INTERNSHIP REPORT ON

INSTRUMENTATION DEPARTMENT

Submitted to

Madhav Institute of Technology & Science, Gwalior

Towards the Partial Fulfillment for the Award of the degree of

Bachelor of Technology

In

ELECTRONICS & TELECOMMUNICATION ENGINEERING

2022-2023

Company Name: Shri Bajrang Power & Ispat Ltd, Raipur

Company Mentor: Mr. Manoj Kumar Puri

Duration: 15-01-2023 to 15-05-2023

SUBMITTED BY

Hrithik Arora

(0901ET191030)

GUIDED BY

Dr. LAXMI SHRIVASTAVA

ASSOCIATE PROFESSOR

DEPARTMENT OF ELECTRONICS ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR-474005

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal, M.P.)

2022-2023

CERTIFICATE OF APPROVAL

This is to certify that the Internship is carried out in **Shri Bajrang Power & Ispat Ltd, Raipur** submitted by **HRITHIK ARORA (0901ET191030)** student of **B. Tech. IV-Year (VIII Semester)** in partial fulfillment for the award of the degree of **Bachelor of Technology in Electronics & Telecommunication Engineering** under R.G.P.V., Bhopal. It is a record of their own work carried by them during internship.

Supervised/Verified by

Dr. Laxmi Shrivastava
ASSOCIATE PROFESSOR

Approved by

26/5/23

Dr. Vandana Vikas Thakare
H.O.D

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

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2019-2023

CANDIDATE DECLARATION

We hereby declare that the work which has been carried out during the Internship in the company **Shri Bajrang Power & Ispat Ltd, Raipur** in partial fulfillment for the award of the degree of **Bachelor of Technology** in **Electronics & Telecommunication Engineering** from Madhav Institute of Technology & Science, Gwalior is an authenticated record of our work carried under the supervision /mentorship of **Mr.Anil Kumar(Vice-President, Instrumentation Department), Mr. Manoj Kumar Puri(Senior General Manager-Hr) & Dr. Laxmi Shrivastava** (Associate Professor, MITS, Gwalior). The matter embodied in this internship report is not submitted for the award of any degree or diploma anywhere else.

Name & Signature of Students

Date: 26/5/23
Place: Gwalior

HRITHIK ARORA
(0901ET191030)

ACKNOWLEDGMENT

We express our sincere gratitude and earnest indebtedness to Madhav Institute of Technology & Science, Gwalior (M.P.) for providing us the golden opportunity to complete our internship. We acknowledge with great pleasure and grateful indebtedness towards our internship mentor Mr. Anil Kumar (Vice-President, Instrumentation Department), Mr. Manoj Kumar Puri(Senior General Manager-Hr) & Dr. Laxmi Shrivastava (Associate Professor, MITS-Gwalior) for providing us with very useful and beneficial guidance throughout the Internship.

We also express our heartfelt gratitude to Dr. Vandana Vikas Thakare, Head of the Electronics Engineering Department for her profound guidance throughout the Internship.

We would also like to acknowledge our Director Dr. R. K. Pandit for helping us with the resources needed to accomplish this task. The environment at M.I.T.S. has been a valuable experience for us. With many difficulties, this Internship has blessed us with great knowledge in our field of interest. We also thank all those who have helped us in every path in the completion of this Internship and made this Internship a success.

Name & Signature of Students

Date: 26/5/23

Place: Gwalior

HRITHIK ARORA

(0901ET191030)

NOC

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Phone: 0751-2409362, Email id: tnp@mitsgwalior.in
(Training and Placement Cell)

Ref.: T&P/22/2631 **Date: 13/1/2023**

To,

Senior General Manager

Shri Bajrang Power and Ispat Ltd,Raipur

Dear Sir/Ma'am,

We are grateful to the co-operation in imparting Industrial Training/Internship/Vocational Training to the Students of our Institute. Industrial training/Internship is a part of Academic Curriculum in Pre-Final and Final year of B.Tech./MCA/MBA students and the progress of the same will be counted in their overall results and also gives them exposure & improves their skills and personality.

We will be highly obliged, if the following student is/are permitted to undergo Training / Internship at your esteemed Organization for a period of 15/01/2023 to 30/05/2023.

S.No.	Name of the Student	Enrollment No.	Course - Branch
1.	Hrithik Arora	0901ET191030	B.Tech - Electronics & Telecommunication Engineering

Hoping for your kind cooperation.

Best Regards!

Mr. Vikram Singh Rajput)
Training & Placement Officer

Kindly feel free to contact us for any further information.

Important Declaration: *This is a system generated letter with reference no. after the approval from the authority. There is no need for a signature and seal on hard copy.*

CERTIFICATE

SHRI BAJRANG POWER AND ISPAT LTD.
BELIEF, STRONGER THAN STEEL.
POWER | STEEL | MINING

SBPIL/HR/2023-24/0184 Dated: 15/05/2023

TO WHOMSOEVER IT MAY CONCERN

This is to certify that ***Mr. Hrithik Arora****, S/O* ***Shri Rajesh Arora****, B.Tech Electronics & Telecommunication Engineering 8th Semester batch of 2022-23,* ***Madhav Institute of Technology & Science, Gwalior (M.P)*** *has completed his Industrial Training from* ***15th Jan 2023 to 15th May 2023.***

During this period, his conduct and behavior was found to be good and he has shown keen interest to learn. He actively participated in performing the work with determination and sincerity.

I appreciate his hard work and wish all the best for his future career.

For, Shri Bajrang Power & Ispat Ltd.

Shri Bajrang Power & Ispat Ltd. RAIPUR (C.G.)

Manoj Kumar Puri
Senior General Manager-HR

Mobile No.9826322039
E-Mail – manoj.puri@goelgroup.co.in

15/05/2023

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Internship/Project Expected Outcomes

Session: Jan–June 2023

Student Name: HRITHIK ARORA……..……..

Enrollment No.: 0901ET191030...……

Internship/Project Title: INTERNSHIP IN INSTRUMENTATION

DEPARTMENT……..

Objective of Internship/Project: To gain practical experience and enhance my knowledge in the field of instrumentation within an industrial setting. I aim to contribute effectively to the operations of Shri Bajrang Power & Ispat Ltd by applying my theoretical understanding of instrumentation principles and techniques while learning from industry professionals. Through this internship, I seek to develop my skills in designing, installing, and maintaining instrumentation systems, as well as troubleshooting and optimizing their performance. Furthermore, I aspire to gain exposure to various industrial processes and equipment, enabling me to apply my problem-solving abilities to real-world scenarios. Ultimately, I aim to contribute to the growth and success of Shri Bajrang Power & Ispat Ltd while building a solid foundation for my future career in the instrumentation field.
Brief details of Internship: Internship in Instrumentation Department at Shri Bajrang Power & Ispat Ltd offers an opportunity to work in a dynamic industrial environment and gain hands-on experience in instrumentation systems and processes. The internship provides exposure to the following areas: I. Instrumentation System Design II. Maintenance and Troubleshooting III. Process Optimization IV. Documentation and Reporting **V.** Team Collaboration
Expected/Achieved Outcomes of Internship/Project: I. Practical Knowledge II. Hands-on Experience III. Process Understanding IV. Problem-solving Skills **V.** Teamwork and Communication VI. Project Completion

VII.	Professional Networking

Social relevance/Impact of your Internship/Project:

I. Enhanced Industrial Efficiency

II. Improved Product Quality and Safety

III. Environmental Sustainability

IV. Technological Advancement

V. Skill Development and Empowerment

Overall, the internship/project in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd has social relevance and impact by fostering industrial efficiency, product quality and safety, environmental sustainability, technological advancement, skill development, knowledge transfer, and socio-economic development.

Name and Signature of Students

Hrithik Arora
0901ET191030

Name & Signature of Institute Mentor

Dr. Laxmi Shrivastava

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1. INTRODUCTION

1.1 Overview

Shri Bajrang Power & Ispat Ltd., commonly known as SBPIL, is a prominent player in the steel and power industry in India. The company is involved in the production and sale of various steel products, including pig iron, billets, TMT bars, wire rods, and structural steel.

Steel Production:

SBPIL operates its integrated steel plant in Chhattisgarh, India. The plant has state-of-the-art facilities for producing different grades of steel. The company focuses on maintaining high-quality standards in its manufacturing processes and delivering products that meet customer specifications.

Power Generation:

In addition to its steel production, SBPIL has also ventured into the power generation sector. The company operates a captive power plant to meet its electricity requirements for steel production. This enables SBPIL to have a reliable and cost-effective power supply.

Product Range:

SBPIL offers a diverse range of steel products catering to various industries and sectors. Some of the key products manufactured by the company include:

1. Pig Iron: Used as a raw material for producing steel, pig iron is produced by smelting iron ore in a blast furnace.
2. Billets: These are semi-finished steel products with a square or rectangular cross-section. Billets serve as feedstock for further processing into bars, rods, and other structural components.
3. TMT Bars: Thermomechanical treated (TMT) bars are widely used in construction for their superior strength and flexibility. They are manufactured through a specialized process that involves controlled cooling and quenching.
4. Wire Rods: Wire rods are long cylindrical metal products with a round cross-section. They find application in various industries, including construction, automotive, and engineering.
5. Structural Steel: SBPIL produces structural steel sections such as angles, channels, and beams. These products are commonly used in construction projects for creating sturdy frameworks and support structures.

Market Presence:

Shri Bajrang Power & Ispat Ltd. caters to both domestic and international markets. Its products are utilized in various industries, including infrastructure, construction, engineering, and manufacturing. The company aims to maintain a strong market presence by focusing on product quality, customer satisfaction, and competitive pricing.

