | | | | |
| Study of existing projects | ■ | | | | |
| Requirement gathering | ■ | | | | |
| Analysis and block diagram preparation | | ■ | | | |
| Circuit design and PLC programming | | ■ | | | |
| Design review and design freeze | | ■ | | | |
| Bread board assembly and testing functionality | | | ■ | | |
| Assembly on general purpose PCB | | | ■ | | |
| Finalizing the project | | | | ■ | |
| Final report | | | | | ■ |

**Work/Study Episode 3**

**Element**

**WE 3.1 Overview of the project**

**WE 3.1.1** This was the project which I completed while working as Senior Engineer at SIEMENS, India. The project title was "Run in Room Construction at SIEMENS, GOA".

**One**

**WE 3.1.2** Siemens AG is a German conglomerate company headquartered in Berlin and Munich and the largest industrial manufacturing company in Europe with branch offices abroad. The principal divisions of the company are *Industry*, *Energy*, *Healthcare*, and *Infrastructure & Cities*, which represent the main activities of the company. The company is a prominent maker of medical diagnostics equipment and its medical health-care division, which generates about 12 percent of the company's total sales, is its second-most profitable unit, after the industrial automation division. The company is a component of the Euro Stoxx 50 stock market index. Siemens and its subsidiaries employ approximately 379,000 people worldwide and reported global revenue of around €83 billion in 2018 according to its earnings release.

**WE 3.2 Your role and responsibilities**



In this project my designation was Senior Engineer wherein I was in charge for all the activities related to Engineer and reported directly to the Director Engineering. Moreover, I had the following responsibilities:

- Working on the 3 different levels of the safety measures.
- Pre-calculated risks while working on the design.
- Analysing the varied temperature included in the design.
- Completing the NEW design.
- Coordinated and collaborated with the client on technical specifications and clarifications.
- Coordinated with the design department for preparing shop drawings and isometric drawings.
- I was responsible for verifying the design, preparing technical queries, reviewing construction costs and reconciling with the target budget to prevent cost overflows.
- Conducted delay analysis, prepared cost variations reports, assessed claims ensuring accuracy and consistency of the claims settlement.
- Prepared technical submittals for the materials and vendor/subcontractor pre qualifications required for the consultant/client approval.
- Developed the project procedures & plans and updated the procurement register.
- Responsible for negotiating with suppliers/vendors/subcontracts based on technical and commercial aspects.
- Coordinated with the subcontractors on engineering, procurement, installation & commissioning aspects.
- Coordinated with various departments required for timely completion of the installation work, interface management.
- I was responsible for maintaining the compliance with the safety procedures and quality standards.
- Coordinated with the QA/QC department to ensure quality construction activities.

**WE 3.3 Complexities (using the complexity definitions) and challenges of the project**

**WE 3.3.1 (Problem 1)**

**Problem1 OLD RUN-IN Room**

**WE 3.3.1.1** Following incidents occurred because of the improper design:

- Burned due to improper safety measure on 5/May/2017
- Improper design caused fire in system
- Temperature level cannot vary, works only for 50 °C
- Belt driven with motor assembly inside the heating chamber
- No control or Measure at Shop floor.

**Four**



**WE 3.4 How does this project demonstrate application of your engineering knowledge?**

**WE 3.4.1 Calculations carried out**

**WE 3.4.2 Solution Approach**

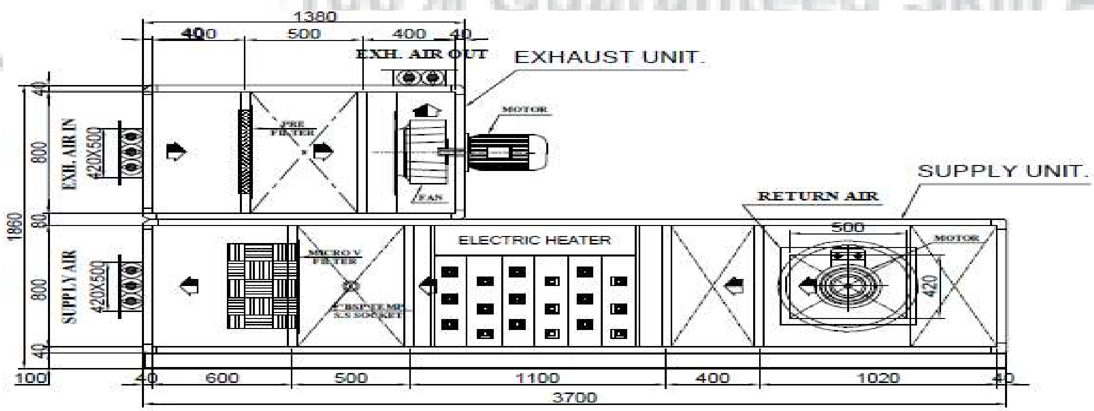
- Direct drive system.
- External fitted Motor.
- Heater Bank capacity improved to supply for 75°C.
- Control panel is accessible to Operator at shop floor.
- Implementation of the installed handling unit

