INTERNSHIP REPORT

On

Instrumentation and Control Division

Of

Ashuganj Power Station Company Ltd.

By

Md. Al Imran Bin Siddique (2008-2-80-006)
Sams Zubayer Mridha (2008-2-80-059)
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Submitted to

The Department of Electrical and Electronic Engineering
Faculty of Sciences and Engineering
East West University
In partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering
(B.Sc. in EEE)
[Spring 2013]

Approved By

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Department Chairperson
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Electrical & Electronic Engineering

ASHUGANJ POWER STATION COMPANY LTD. (APSCL)

(An Enterprise of Bangladesh Power Development Board)

APSCL

Certificate

For

Industrial Attachment Training Program

This is to certify that ,Md. Al-Imran Bin Siddique, ID No. 2008-2-80-006 ,the Student of B.Sc in Electrical and Electronic Engineering from East West University , Dhaka has successfully completed the Industrial Attachment Training Program held from 24-08-2012 to 07-09-2012. During the training period , he paid due attention to the practical work .

I wish him every success in life.

Manager (HRD)
Ashuganj Power Station Company Ltd.
Ashuganj, B-Baria.

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This is to certify that Mr. Sams Zubayer Mridha , ID No. 2008-2-80-059 ,the Student of B.Sc in Electrical and Electronic Engineering from East-West University , Dhaka has successfully completed the Industrial Attachment Training Program held from 24-08-2012 to 07-09-2012. During the training period, he paid due attention to the practical work.

I wish him every success in life.

Manager (HRD)
Ashuganj Power Station Company Ltd.
Ashuganj, B-Baria.

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Certificate

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Industrial Attachment Training Program

This is to certify that Mr.Kishor Kumar Barai , ID No. 2008-2-80-003 ,the Student of B.Sc in Electrical and Electronic Engineering from East-West University , Dhaka has successfully completed the Industrial Attachment Training Program held from 24-08-2012 to 07-09-2012. During the training period , he paid due attention to the practical work.

I wish him every success in life.

Manager (HRD)
Ashuganj Power Station Company Ltd.
Ashuganj, B-Baria.

Authorization page

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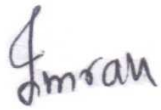
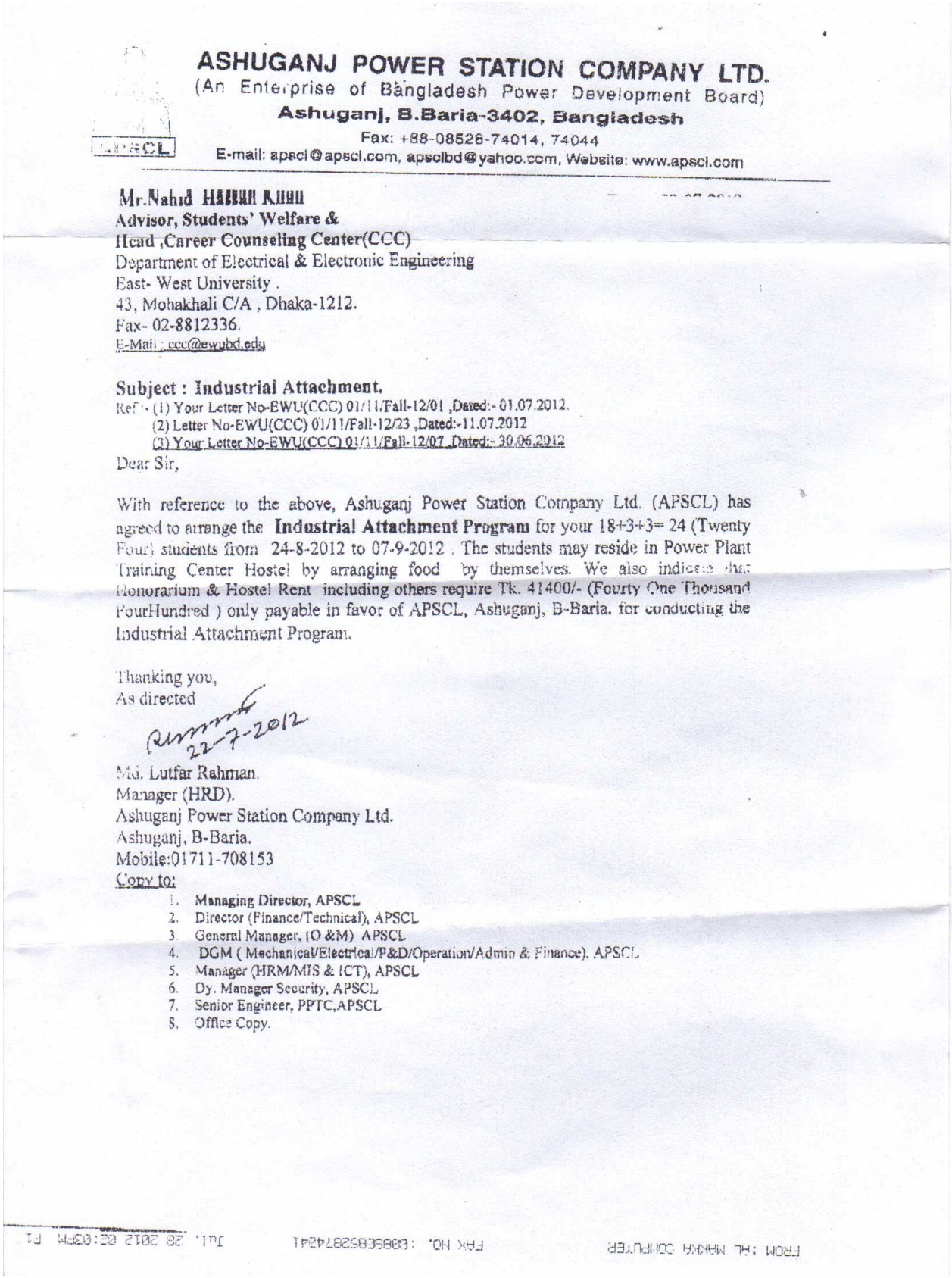