2. Roles and Responsibility

Introduction:
As an intern in the Instrumentation department at Shri Bajrang Power & Ispat Ltd., I got the opportunity to gain valuable hands-on experience and contribute to the company's industrial instrumentation projects.

Learning and Skill Development:
As an intern, my primary focus was to learn and develop essential skills related to industrial instrumentation.I got the opportunity to work closely with experienced professionals in the field, observing and participating in various tasks and projects. This hands-on experience allowed me to gain a practical understanding of instrumentation systems, equipment, and procedures used in an industrial setting. By actively engaging in learning activities, I got to enhance my technical knowledge and develop valuable skills that will benefit my future career.

Assisting with Maintenance Activities:
One of my key responsibilities as an intern is to assist the instrumentation team with routine maintenance activities. By actively participating in maintenance activities, I gain exposure to different types of instruments, their functions, and the importance of regular upkeep to ensure accurate and reliable measurements.

Supporting Calibration Efforts:
Calibration is a critical aspect of instrumentation to maintain measurement accuracy. As an intern, I got to involved in supporting the calibration process under the supervision of senior technicians. This involved assisting with calibration procedures, gathering data, and documenting calibration results. This hands-on experience provided me with insights into calibration techniques and the importance of precision in industrial measurements.

Assisting with Documentation and Record-Keeping:
Accurate documentation and record-keeping are essential in the field of instrumentation. As an intern, I got the responsiblility for assisting with documentation tasks such as maintaining calibration records, updating equipment databases, and organizing technical documentation. This role will helped me understand the importance of documentation for traceability, compliance, and future reference.

Supporting Projects and Initiatives:
Throughout my internship, I got the opportunity to contribute to various projects and initiatives within the instrumentation department. This involves assisting with the installation of new instruments, participating in system upgrades, or supporting ongoing improvement projects. My involvement in these activities provided me with a comprehensive understanding of instrumentation projects, teamwork, and the implementation of new technologies.

Learning Safety Procedures and Regulations:
Safety is a top priority in any industrial setting. As an intern, I got to learn and adhere to safety procedures and regulations applicable to the instrumentation department. This includes

understanding the emergency protocols. By prioritizing safety in my daily tasks, I contributed to maintaining a secure working environment for yourself and others.

Conclusion:

As an intern in the Instrumentation department at Shri Bajrang Power & Ispat Ltd., my role offers a valuable opportunity to gain practical experience and develop essential skills in the field of industrial instrumentation. By actively participating in maintenance activities, supporting calibration efforts, assisting with documentation, contributing to projects, and prioritizing safety, I not only got enhance my technical knowledge but also contribute to the overall success of the department and the organization. This internship experience will lay a solid foundation for m future career in the field of instrumentation and provided me with valuable insights into the workings of an industrial environment

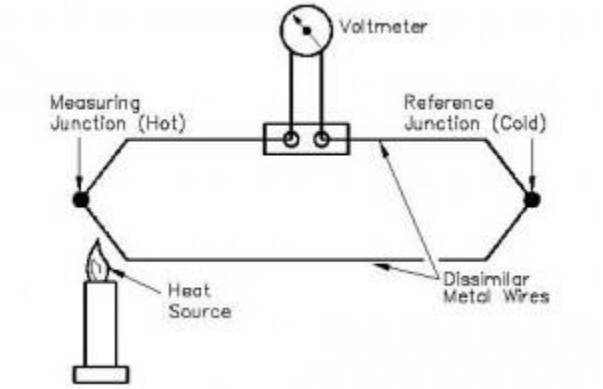
3. Learning and Topics covered

3.1 INSTRUMENTATION

3.1.1 Temperature Measurement

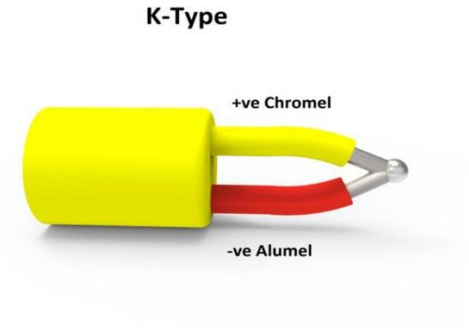
1. Thermocouple

- Principle of Operation: Thermocouples operate based on the Seebeck effect, which states that when two dissimilar metals are joined together at two junctions and a temperature gradient exists, it creates a voltage difference.
- Construction and Types: Thermocouples consist of two different metal wires connected at a measuring junction. Thermocouple which use specific combinations of metals for different temperature ranges.
- Advantages: Thermocouples offer a wide temperature range, fast response time, ruggedness, and low cost.
- Limitations: Thermocouples have lower accuracy compared to other temperature sensors like RTDs**.**



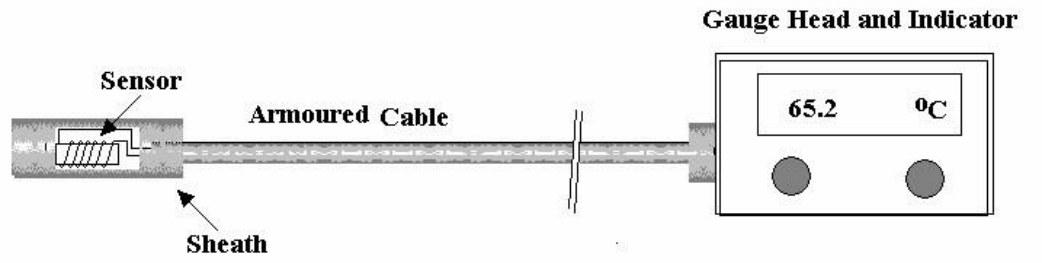
The picture shows thermocouple.

Here In our plant K-type thermocouple because Type K Thermocouple provides widest operating temperature range. Thermocouple gives us output in milliVolts.



2. Resistance Temperature Detector (RTD):

- Principle of Operation: RTDs operate based on the principle that the metal react with temperature. The resistance of the RTD element increases linearly with temperature.
- Construction and Types: RTDs are typically made of pure metals such as platinum (Pt) or nickel (Ni). The most common type is the Pt100, which has a resistance of 100 ohms at 0°C.
- Advantages: RTDs offer high accuracy, stability, and repeatability. They also have a wide temperature range and are suitable for precision measurements.
- Limitations: RTDs tend to be more expensive compared to thermocouples and have a slower response time.



3. Vapor Pressure Sensor:

- Principle of Operation: Vapor pressure sensors measure temperature indirectly by measuring the pressure of a volatile fluid or gas in a sealed chamber. The vapor pressure of the substance changes with temperature, allowing temperature measurement.
- Construction and Types: Vapor pressure sensors can use various techniques, including filled systems with a liquid or gas that vaporizes with temperature changes.
- Advantages: Vapor pressure sensors offer good accuracy, stability, and repeatability. They can be used in applications where direct contact with the medium being measured is not desired.
- Limitations: Vapor pressure sensors may have limited temperature ranges.

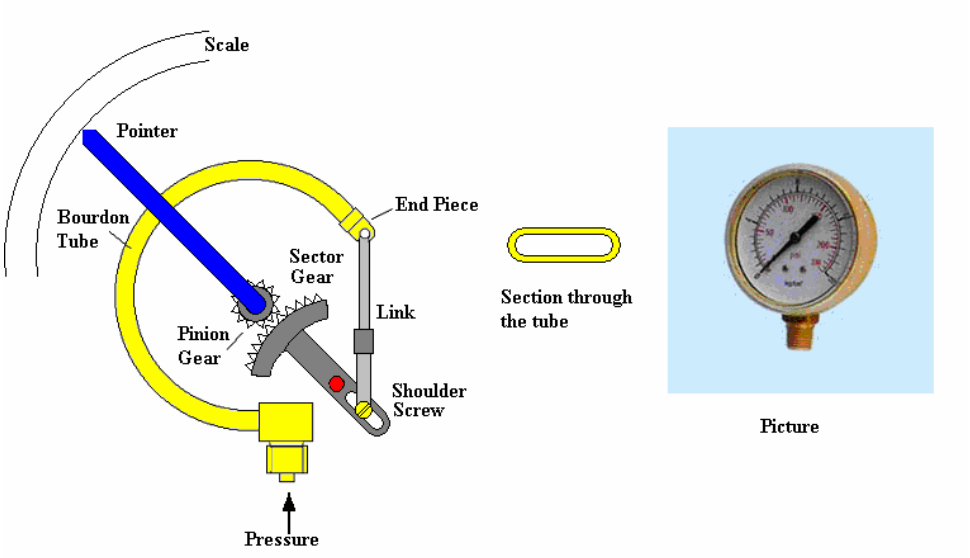
4. Bimetallic Temperature Sensor:

- Principle of Operation: Bimetallic temperature sensors use the principle metal reacts to temperature changes. This differential expansion causes the bimetallic strip to bend, which can be measured as a temperature change.
- Construction and Types: Bimetallic temperature sensors consist of two different metals bonded together, usually steel and brass or steel and copper, forming a strip or coil.
- Advantages: Bimetallic temperature sensors are cost-effective, simple, and suitable for temperature control in industrial applications.
- Limitations: Bimetallic temperature sensors generally have slower response times and lower accuracy compared to other temperature sensors like RTDs.

These temperature sensors, including thermocouples, RTDs, vapor pressure sensors, and bimetallic temperature sensors, offer different characteristics, applications, and trade-offs in terms of accuracy, cost, response time, and temperature range.

3.1.2 PRESSURE MEASUREMENT

1. Bourdon Tube



Principle of Operation

Bourdon tubes are mechanical pressure sensors that operate based on the principle that a curved tube tends to straighten when subjected to pressure. This straightening motion is converted into a rotational motion using linkages and levers, which is then measured as a pressure reading.