**Three**



**WE 3.4.1.1** Procedure:

I implemented the Elevation plan as shown in the below drawing:

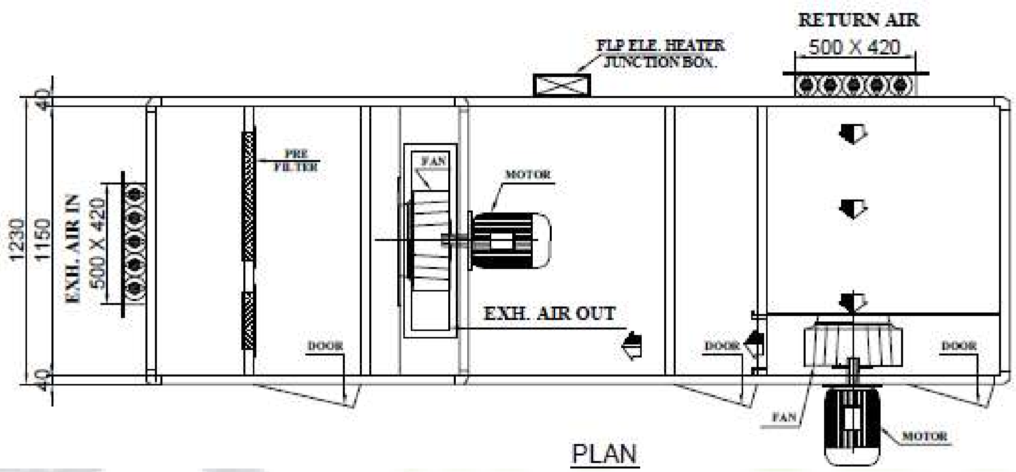



ELEVATION

**Five**

**WE 3.4.1.2** OVERALL DESIGN PLAN:

I implemented the overall design after visiting the room and taking all the necessary measurements:

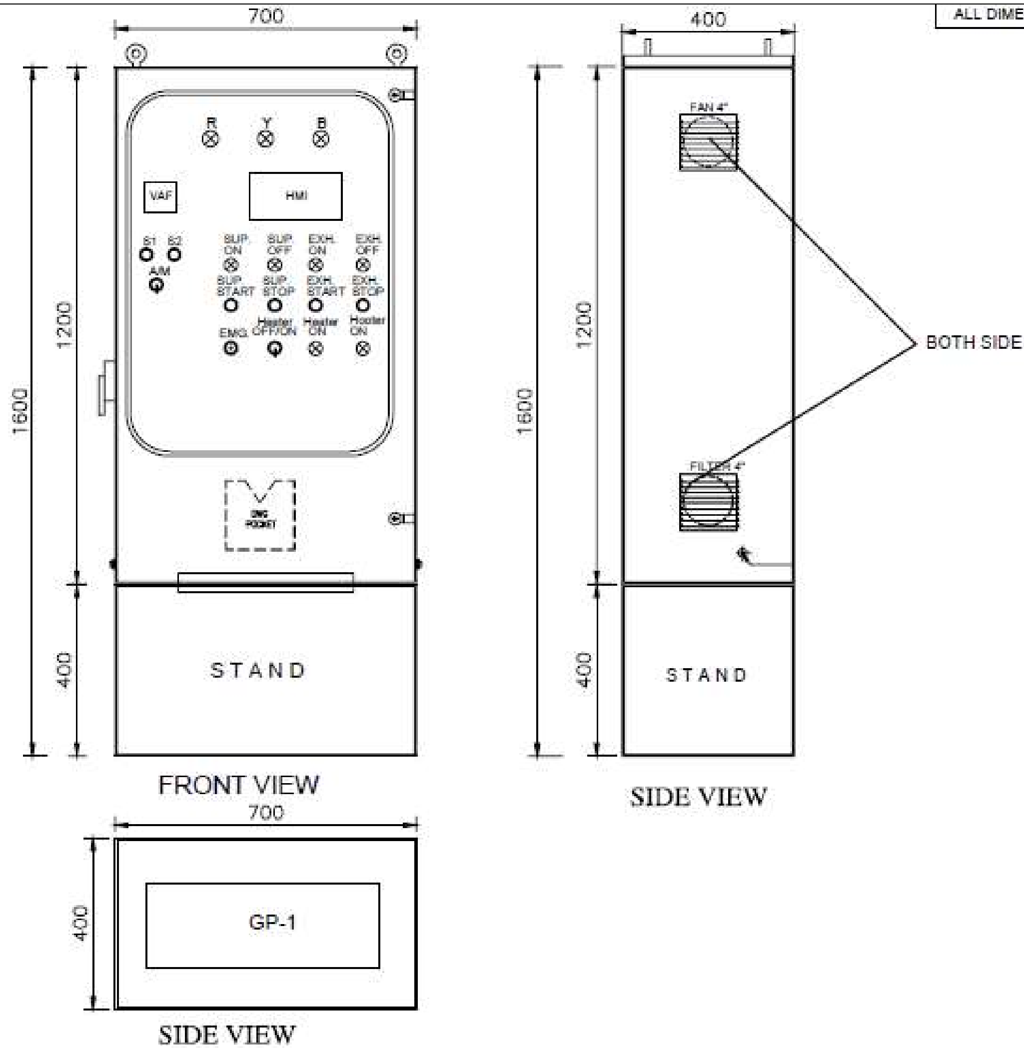



Six



The drawing of the implemented AHU panel is shown below:

Eight




| ALL DIMENSIONS ARE IN MM | IF IN DOUBT, ASK | SCALE:- NOT TO SCALE |
|---|---|---|

| LEGNED | | |
|---|---|---|
| 1 | S1 | CYCLE START |
| 2 | S2 | CYCLE STOP |
| 3 | A/M | AUTO MANUAL SWITCH |
| 4 | VAF | VOLTAGE AMP.METER |
| 5 | HMI | HUMAN MAN INTER FACE |
| 6 | EMG. | EMERGENCY PUSH BUTTON |

| NO | | | |
|---|---|---|---|
| 1 | SHEET MATERIAL | MS | CRCA |
| 2 | TYPE OF PANEL | STRUCTURE/BOX | BOX |
| 3 | SHEET THICKNESS | STRUCTURE/BOX | 1.6mm/2mm |
| | | DOOR | 2mm |
| | | BASE PLATE | 2mm |
| | | GLAND PLATE | 3mm |
| | | STIFFENER | 2mm |
| | | BASE STAND | 1.6/2mm |
| 4 | COLOUR | PANEL | RAL 7035 |
| | | BASE PLATE | RAL 7035 |
| | | BASE CHANNEL | BLACK |
| 5 | HINGES | MAKE | SIEMENS |
| | | QTY | 2 NOS. |
| 6 | LOCK TYPE | ABB/ 3POINT CENTER | DC LOCK |
| 7 | GLAND PLATE | LOCATION | BOTTOM |
| 8 | PANEL MOUNTING | FLOOR | FLOOR |
| 9 | PROTECTION CATEGORY | | IP 42 |
| 10 | GASKET | | 25X3 |
| 11 | SWITCHGEAR | MAKE | SIEMENS |