Md. Al-Imran Bin Siddique	Sams Zubayer Mridha	Kishor Kumar Barai

Approval Letter



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Subject : Industrial Attachment.

Ref :- (1) Your Letter No-EWU(CCC) 01/11/Fall-12/01 ,Dated:- 01.07.2012.
(2) Letter No-EWU(CCC) 01/11/Fall-12/23 ,Dated:-11.07.2012
(3) Your Letter No-EWU(CCC) 01/11/Fall-12/07 ,Dated:- 30.06.2012

Dear Sir,

With reference to the above, Ashuganj Power Station Company Ltd. (APSCL) has agreed to arrange the **Industrial Attachment Program** for your 18+3+3= 24 (Twenty Four) students from 24-8-2012 to 07-9-2012 . The students may reside in Power Plant Training Center Hostel by arranging food by themselves. We also indicate that Honorarium & Hostel Rent including others require Tk. 41400/- (Fourty One Thousand FourHundred) only payable in favor of APSCL, Ashuganj, B-Baria. for conducting the Industrial Attachment Program.

Thanking you,
As directed
22-7-2012

Md. Lutfar Rahman.
Manager (HRD).
Ashuganj Power Station Company Ltd.
Ashuganj, B-Baria.
Mobile:01711-708153

Copy to:

1. Managing Director, APSCL
2. Director (Finance/Technical), APSCL
3. General Manager, (O &M) APSCL
4. DGM (Mechanical/Electrical/P&D/Operation/Admin & Finance), APSCL
5. Manager (HRM/MIS & ICT), APSCL
6. Dy. Manager Security, APSCL
7. Senior Engineer, PPTC,APSCL
8. Office Copy.

Acknowledgement

Starting with the name of Almighty Allah, we would like to thank Engr. Mr. Md. Nurul Alam (P.Engg) the Managing Director APSCL, Engr. Bikash Ronjon the Manager of Instrument and Control Division and Md. Lutfar Rahman the HRM Manager of APSCL Ltd. for allowing us to complete the internship program and work under their guidance. We would also like to express our gratitude to Engr. Shafiqul Islam the Senior Engineer, Instrumentation and Control Division, who has given us his precious time and helped us to learn and to collect related data for our report and also helped us understand many relevant subject matter.

We would also like to convey our gratitude to Dr. Halima Begum, Assistant Professor, Department of Electrical and Electronic Engineering and Ms. Tahseen Kamal, Senior Lecturer, Department of Electrical and Electronic Engineering, East West University, Bangladesh for providing their valuable suggestion and helping us to complete this internship report under their supervision.

We would also like to mention the name of Dr. Mohammad Mojammel Al Hakim, Chairperson and Associate Professor, Electrical and Electronic Engineering department, Dr. Anisul Haque, Professor of the Department of Electrical and Electronic Engineering, East West University, Bangladesh for guiding us well throughout the four years of our undergraduate study.

Special thanks to all of our teachers, friends and mostly to our parents for their contribution, co-operation and encouragement throughout our whole academic life at East West University.

Executive Summary

As a part of our undergraduate requirement, we have to complete our thesis or internship. We have chosen internship because we are interested to pursue our career in power sector. Therefore we hoped that building relationship with the power producing industries would help us to reach our goal. On the other hand, the scale of demand for electricity is going up. It varies according to different zones of the country. With the improvement of the people's life standard, the demand for electricity has also increased. Therefore, a good number of generation units or power plants are being established to meet that demand.

Ashuganj Power Station Company Limited (APSCL) is a well reputed company. Together it has 3 types of power production plants (thermal power plant, combined cycle power plant and gas engine power plant). Other power plant companies do not contain this combination. If de-rated capacity is considered, APSCL is providing maximum amount of power to the national grid. They are also willing to train the university students. Hence, we did not want to miss the opportunity of completing our internship in one of the largest power producing company of Bangladesh.