Construction and Working

Bourdon tubes are typically made of a curved, flattened tube with an elliptical or spiral shape. As pressure is applied, the tube straightens, causing the tip to move. This movement is typically amplified and displayed on a dial or converted into an electrical signal.

Advantages

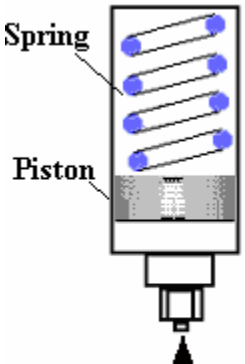
Bourdon tubes offer good accuracy, reliability, and durability. They are widely used in various industries and applications.

Limitations

Bourdon tubes may have limitations in terms of response time, especially in applications with rapid pressure fluctuations.

2. PISTON TYPE

Principle of Operation: Piston tube pressure sensors use a piston and cylinder arrangement to measure pressure. The pressure acting on the piston creates a force that can be measured and converted into a pressure reading.



Construction and Working: The piston tube assembly

consists of a piston that moves within a cylinder. The piston is exposed to the pressure being measured, and the resulting force is measured either mechanically or electronically.

Advantages: Piston tube sensors offer high accuracy and are suitable for measuring high pressures in applications such as hydraulic systems.

Limitations: Piston tube sensors may have limitations in terms of cost, size, and sensitivity to vibration and shock

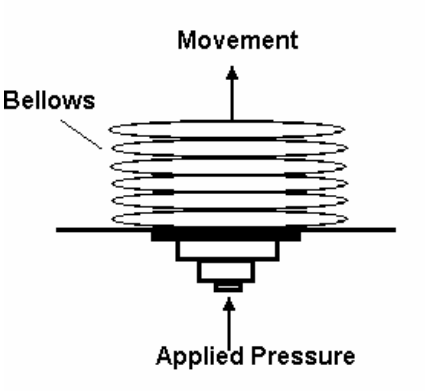
3. CAPSULES AND BELLOWS

Principle of Operation: Diaphragm capsule pressure sensors use a flexible diaphragm that deforms under pressure, resulting in a displacement that is proportional to the applied pressure. This displacement is then converted into a measurable quantity.

Construction and Working: Diaphragm capsules consist of a thin, flexible diaphragm sealed to a rigid structure. When subjected to pressure, the diaphragm deflects, and this deflection is measured using various methods such as strain gauges or capacitive sensors.

Advantages: Diaphragm capsules offer good sensitivity, accuracy, and the ability to measure both low and high pressures. They are commonly used in applications requiring precise pressure measurements.

Limitations: Diaphragm capsules may be sensitive to overpressure or damage from aggressive media. They may also have limitations in terms of temperature range.



4. DIAPHRAGMS

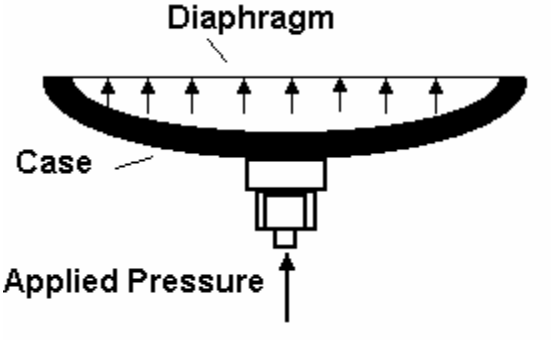
Principle of Operation: Bellows pressure sensors use a flexible, corrugated metal bellows that expands or contracts with changes in pressure. This expansion or contraction is converted into a measurable displacement, allowing pressure measurement.

Construction and Working: Bellows pressure sensors consist of a sealed,

accordion-like metal structure that expands or contracts with pressure changes. This displacement is typically measured using strain gauges or other methods to determine the pressure.

Advantages: Bellows sensors offer good sensitivity, accuracy, and durability. They are commonly used in applications with low pressure ranges and where resistance to vibration and shock is important.

Limitations: Bellows sensors may have limitations in terms of cost, response time, and compatibility with certain fluids or environments..



3.1.3 FLOW MEASUREMENT

a. POSITIVE DISPLACEMENT TYPES:

Positive displacement types of flow measurement devices operate based on the principle that the flow of fluid causes the displacement of a known volume, which is then measured. These devices are typically used for measuring low flow rates and are suitable for both liquids and gases.

b. INFERENTIAL TYPES:

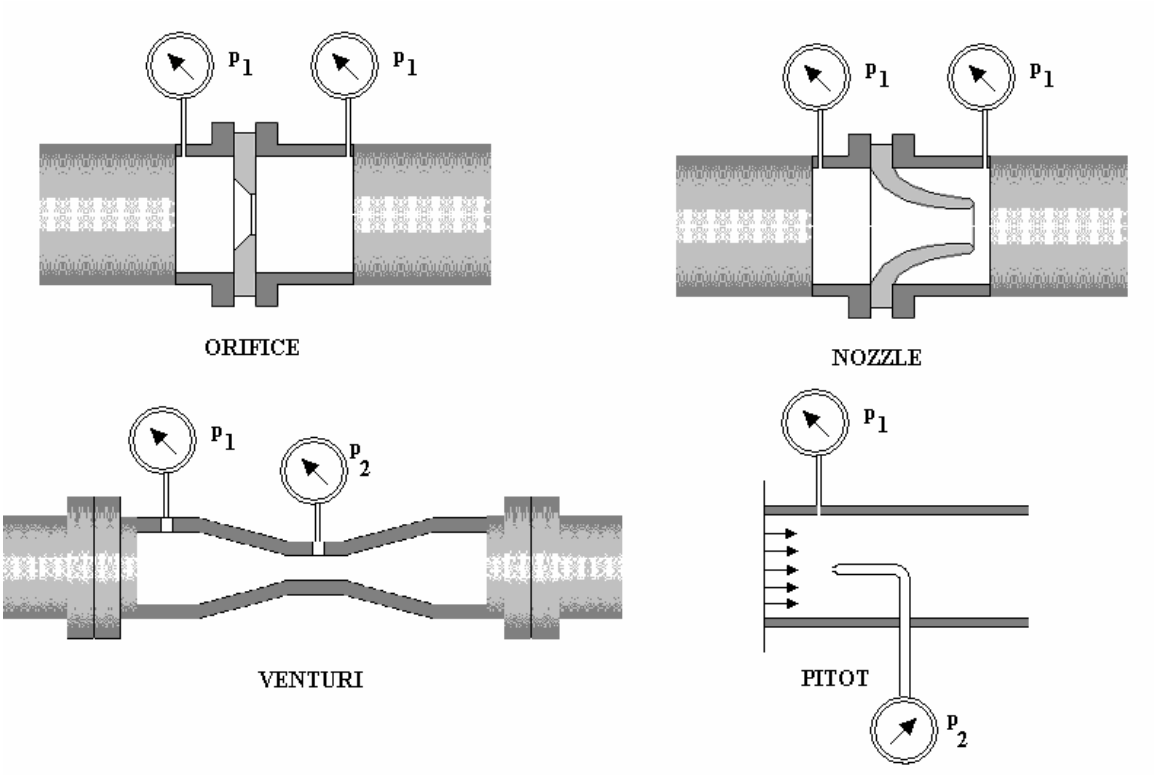
Inferential types of flow measurement devices estimate the flow rate by inferring it from other measured parameters such as velocity, pressure, or fluid properties. These devices are commonly used when direct measurement of flow is challenging or not feasible.

c. VARIABLE AREA TYPES:

Variable area types of flow measurement devices rely on the change in the flow area as the fluid passes through the meter. These devices typically have a tapered or conical shape, and the position of a float or a spring-loaded piston indicates the flow rate.

d. DIFFERENTIAL PRESSURE TYPES:

Differential pressure types of flow measurement devices utilize the pressure drop across a constriction or obstruction in the flow path to determine the flow rate. These devices measure the pressure difference and convert it into a flow rate.



$$Q = K(Dp)^{0.5}$$

3.2 INSTRUMENT ERRORS

Instrument errors refer to the inaccuracies or deviations that can occur in measurement instruments during the measurement process. These errors can arise from various sources and can affect the accuracy and reliability of the measurements. Understanding and managing instrument errors is crucial for obtaining accurate and meaningful measurement data. The following are common types of instrument errors:

1. Systematic Errors:

Systematic errors, also known as deterministic errors, are consistent and repeatable errors that occur in the same direction for every measurement. They are caused by factors such as calibration errors, equipment malfunctions, or environmental influences. Systematic errors can lead to biases in the measurements and can be corrected through calibration or by applying correction factors.

2. Random Errors:

Random errors, also called indeterminate errors or fluctuations, are unpredictable and occur randomly with no consistent pattern. They can result from factors such as electronic noise, variations in environmental conditions, or human error. Random errors lead to variations in measurements and can be reduced by using statistical techniques such as averaging multiple readings or applying statistical analysis methods**.**

3. Zero Error:

Zero error refers to the deviation of an instrument's indication from the true zero value when no input is applied. It can occur due to mechanical misalignments, calibration issues, or wear and tear of the instrument. Zero error can be eliminated or minimized through proper calibration and adjustment procedures.

4. Hysteresis Error:

Hysteresis error is a phenomenon where the output of an instrument lags or exhibits a different response when the input is applied in one direction compared to when it is applied in the opposite direction. It is common in instruments with mechanical components or systems with memory effects. Hysteresis error can be reduced through careful design, selection of materials, and calibration techniques.