**Seven**

**Seven**

**Eight**

**WE 3.4.2.1** Final Output (ROOM DESIGN)

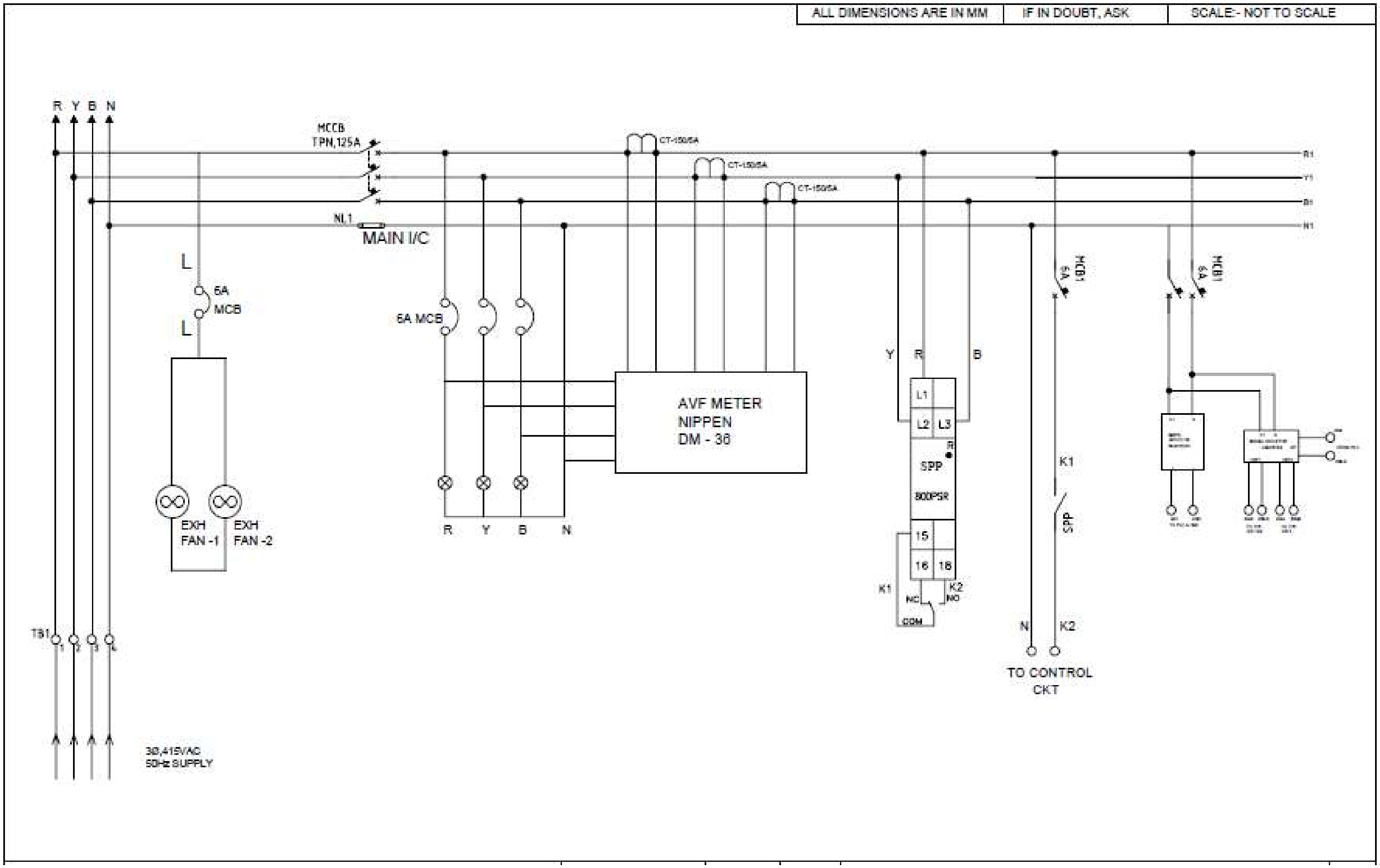
**Three**

**Six**



**WE 3.4.3** SLD Results

The implemented SLD is shown below:


ALL DIMENSIONS ARE IN MM
IF IN DOUBT, ASK
SCALE:- NOT TO SCALE
R Y B N
MCCB
TPN,125A
NL1
MAIN I/C
6A
MCB
EXH
FAN -1
EXH
FAN -2
6A MCB
R Y B N
AVF METER
NIPPEN
DM - 36
SPP
800PSR
K1
K2
NC
NO
COM
MCB1
6A
SPP
N
K2
TO CONTROL
CKT
TB1
3Ø,415VAC
50Hz SUPPLY