5. Range Error:

Range error occurs when an instrument is used outside its specified measurement range. This can lead to inaccuracies, non-linearity, or distortion in the measurements. It is important to use instruments within their designated range to ensure accurate and reliable results**.**

6. Sensitivity Error:

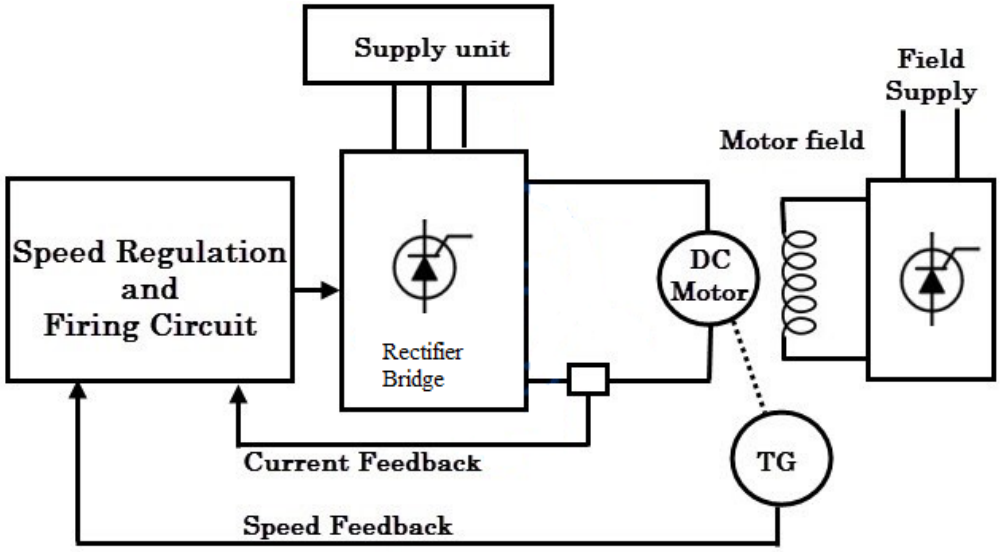
Sensitivity error refers to the deviation of an instrument's response from the expected change in the input quantity. It can occur due to non-linearity, calibration errors, or variations in the instrument's sensitivity over time. Sensitivity errors can be minimized through proper calibration, regular maintenance, and using instruments with higher accuracy and sensitivity.

7. Environmental Errors:

Environmental factors such as temperature, humidity, electromagnetic interference, or vibrations can introduce errors in instrument measurements. These errors can affect the stability, precision, and accuracy of the instrument. Proper shielding, grounding, and environmental control measures can help mitigate these errors.

3.3 DC DRIVE

Introduction to DC Drive:
A DC drive, also known as a DC motor controller or DC motor drive, is an electronic device used to control the speed and direction of a DC motor. It provides the necessary voltage and current to the motor for smooth operation and precise control. DC drives are widely used in various industrial applications, including manufacturing, automation, robotics, and transportation systems.



COMPONENTS OF A DC DRIVE SYSTEM

Working Principle of DC Drive:
The working principle of a DC drive involves converting an AC power supply into a controlled DC power supply to drive a DC motor. The main components of a typical DC drive system include a rectifier, a smoothing capacitor, a chopper or an inverter, and a control unit.

1. Rectifier:
The AC power supply is first connected to a rectifier, which converts the alternating current into direct current. The rectifier can be a diode bridge or a controlled rectifier circuit, depending on the type of drive and its control requirements.

2. Smoothing Capacitor:
After rectification, the output of the rectifier contains ripples or fluctuations. To obtain a smoother DC voltage, a smoothing capacitor is connected across the output terminals. The capacitor helps reduce the ripple content and provides a more stable DC voltage.

3. Chopper or Inverter:
The smoothed DC voltage is then fed to a chopper or an inverter circuit. The type of circuit used depends on the control strategy employed in the DC drive system.

- Chopper: In a chopper-based DC drive, a power electronic switch, typically a transistor or an insulated gate bipolar transistor (IGBT), is used to chop or switch the DC voltage. By controlling the on/off periods of the switch, the average voltage applied to the motor can be adjusted, thereby controlling the motor speed.

- Inverter: In an inverter-based DC drive, the DC voltage is converted into an AC voltage using power electronic devices such as IGBTs or MOSFETs. This AC voltage is then fed to the motor through an inverter bridge. The frequency and amplitude of the AC voltage can be controlled to vary the motor speed.

4. Control Unit:

The control unit of the DC drive is responsible for monitoring and controlling the motor speed and direction. It receives feedback signals from sensors such as encoders or tachometers to measure the actual motor speed. Based on the desired speed set by the user, the control unit adjusts the chopper or inverter switching patterns to achieve the desired speed and direction of the motor. The control unit also provides various protection features to ensure safe operation, such as overcurrent protection, overvoltage protection, and thermal protection.

By adjusting the average voltage applied to the motor, the DC drive controls the armature current, which in turn controls the motor speed. The direction of rotation can be reversed by reversing the polarity of the applied voltage.

Overall, the working principle of a DC drive involves converting the AC power supply into a controlled DC voltage, chopping or inverting the DC voltage as per the control strategy, and using a control unit to monitor and adjust the motor speed and direction. This allows for precise control of the DC motor in various industrial applications.

3.4 AC DRIVE

Introduction to AC Drive:

An AC drive, also referred to as an AC motor drive or variable frequency drive (VFD), is an electronic device utilized for regulating the speed and torque of an AC induction motor. Its primary function is to provide adjustable voltage and frequency to the motor, enabling precise control and enhanced energy efficiency. AC drives find widespread application in various industrial sectors such as HVAC systems, pumps, fans, conveyors, and machine tools.

The working principle of an AC drive

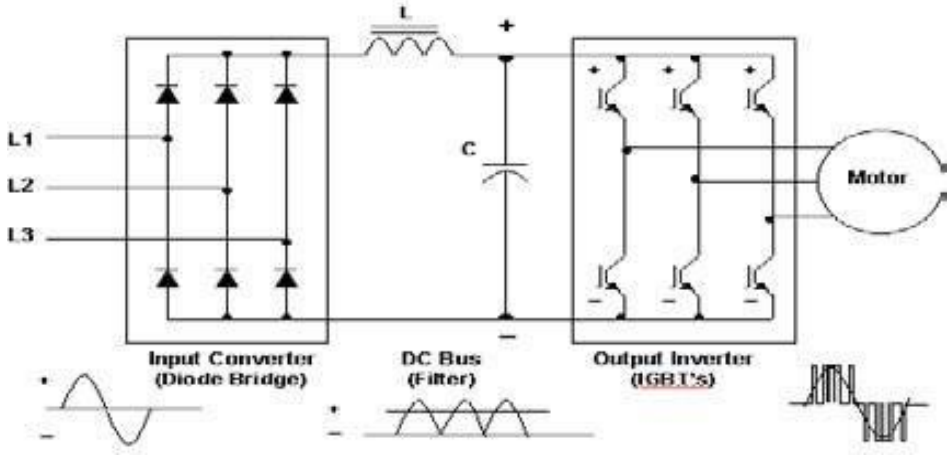
It involves the conversion of the incoming AC power supply into a controlled AC voltage and frequency to drive the AC motor. This process relies on several key components within a typical AC drive system, including a rectifier, a DC bus, an inverter, and a control unit.

To begin with, the AC power supply is connected to a rectifier, which converts the incoming AC voltage into a DC voltage. The rectifier employed may either be a diode bridge or a controlled rectifier circuit, depending on the specific type of AC drive and its control requirements. Additionally, the rectifier serves the purpose of maintaining a stable DC voltage by smoothing out any ripples or fluctuations present in the input power.

Next, the rectified DC voltage is directed to a DC bus, which functions as an energy storage device. A DC bus capacitor is employed to ensure the maintenance of a steady DC voltage and serves as a buffer for absorbing and supplying energy as required. This component acts as a constant voltage source for the subsequent inverter stage.

The inverter, a vital component of the AC drive, is responsible for converting the DC voltage obtained from the DC bus back into an AC voltage with controllable frequency and amplitude. This conversion process is facilitated by utilizing power electronic devices such as insulated gate bipolar transistors (IGBTs) or metal-oxide-semiconductor field-effect transistors (MOSFETs). By precisely switching these devices on and off at specific intervals, the inverter generates a variable frequency and voltage output that is subsequently supplied to the AC motor.

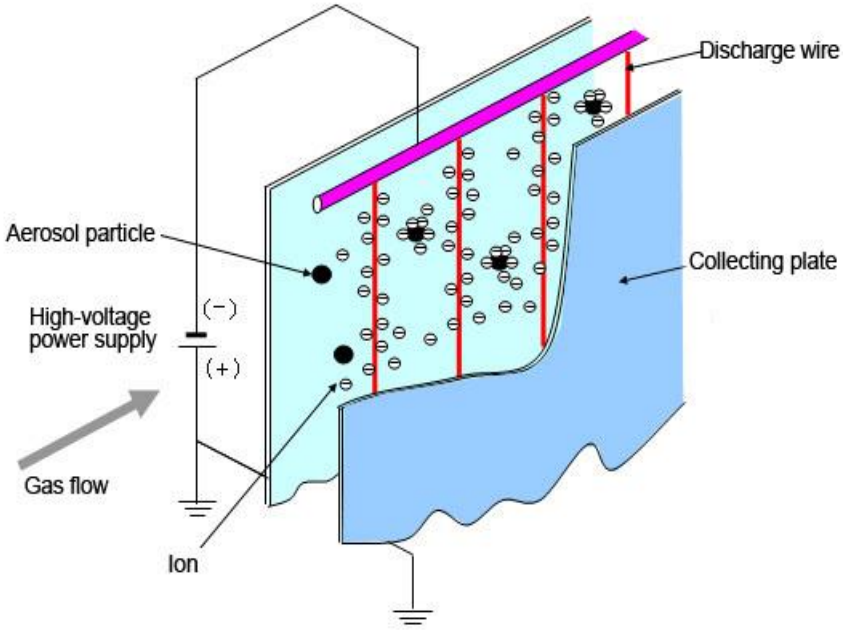
In summary, an AC drive operates by converting the incoming AC power supply into a controlled AC voltage and frequency to drive an AC motor. This is achieved through the combined function of a rectifier, a DC bus, an inverter, and a control unit. By regulating the voltage and frequency, the AC drive enables precise control over the motor's speed and torque, leading to enhanced energy efficiency and improved performance in various industrial applications..



The control unit adjusts the switching patterns of the inverter to control the frequency and amplitude of the AC voltage applied to the motor. By varying the frequency, the speed of the AC motor can be precisely controlled. The control unit also adjusts the voltage magnitude to control the torque produced by the motor.

Overall, the working principle of an AC drive involves rectifying the incoming AC power supply into a stable DC voltage, storing it in the DC bus, and then converting it back to a controlled AC voltage with adjustable frequency and voltage through the inverter. The control unit ensures precise control of the motor speed and torque, enabling efficient operation and enhancing the performance of AC induction motors in various industrial applications.

3.5 ESP (ELECTROSTATIC PRECIPITATOR)



Electrostatic precipitation is a method of dust collection that uses electrostatic forces. It consists of two electrodes: a discharge wire and a collecting plate. A high voltage is applied to the discharge wire, which ionizes the gas around it. The ions then collide with the dust particles in the gas, charging them. The charged particles are then attracted to the collecting plate, where they are collected.

The particles collected on the collecting plate can be removed by rapping the plate, scraping it with a brush, or washing it with water. Electrostatic precipitators are used in a variety of industries, including power plants, steel mills, and cement plants. They are an effective way to control air pollution and improve air quality.

- Electrostatic precipitators are very efficient at removing dust particles from the air. They can remove up to 99% of the particles in the air.
- Electrostatic precipitators are relatively inexpensive to operate and maintain.
- Electrostatic precipitators are a reliable way to control air pollution. They have been used for many years in a variety of industries

3.6 UPS (Uninterrupted Power Supply)

UPS stands for Uninterruptible Power Supply. It is an electrical device that provides backup power to connected equipment during power outages or disruptions. UPS systems are commonly used to protect critical equipment, such as computers, servers, data centers, telecommunications systems, and industrial machinery, from power failures that could lead to data loss, equipment damage, or operational disruptions.

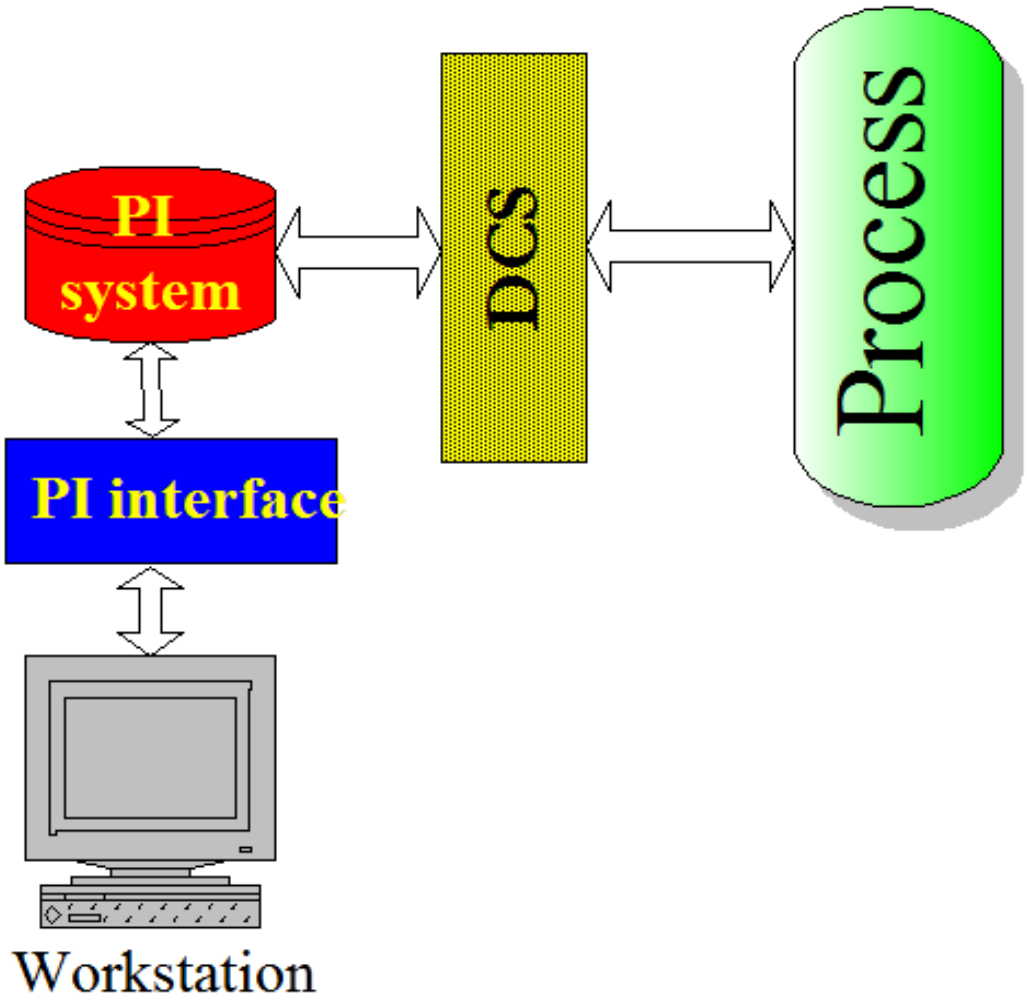
Online UPS:

An online UPS, also known as a double-conversion UPS, is a type of UPS that provides continuous power protection and conditioning. In an online UPS, the AC power from the mains is first converted into DC power, which charges the internal batteries and powers the inverter. The inverter then converts the DC power back into AC power, which is supplied to the connected equipment. The equipment always receives power from the inverter, regardless of the quality or availability of the utility power.

Offline UPS:

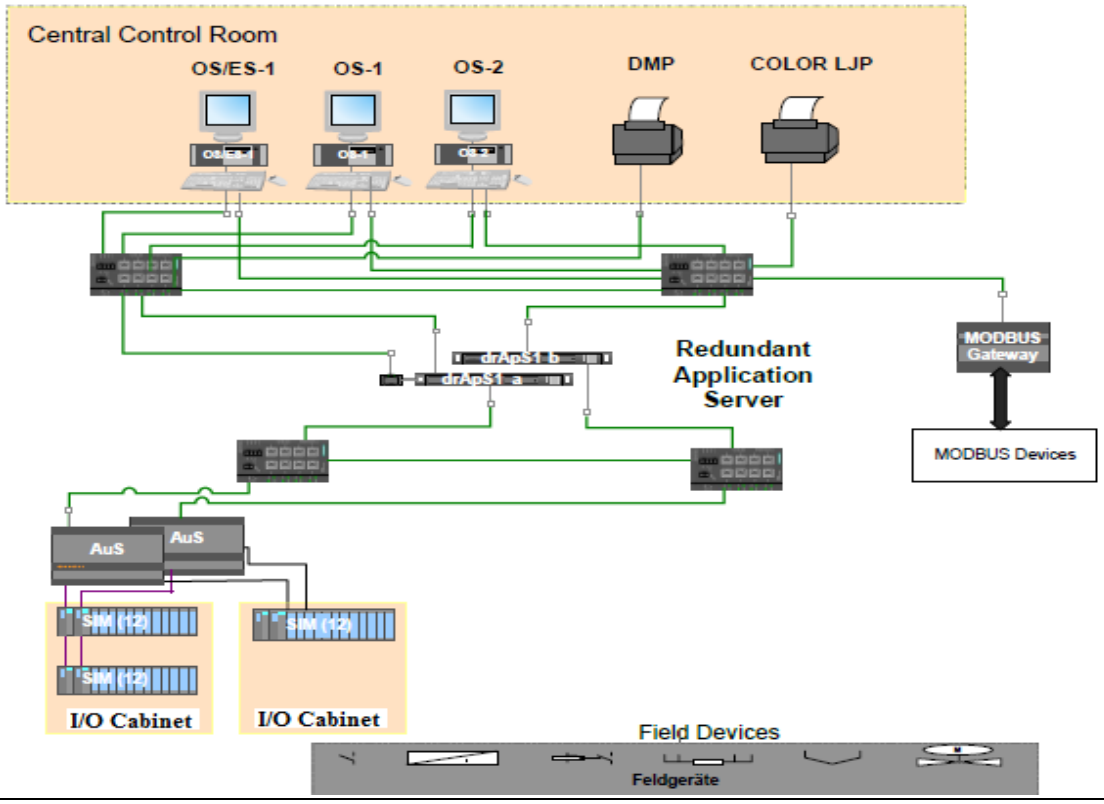
An offline UPS, also known as a standby UPS, is a simpler and less expensive type of UPS. It operates by monitoring the incoming AC power and switches to battery power only when a power interruption or abnormality is detected. In normal operating conditions, the connected equipment is powered directly from the utility power without any electrical conversion or conditioning.

3.7 DCS (Distributed Control System)



A Distributed Control System (DCS) is a computer-based control system used in industrial processes to monitor and control multiple interconnected devices and processes from a centralized location. DCSs are widely used in various industries, including manufacturing, oil and gas, power generation, and chemical processing. They provide a reliable and efficient means of managing complex industrial processes.

TYPICAL- DCS CONFIGURATION



DCS (Distributed Control System) is a control system architecture widely used in industrial automation to monitor and control various processes within a plant or facility. While DCS platforms can support different programming languages, the most commonly used coding language in DCS is the IEC 61131-3 standard.