**Four**

| | |
|---|---|
| **WE 3.4.4 Project management**<br><br>My role in this project was Senior Executive Engineer wherein I was coordinating with all the Original Equipment manufacturer (OEM) in the company for any works related to the testing of motors. I prepared reports addressing the defects of equipment's and followed with suppliers for rectifying those defects in an cost effective timely manner without affecting adversely on the operation of the campus. | **Six** |
| **WE 3.4.5 Software used**<br><br>● Microsoft Word, Excel, PowerPoint<br>● AUTOCAD | **Three** |
| **WE 3.4.6 Engineering Standards**<br><br>● IEEE<br>● IET<br><br>**WE 3.4.7 Resources Allocation**<br><br>I consulted with my Steam Specialist on this matter and he helped me to gather the Codes and Standards which is applied for Power Quality Management which was also confirmed and concurred by other SIEMENS engineers.<br><br>I took initiation and started checking possibilities of performing this task by myself. I gathered data related to other motor's manufacturers from companies around the world and it was also for equipment's and test kits used for Quality Check. I approached my Project Manager for approval and received his acceptance. Thereafter, I approached my Client and got approval to go further. I placed purchase order for equipment's and kits taking into consideration for quality improvement and allowable provision within the system. | **Five** |

| | |
|---|---|
| | |

# Knowledge Matrix

| Knowledge Element | W/S Episode 1 | W/S Episode 2 | W/S Episode 3 |
|---|---|---|---|
| 1. Application of knowledge from one or more of the natural sciences | 1.9, 1.10, 1.11, 1.12, 1.13, 1.14 | 2.9, 2.10, 2.11, 2.12 | 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15 |
| 2. Application of knowledge of mathematics | 1.9, 1.11, 1.13 | 2.9, 2.11, 2.13 | 3.8, 3.9, 3.10 |
| 3. Application of knowledge of engineering fundamentals | 1.9, 1.10, 1.11, 1.12, 1.13 | 2.9, 2.10,2.11, 2.13 | 3.7,3.8, 3.9, 3.10 |
| 4. Application of specialist engineering knowledge to solve complex problems | 1.11 | 2.7, 2.8 | 3.9,3.11,3.12,3.13, 3.14, 3.15 |
| 5. Application of knowledge of design methods to solve complex problems | 1.9, 1.14 | 2.11, 2.13, 2.14 | 3.8, 3.9, 3.10, 3.13 |
| 6. Application of knowledge of key elements of engineering practice | 1.9, 1.7, 1.15, 1.18 | 2.9, 2.13, 2.14, 2.15, 2.16 | 3.6, 3.8, 3.10, 3.18, 3.19 |
| 7. Role of Engineering in Society | 1.6,1.16, 1.19,1.20 | 2.7, 2.8, 2.17 | 3.12, 3.13, 3.14, 3.15, 3.17, 3.18, 3.20 |
| 8. Application of advanced knowledge in an area of your discipline | 1.6, 1.16 | 2,11, 1,12 | 3.7, 3.8 |

# SECTION FOUR – SUPPLEMENTARY EVIDENCE

## Academic Transcript(s)

Please attach a certified copy of your academic transcript(s) if you have not already supplied one to IPENZ

## WORK HISTORY SUMMARY

List your employment history starting from your most recent employment and then chronologically back to the start of your first job.

| Ref No | Name of Employing Organisation | Position Title | End mm/yy<br>Start mm/yy | Key responsibilities, activities undertaken, major achieveme projects. These should relate to your practice area descripti |
|---|---|---|---|---|
| 1. | SIEMENS Ltd., India | Maintenance Manager | Present -<br>November, 2016 | |
| 2. | EOLANE Electronics, India | Process Engineer | End date: Oct, 2016<br>Start date: Dec, 2013 | |

| | | | | |
|---|---|---|---|---|
| 3. | ASM Assembly Systems, India | Sr. Executive Service Engineer | End date: August 2013<br>Start date: April 2012 | . |
| 4. | SIEMENS Ltd., India | Sr. Executive Service Engineer | End date: March 2012<br>Start date: May 2005 | |



## CONTINUED PROFESSIONAL DEVELOPMENT (CPD) ACTIVITIES SUMMARY

| DESCRIPTION OF ACTIVITY AND LEARNING.<br>**Please record all relevant CPD activities (eg. short course, conference, reading, technical lectures, formal study towards qualification, research, discussion groups, workshops, symposia, voluntary service roles) that have extended your professional engineering knowledge and have assisted you to develop the knowledge profile of a professional engineer. Describe the learning outcomes and how these have contributed to your acquiring a Washington Accord level of knowledge.** | **Was Asse invo<br>Wha outc** |
|---|---|

| Date(s) | Actual Hours | Form of Activity | Title of activity | What was the knowledge you acquired? How have you applied this knowledge in your engineering practice? | |
|---|---|---|---|---|---|
| Jun 2018 | 200 | Training | Wave soldering defect reduction, FPY improved by 10% | Worked on the overall improvement of the wave soldering defect reduction and it resulted in improving the overall FPY by 10% | Cou Com Cert |
| April 2017 | 40 | Training | Overall Productivity Improvement workshop | Completed training workshop on improving the overall productivity. | Cou Com Cert |
| May 2015 | 40 | Training | Course on Project Planning using PRIMAVERA | I prepared Level 1 & Level 2 schedules for the projects using Primavera P3, budgeted Man-hours were incorporated to the schedule. Also learnt and prepared S-curve. | Cou Com Cert |
| March 2013 | 8 | Course | Introduction to Quality Management Systems | In my projects at SIEMENS, I strictly followed my company's safety policies and quality regulations to achieve the quality and standard results. | Cou Com Cert |

# SECTION FIVE - PAYMENT

## KNOWLEDGE ASSESSMENT (LEVEL 2) FEE PAYMENT

| | | | |
|---|---|---|---|
| **ASSESSMENT FEE (INCL GST) IN NZD** | **NZ$1,351.25** | Please send a receipt | ☐ |

**CREDIT CARD DETAILS:**

Visa ☐ Bankcard / Mastercard ☐ American Express ☐ Diners Card ☐

**Credit Card Number**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |

**Name on card** **Expiry Date** **CVV**

**Cardholders Signature** ______________________

## WHERE TO SEND COMPLETED DOCUMENTS

Send the completed form and associated documents to the **IPENZ Membership Manager** at one of the addresses below:

**Courier Address:**

IPENZ National Office,
Level Three
50 Customhouse Quay
Wellington 6144,
New Zealand

**Postal Address:**

IPENZ National Office
PO Box 12-241
Wellington 6144
New Zealand

# Appendix One

## COMPLEXITY DEFINITIONS

### COMPLEX ENGINEERING PROBLEMS

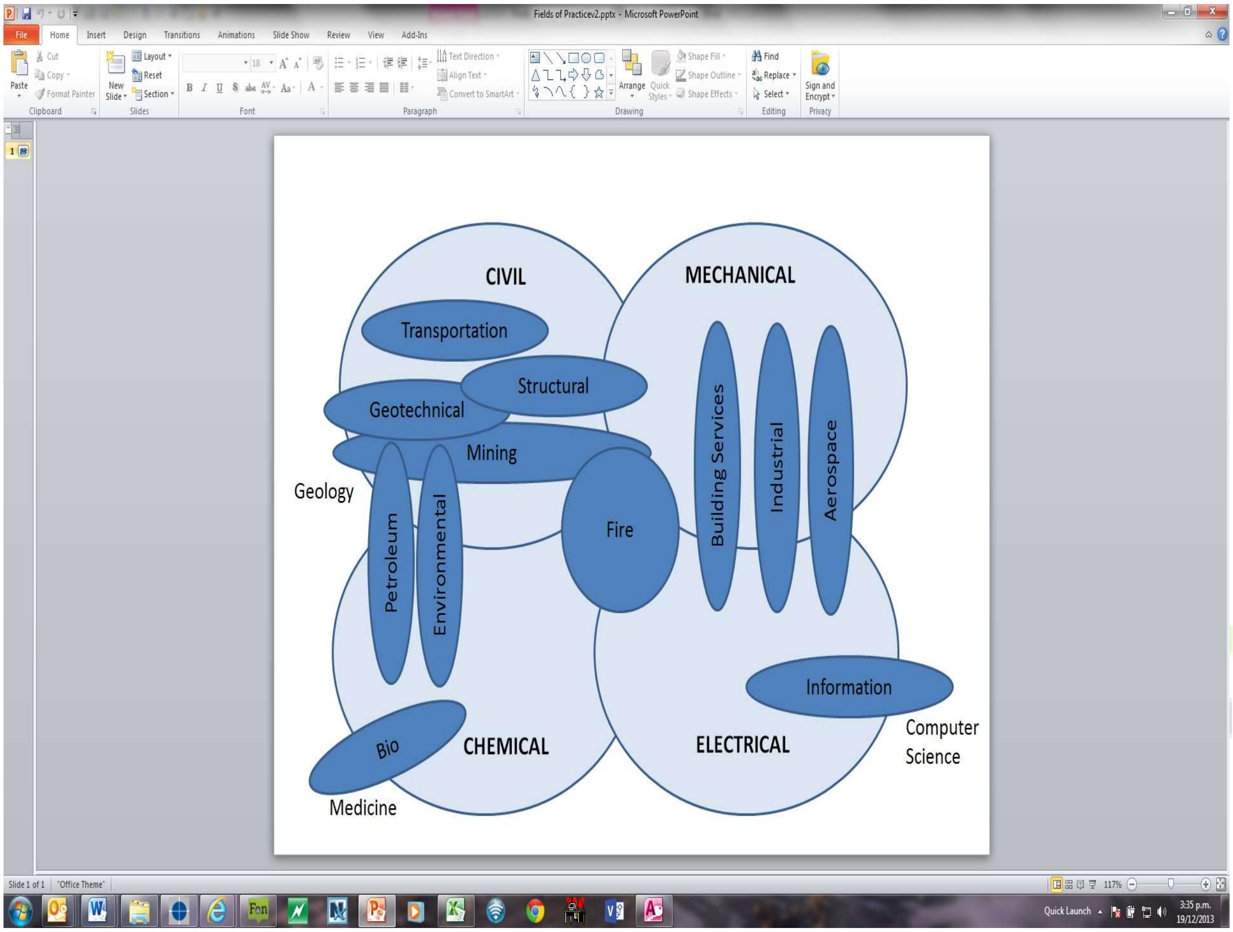
Complex engineering problems have some or all of the following characteristics:

- Involve wide-ranging or conflicting technical, engineering, and other issues;
- Have no obvious solution and require originality in analysis;
- Involve infrequently encountered issues;
- Are outside problems encompassed by standards and codes of practice for professional engineering;
- Involve diverse groups of stakeholders with widely varying needs;
- Have significant consequences in a range of contexts;
- Cannot be resolved without in-depth engineering knowledge

# APPENDIX TWO

## DISCIPLINES AND FIELDS OF ENGINEERING

Engineering practice fields are loosely defined terms and are used as an indication of the nature of engineering work carried out by engineers practising in an engineering field of practice. The following diagram is a graphical display of the relationships between the various fields and the four core disciplines. Some fields may extend into other fields of scientific endeavour.




## AEROSPACE ENGINEERING

Aerospace engineering is the design, development, and production of aircraft (aeronautical engineering), spacecraft (astronautical engineering) and related systems. Aerospace engineers may specialise in aerodynamics, avionics, structures, control systems or propulsion systems. It may involve planning maintenance programmes, designing repairs and modifications and exercising strict safety and quality controls to ensure airworthy operations.

## BIO ENGINEERING

Bioengineering draws heavily on the Chemical Engineering discipline and involves the engineered development of raw materials to produce higher value products, using biological systems (biological catalysts). The description also encompasses the general application of engineering to biological systems to develop new products or solve problems in existing production processes. As examples, bioengineers are found in medical research, genetic science, fermentation industries and industries treating biological wastes.

## BUILDING SERVICES

Building Services engineering is the application of mechanical or electrical engineering principles, and an understanding of building structure, to enhance all aspects of the built environment from air conditioning and mechanical ventilation, electrical light and power, fire services, fire safety engineering, water and waste services, data and communications, security and access control, vertical transportation, acoustics and energy management.

## CHEMICAL ENGINEERING

Chemical engineering is concerned with the ways in which raw materials are changed into useful and commercial end products such as food, petrol, plastics, paints, paper, ceramics, minerals and metals. Often these processes are carried out at large scale plants. Research of raw materials and their properties, design and development of equipment and the evaluation of operating processes are all part of chemical engineering.



## CIVIL ENGINEERING

Civil engineering is a broad field of engineering concerned with the, design, construction, operation and maintenance of structures (buildings, bridges, dams, ports) and infrastructure assets (road, rail, water, sewerage). The Civil engineering discipline underpins several engineering fields such as Structural, Mining, Geotechnical and Transportation engineering, in which civil engineers often specialise. General Civil engineers are likely to be competent to undertake work that relates to one or more of these areas.

## ELECTRICAL ENGINEERING

Electrical engineering is the field of engineering which deals with the practical application of electricity. It deals with the aspects of planning, design, operation and maintenance of electricity generation and distribution, and use of electricity as a source of energy within major buildings, industrial processing complexes, facilities and transport systems. It includes the associated networks and the equipment involved such as switchboards, cabling, overhead lines/catenaries, earthing, control and instrumentation systems.