The IEC 61131-3 standard defines a set of programming languages specifically designed for industrial control systems. These languages are:

1. Function Block Diagram (FBD).
2. Structured Text (ST).
3. Ladder Diagram (LD).
4. Instruction List (IL).
5. Sequential Function Chart (SFC).

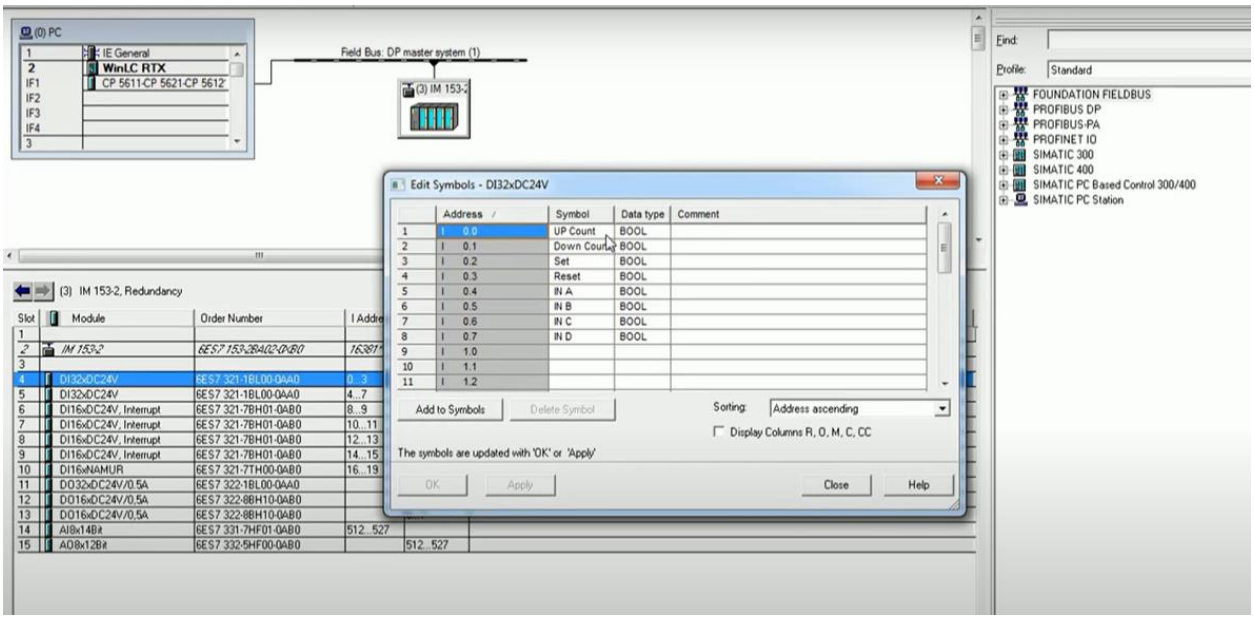
These programming languages in the IEC 61131-3 standard provide flexibility and versatility in developing control strategies for DCS systems. Each language has its strengths and is suited for

different control tasks and programming preferences. The choice of language depends on factors such as the complexity of the control logic, the programming team's skill set, and the specific requirements of the DCS application.

It's important to note that DCS platforms may also support additional programming languages like C/C++, Java, or proprietary scripting languages for specific customizations or interfacing with external systems. However, the IEC 61131-3 standard languages are the primary coding languages used in DCS environments due to their industry-wide acceptance and compatibility with DCS software and hardware.