Areas of specialisation within the wider electrical engineering discipline, such as electronics and telecommunications are usually concerned with using electricity to transmit information rather than energy. For this reason electronics and radiocommunications/telecommunications are captured under the field of Information Engineering.

## ENGINEERING MANAGEMENT

The Engineering Management practice field is used by engineers who manage multi-disciplinary engineering activities that are so multi-disciplined that it is difficult to readily link their engineering practice with any other specific practice field. Project managers, asset managers and engineers working in policy development are likely to use the 'Engineering Management' field.

## ENVIRONMENTAL ENGINEERING

Environmental engineering draws on the Civil and Chemical engineering disciplines to provide healthy water, air and land to enhance human habitation. Environmental engineers devise, implement and manage solutions to protect and restore the environment, within an overall framework of sustainable development. The role of the environmental engineer embraces all of the air, water and soil environments, and the interactions between them.

## FIRE ENGINEERING

Fire engineering draws on knowledge from the range of engineering disciplines to minimise the risk from fire to health and safety and damage to property through careful design and construction. It requires an understanding of the behaviour of fires and smoke, the behaviour of people exposed to fires and the performance of burning materials and structures, as well as the impact of fire protection systems including detection, alarm and extinguishing systems.

## GEOTECHNICAL ENGINEERING

Geotechnical engineering involves application of knowledge of earth materials in the design of structures, such as foundations, retaining walls, tunnels, dams and embankments. Geotechnical engineers assess the properties and performance of earth materials such as their stability and strength, and the impact of groundwater.

## INDUSTRIAL ENGINEERING

Industrial engineering is the application of mechanical and electrical engineering principles to the design and operation of production equipment, production lines and production processes for the efficient production of industrial goods. Industrial engineers understand plant and procedural design, the management of materials and energy, and human factors associated with worker integration with systems. Industrial engineers increasingly draw on specialised knowledge of robotics, mechatronics, and artificial intelligence.

## INFORMATION ENGINEERING

The field of Information engineering is based on the Electrical engineering discipline but also draws heavily from Computer Science. Three areas of further specialisation can be identified:

Software engineering - The development and operation of software-intensive systems that capture, store and process data.

Telecommunications engineering - The development and operation of systems that encode, transmit and decode data via cable systems (including fibre optics) and wireless systems (radiocommunications).

Electronics engineering - The design, development and testing of electronic circuits and networks that use the electrical and electromagnetic properties of electronic components integrated circuits and microprocessors to sense, measure and control processes and systems.

## MECHANICAL ENGINEERING

Mechanical Engineering involves the design, manufacture and maintenance of mechanical systems. Mechanical engineers work across a range of industries and are involved with the design and manufacture of a range of machines or mechanical systems, typically applying principles of hydraulics (fluid control), pneumatics (air pressure control) or thermodynamics (heat energy transfer). Mechanical engineers may specialise in the Building Services or Industrial engineering field.

## MINING ENGINEERING

Mining engineering involves extracting and processing minerals from the earth. This may involve investigations, design, construction and operation of mining, extraction and processing facilities.

## PETROLEUM ENGINEERING

Petroleum engineering is a field of engineering relating to oil and gas exploration and production. Petroleum engineers typically combine knowledge of geology and earth sciences with specialised Chemical engineering skills, but may also draw on Mechanical engineering expertise to design extraction and production methods and equipment. Petroleum engineering activities are divided into two broad categories:

Upstream - locating oil and gas beneath the earth's surface and then developing methods to bring them out of the ground.

Downstream - the design and development of plant and infrastructure for the refinement and distribution of the mixture of oil, gas and water components that are extracted

## STRUCTURAL ENGINEERING

Structural Engineering is a specialised field within the broader Civil engineering discipline that is concerned with the design and construction of structures. Structures might include buildings, bridges, in-ground structures, footings, frameworks and space frames, including those for motor vehicles, space vehicles, ships, aeroplanes and cranes, composed of any structural material including composites and novel materials.

## TRANSPORTATION

Transportation engineering is a specialised field of practice in the civil engineering discipline relating to the movement of goods and people by road, water, rail and air.

A Transportation engineer might specialise in one or more of: pavement design, asset maintenance/management, construction/project management, traffic operations and control, transportation planning and systems analysis, freight transportation and logistics, road safety, railways or public transport systems.