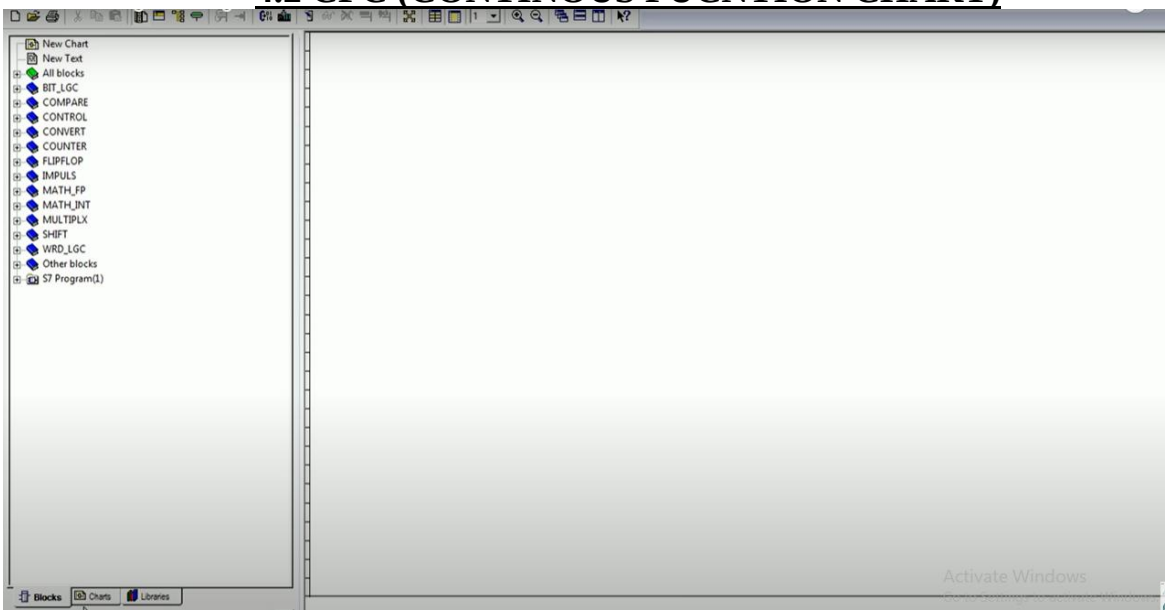
4. Methodology and Approach

4.1 CODE SNIPPET FOR DCS PRGRAMMING

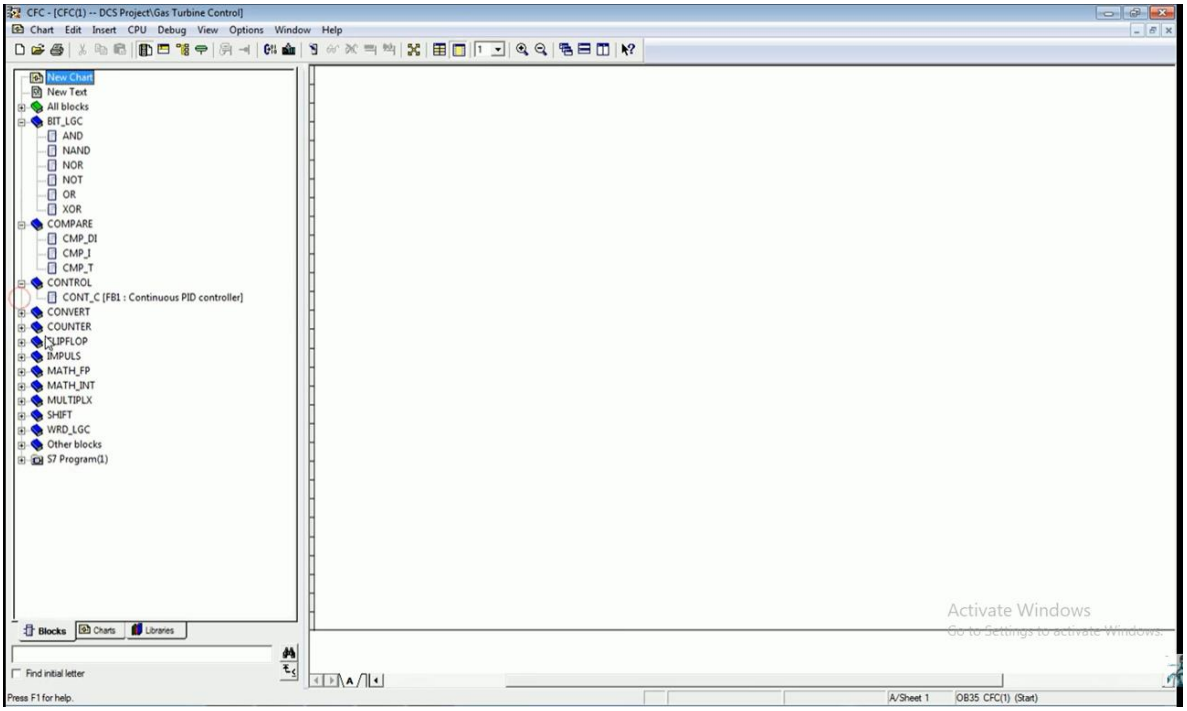


AUTOMATATION SYSTEM CFC

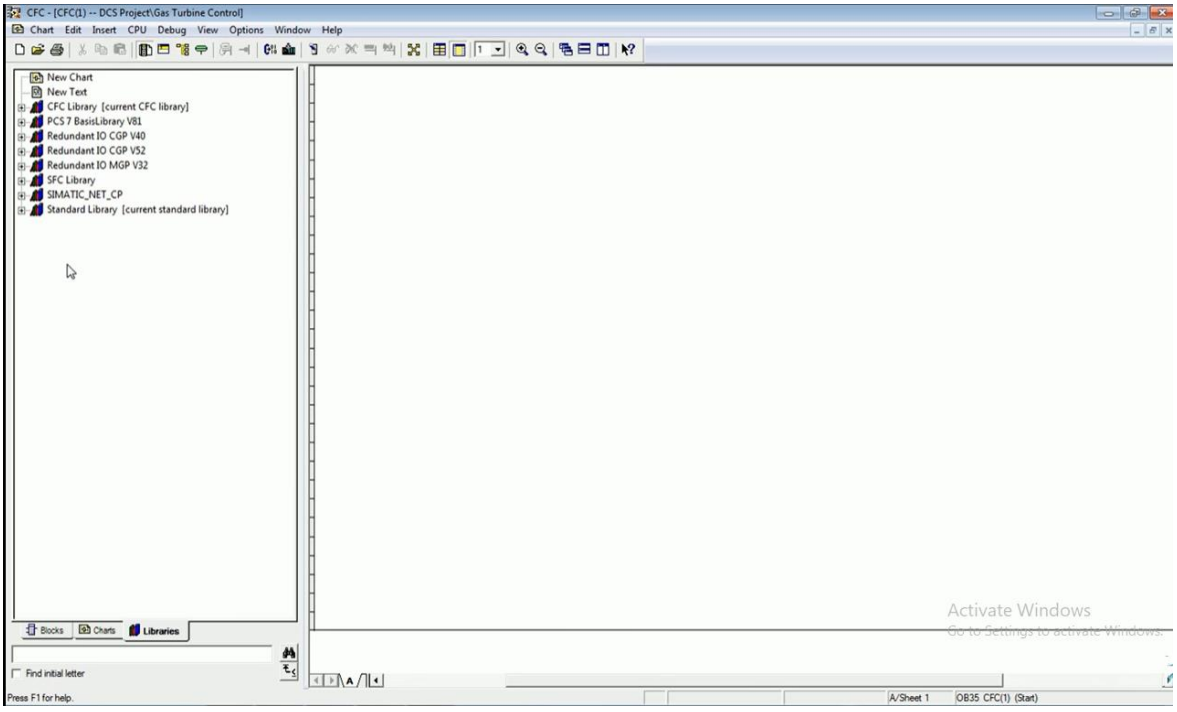
4.2 CFC (CONTINOUS FUCNTION CHART)



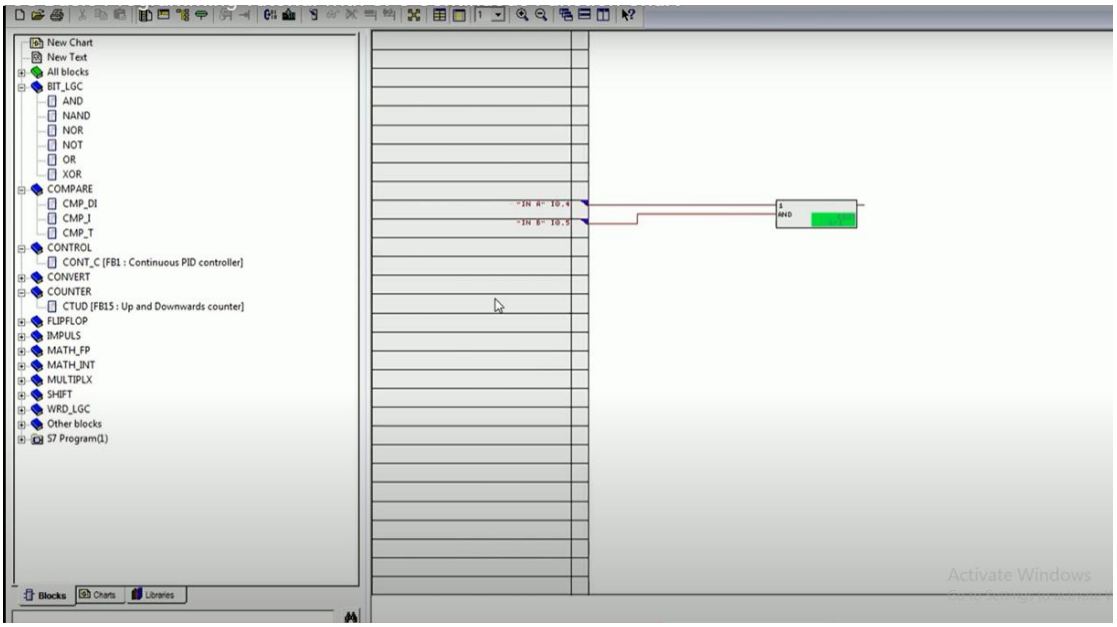
BLOCKS CONFIG.



CHARTS CONFIG.



LIBRARIES CONFIG.



SYSTEM CONFIG. FOR CFC

5. Challenges and Learning Experience

5.1 Overview of Challenges Encountered:
During the internship in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd, I encountered several challenges that tested my skills and pushed me to learn and grow. Some of the challenges I faced include:

- Understanding complex industrial processes and their instrumentation requirements
- Troubleshooting and resolving technical issues with instrumentation systems
- Adapting to the fast-paced and dynamic nature of an industrial environment
- Coordinating with cross-functional teams and stakeholders to ensure smooth project execution
- Keeping up with emerging technologies and industry advancements in instrumentation
- Working efficiently under time constraints and meeting project deadlines

5.2 Lessons Learned and Skills Developed:
Through these challenges, I gained valuable lessons and developed essential skills that contributed to my personal and professional growth. Some of the key lessons learned and skills developed during the internship include:

- Enhanced technical knowledge in instrumentation systems and their applications
- Improved problem-solving and troubleshooting skills in an industrial setting
- Effective communication and collaboration with team members and stakeholders
- Time management and prioritization of tasks to meet project deadlines
- Flexibility and adaptability to work in a dynamic and ever-changing environment
- Continuous learning and staying updated with the latest trends and technologies in the field of instrumentation

5.3 Personal Growth and Professional Development:
The internship in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd provided me with significant opportunities for personal growth and professional development. Some of the key areas of growth include:

- Increased self-confidence in handling complex instrumentation tasks and projects
- Expanded technical knowledge and practical skills in instrumentation systems
- Improved ability to work effectively in a team and collaborate with diverse stakeholders
- Enhanced problem-solving and critical thinking abilities in real-world scenarios
- Strengthened communication and interpersonal skills through interactions with professionals in the department
- Developed a deeper understanding of the industrial processes and the importance of instrumentation in optimizing efficiency and productivity

The challenges I encountered during the internship allowed me to overcome obstacles, learn from experiences, and emerge as a more skilled and confident professional. The lessons learned and the personal growth achieved during this internship will undoubtedly benefit me in my future endeavors in the field of instrumentation.

6. PERSONAL EXPERIENCE

During my internship in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd, I had a transformative and enriching personal experience.

1. **Learning and Skill Development**: The internship provided me with a valuable opportunity to apply the theoretical knowledge I gained in my academic studies to real-world scenarios. I was exposed to a wide range of instrumentation systems and processes used in the power and steel industries. Through hands-on experiences, I developed practical skills in designing, installing, calibrating, and troubleshooting instrumentation systems. This immersive learning experience broadened my understanding of the instrumentation field and enhanced my technical competencies.

2. **Professional Growth**: The internship allowed me to work closely with experienced professionals in the Instrumentation Department. Their guidance, mentorship, and expertise helped shape my professional growth. I gained insights into industry best practices, learned about the challenges and intricacies of working in an industrial setting, and honed my communication and teamwork skills. The exposure to a professional work environment and the opportunity to collaborate with cross-functional teams expanded my horizons and prepared me for future career endeavors.

3. **Problem-solving and Decision-making**: One of the most rewarding aspects of the internship was the opportunity to tackle real-world challenges and contribute to finding solutions. I faced various situations that required critical thinking, problem-solving, and decision-making skills. Whether it was troubleshooting an instrumentation issue, optimizing system performance, or addressing unexpected technical difficulties, I learned to approach problems methodically, gather relevant information, and make informed decisions. These experiences enhanced my problem-solving abilities and built my confidence in handling complex situations.

4. **Adaptability and Resilience**: Working in an industrial environment comes with its own set of challenges, including adapting to new technologies, processes, and work dynamics. During my internship, I encountered unexpected situations that demanded flexibility and adaptability. I learned to quickly adjust to changing priorities, work under pressure, and embrace a solution-oriented mindset. These experiences not only strengthened my resilience but also prepared me to thrive in dynamic work environments.

5. **Networking and Professional Connections**: The internship provided an excellent platform for networking and building professional connections. I had the opportunity to interact with professionals not only from the Instrumentation Department but also from other departments within the organization. Engaging with these individuals allowed me to gain insights into different roles and perspectives within the industry. Establishing these connections expanded my professional network, opening doors for future collaboration and career opportunities.

6**. Confidence and Self-growth**: The internship challenged me to step out of my comfort zone and take ownership of my work. As I successfully completed tasks, projects, and responsibilities, I gained confidence in my abilities and knowledge. The internship allowed me to witness my

own growth, both personally and professionally. It instilled a sense of self-assurance and motivation to continue pursuing a career in the field of instrumentation.

Overall, my personal experience during the internship in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd was incredibly rewarding. It provided a solid foundation for my career, expanded my skill set, and allowed me to grow both personally and professionally. The internship was a transformative experience that I will always cherish and value as I move forward in my professional journey.

7. Conclusion

7.1 Summary of Internship Experience:
Throughout the internship in the Instrumentation Department at Shri Bajrang Power & Ispat Ltd, I had a valuable and enriching experience. The internship provided me with an opportunity to apply my theoretical knowledge in a real-world industrial setting. I gained practical skills in designing, installing, calibrating, and troubleshooting instrumentation systems. I also had the chance to work closely with professionals in the field, further enhancing my understanding of the industry and its processes. The internship served as a platform for personal and professional growth, and I am grateful for the learning opportunities it provided.

7.2 Achievements and Contributions to the Instrumentation Department:
During my internship, I successfully completed assigned projects and tasks in the Instrumentation Department. I contributed to the development and implementation of control strategies, optimization of instrumentation systems, and troubleshooting of technical issues. My efforts helped improve the efficiency and reliability of instrumentation systems, ensuring smooth operations within the department. Additionally, I actively participated in team collaborations, sharing knowledge and insights to support the overall objectives of the department.

7.3 Acknowledgments and Appreciation in Shri Bajrang Power & Ispat Ltd:
I would like to express my sincere gratitude to the management of Shri Bajrang Power & Ispat Ltd for providing me with the opportunity to intern in the Instrumentation Department. I am thankful for the guidance and support extended to me by the professionals in the department. Their expertise, mentorship, and willingness to share knowledge significantly contributed to my learning and growth during the internship. I am also grateful to my colleagues and fellow interns for their collaboration and camaraderie throughout the internship period.

I would like to extend my appreciation to the entire Shri Bajrang Power & Ispat Ltd organization for creating a conducive and inclusive work environment. The internship experience has equipped me with valuable skills, experiences, and insights that will undoubtedly benefit me in my future endeavors. I am honored to have been a part of Shri Bajrang Power & Ispat Ltd and I will always cherish the memories and lessons gained during my time as an intern in the Instrumentation Department.

References

Learnings and Topics Covered:

1.

- "Process Instrumentation and Control Fundamentals," by Johnson & Marlin

- "Instrumentation and Measurement in Electrical Engineering," by Roman Malaric

2.

- "Measurement and Instrumentation Principles," by Alan S. Morris

- "Industrial Instrumentation: Principles and Design," by D. Patranabis

3.

- "Electrostatic Precipitation," by S. R. Rao

- "Environmental Electrostatics," by Fernando Galembeck

4.

- "Uninterruptible Power Supplies and Active Filters," by Ali Emadi

- "Handbook of Batteries," by David Linden and Thomas B. Reddy

5.

- "Distributed Control System: Their Evaluation and Design," by Maurice J. Zekri

- "Distributed Control Systems: Their Evaluation and Design," by M. H. Hamza

6.

- Manufacturer's documentation and manuals for specific DCS platforms used at Shri Bajrang Power & Ispat Ltd.

- "Programming Industrial Control Systems Using IEC 1131-3," by R. W Lewis

Internship/Project Daily Diary

Session: Jan–June 2023

Name of Students: **Hrithik Arora**……

Enrollment Number: **0901ET191030**……

Branch and Year**: Electronics and Telecommunication 4th year**…….

Internship/Project Title: **Internship in Instrumentation Department**……..

Company Name with Full Address: **Shri Bajrang Power & Ispat Ltd, Village Bojhara, Urla Guma Road, Urla, Raipur**……..

……..

Stipend Detail: Yes No √ Stipend Amount: **None**…….

Industrial Mentor Detail: **Senior General Manager-Hr**

Name of Industry Mentor: **Mr Manoj Kumar Puri**……

Email Address of Industry mentor: **manoj.puri@goelgroup.co.in**……..

Students must mention the daily progress details with dates in the given format such as daily work done/ software learn/coding/testing/site or field visit/hardware implementation, etc.

Month	Date	Daily Progress Details
Jan. 2023	**(16/1/23)**	Introduction to the Instrumentation Department and team members. Orientation session on safety protocols and guidelines. Familiarization with the workplace and equipment.
	(17/1/23-20/1/23)	Attended training sessions on basic instrumentation concepts and principles. Topic Covered: Introduction to Instrumentation.
	(23/1/23-27/1/23)	Training sessions on temperature measurement techniques and instruments. Topic Covered: Temperature Measurement. Practical exercises on using temperature sensors and calibration.
	(30/1/23-3/2/23)	Training sessions on pressure measurement techniques and devices. Topic Covered: Pressure Measurement. Hands-on experience with pressure transmitters and gauges.
Feb. 2023	**(6/2/23-10/2/23)**	Training sessions on flow measurement principles and instruments. Topic Covered: Flow Measurement. Practical exercises on using flow meters and troubleshooting common issues.
	(13/2/23-17/2/23)	Training sessions on instrumentation errors and their impact on measurement accuracy. Topic Covered: Instrumentation Errors. Discussion on sources of errors, calibration procedures, and error correction techniques.
	(20/2/23-	Training sessions on DC drives and their control systems. Topic Covered: DC Drive.

	24/2/23) **(27/2/23-3/3/23)**	Understanding the working principle, control methods, and troubleshooting of DC drives. Training sessions on AC drives and their applications. Topic Covered: AC Drive. Hands-on experience with AC drive configuration, parameter settings, and performance analysis.
March 2023	**(6/3/23-10/3/23)** **(13/3/23-17/3/23)** **(20/3/23-24/3/23)** **(27/3/23-31/3/23)**	Training sessions on Electrostatic Precipitators (ESP) and their instrumentation. Topic Covered: ESP (Electrostatic Precipitator). Overview of ESP operation, monitoring systems, and maintenance procedures. Training sessions on Uninterrupted Power Supply (UPS) systems and their functionality. Topic Covered: UPS (Uninterrupted Power Supply). Understanding the different types of UPS, their components, and backup power management. Training sessions on Distributed Control Systems (DCS) and their role in process control. Topic Covered: DCS (Distributed Control System). Introduction to DCS architecture, programming, and system integration. Practical exercises on DCS programming using code snippets. Topic Covered: Code Snippets for DCS Programming. Hands-on experience in developing and modifying control logic.
April 2023	**(3/4/23-7/4/23)** **(10/4/23-14/3/23)** **(17/4/23-22/4/23)** **(24/4/23-28/4/23)**	Training sessions on Control Function Chart (CFC) design and implementation. Topic Covered: CFC Design. Understanding CFC elements, connections, and designing control strategies. Recap of previous topics and discussions on real-world applications. Industrial visit to observe and analyze instrumentation systems in operation. Documentation and reporting on the visit findings. Mentorship sessions with senior professionals to discuss career opportunities and future growth in the field of instrumentation.

May 2023	**(1/5/23-5/5/23)**	Final report presentation and evaluation. Feedback session with mentors and department heads. Wrapping up the internship and preparing for the next steps
	(8/5/23-12/5/23)	Changes made to report and suggestion by industry mentor
	15/5/23	Certificate issue and wrapping internship.

Name and Signature of Students
Hrithik Arora
0901ET191030

Name & Signature of Institute Mentor
Dr.Laxmi Shivastava

ALL MPR

MPR-1

FORMAT

MONTHLY PROGRESS REPORT (MPR) FROM INDUSTRY MENTOR

Name of student	HRITHIK ARORA		Department	INSTRUMENTATION	
Industry/Organization	SHRI BAJRANG POWER & ISPAT LTD, RAIPUR		Date/Duration	10-02-2023	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality Timely completion of assigned work					✓
Learning capacity Knowledge up gradation				✓	
Performance Quality of work				✓	
Behaviour Discipline Team work					✓
Sincerity Hard work					✓
Comment on nature of work done Area Topic	Field Instruments / Drives / ESP DCS / UPS / Networking / Telephone System				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓				
Name of Industry Mentor	Anil Kumar				
Signature of Industry Mentor	Anil Kr				
Receiving Date		Name of Faculty Mentor	Dr. Laxmi Srivastav	Sign	

MPR -2

FORMAT

MONTHLY PROGRESS REPORT (MPR) FROM INDUSTRY MENTOR

Name of student	HARSHIT ARORA		Department	INSTRUMENTATION	
Industry/Organization	SHRI BAJRANG POWER & ISPAT LTD, Raipur		Date/Duration	10-3-2023	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality, Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity, Hard work					✓
Comment on nature of work done/Area/Topic	Field Instruments / Drives / ESP DCS / UPS / Networking / Telephone System				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓				
Name of Industry Mentor	Anil Kumar				
Signature of Industry Mentor	Anil Kr.				
Recommended	Name of Faculty Mentor	Dr. Laxmi Shrivastava	Sign		

Shri Bajrang Power & Ispat Ltd. RAIPUR (C.G.)

MPR-3

FORMAT

MONTHLY PROGRESS REPORT (MPR) FROM INDUSTRY MENTOR

Name of student	HRITHIK ARORA		Department	INSTRUMENTATION	
Industry/Organization	SHRI BAJRANG POWER & ISPAT Ltd, Raipur		Date/Duration	10-4-2023	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality Timely completion of assigned work					✓
Learning capacity Knowledge up gradation					✓
Performance Quality of work				✓	
Behaviour Discipline Team work					✓
Sincerity Hard work					✓
Comment on nature of work done Area Topic	Working in DCS Learning about AC/DC Drive				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓				
Name of Industry Mentor	Anil Kumar				
Signature of Industry Mentor	Anil Kr.				
Receiving Date		Name of Faculty Mentor	Dr. Laxmi Shrivastav	Sign	

Shri Bajrang Power & Ispat Ltd. RAIPUR (C.G.)

MPR-4

FORMAT

MONTHLY PROGRESS REPORT (MPR) FROM INDUSTRY MENTOR

Name of student	HRITHIK ARORA		Department	INSTRUMENTATION	
Industry/Organization	SHRI BAJRANG POWER & ISPAT Ltd, Raipur		Date/Duration	10/01/23 - 15/02/23	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality Timely completion of assigned work					✓
Learning capacity Knowledge up gradation					✓
Performance Quality of work					✓
Behaviour Discipline Team work					✓
Sincerity Hard work					✓
Comment on nature of work done Area/Topic	Report submission for learnings during internship				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓				
Name of Industry Mentor	Anil Kumar				
Signature of Industry Mentor	Anil Kr				
Remarks/Date			Faculty Mentor	Dr. Laxmi Srivastava	Sign

Shri Bajrang Power & Ispat Ltd. RAIPUR (C.G.)

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