By completing internship at APSCL, we have learned about the process of electricity generation. We have learned how to maintain a plant. Specifically we have learnt about Instrumentation and Control Division of APSCL elaborately. We also learnt how to find out the problems that occurred in the plant and their possible solutions from our superintendent engineer. We have gained knowledge about the new technologies that are applied recently.

Industrial training has benefitted us in many ways. Now we can relate the theoretical experience with the practical experience in power sector. It built the confidence in us, to work in a power production company. Industrial training gave us the primary level of experience which will be helpful for future job opportunities.

Training Schedule

The following table is representing the training schedule of our internship. We completed the internship at Ashuganj Power Station Company Ltd. from the duration 24 August, 2012 to 7 September, 2012 and each day we worked for 7 hours.

Table 1 : Training Schedule.

Date	Division	Time	Mentor Engr.
24-08-2012	Total Plant Overview	8am - 4pm	Shafiqul Islam
25-08-2012	Instrumentation and Control Division and steam turbine	8am - 4pm	Shafiqul Islam
26-08-2012	Piping and Instrumentation diagram, condenser, circulating water pump, cooling water pump.	8am - 4pm	Shafiqul Islam
27-08-2012	Signal conditioning, the firing of boiler.	8am - 4pm	Shafiqul Islam
28-08-2012	Burner and feed water pump.	8am - 4pm	Shafiqul Islam
29-08-2012	Logic related control elements.	8am - 4pm	Shafiqul Islam
30-08-2012	Control system, elements of control loop.	8am - 4pm	Shafiqul Islam
31-08-2012	Faults of circulating water pump.	8am - 4pm	Shafiqul Islam
01-09-2012	Control parameters and logic cards.	8am - 4pm	Shafiqul Islam
02-09-2012	Different protections, control and test.	8am - 4pm	Shafiqul Islam
03-09-2012	Components and maintenance of boiler.	8am - 4pm	Shafiqul Islam
04-09-2012	Turbine and its control and protection.	8am - 4pm	Shafiqul Islam
05-09-2012	Unit-5 power plant.	8am - 4pm	Shafiqul Islam
06-09-2012	Control room of unit-5, fault analysis.	8am - 4pm	Shafiqul Islam
07-09-2012	Substation	8am - 4pm	Shafiqul Islam

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Chapter 1: Introduction

In Bangladesh, the average maximum demand for electricity was 3970 MW in 2007 which has increased to 4833 MW in 2011 (May, 2011). On the other hand, the average generation was 3378 MW in 2007 which has increased to 4103 MW in 2011 (May, 2011) [1]. Keeping this demand in account, the Bangladesh Power Development Board (BPDB) has established few power generation companies at different parts of the country. Such as Ashuganj Power Station Company Ltd. (APSCL), Electricity Generation Company of Bangladesh (EGCB), North West Power Generation Company Ltd. (NWPGCL), West Zone Power Distribution Company Ltd. (WZPDCL). Those power plants generate electricity and synchronize the power in national grid. To generate electricity, coal is used in the western zone and natural gas and hydro power is used in the eastern zone. On the other hand, privet sectors are also extending their hand in the economic development of Bangladesh by providing uninterrupted power supply to the consumers.

As to-be electrical engineers we are interested to pursue our career in power sector. Therefore we think building relationship with the power generating industries will help us to reach our goal. There is a huge demand of power in Bangladesh and in near future, establishment of many industries in Bangladesh will fulfill this demand. So there will be a big job market for power engineers. Hence, we wanted to take the opportunity of completing our internship at Ashuganj Power Station Company Ltd. (APSCL), one of the largest power producing company in Bangladesh.

APSCL is well reputed for maximum production of power (with respect to the de-rated capacity) in Bangladesh. APSCL produces a total of 737 MW of power through its thermal power plant, combined cycle power plant and gas engine power plant. The experiences that we have gathered during our internship at APSCL have been summarized in this report. We have also tried to explain the relationship between the theoretical knowledge of our academic syllabus and the practical knowledge obtained from industrial training, in this report. As a trainee, we specifically worked in the Instrumentation and Control department utilities. In this report we have also written about the relevant unexpected problems (faults at the power station) that occurred during our internship period and presented the solutions taken by APSCL engineers to handle those problems. Our Internship at APSCL has given us the opportunity to gain knowledge about the practical fields of power sector and has boosted up our confidence for future job opportunities in this sector.

1.1 Company Profile

APSCL is the second largest power producing company (with respect to the installed capacity) in Bangladesh.

Table 2: General information of APSCL [2].

Components	**Description and Information**
Company name	Ashuganj Power Station Company Ltd. (ASPCL).
Incorporate	28 June 2000
Location	90 km North-East of Dhaka on the left bank of the river Meghan.
Land	311.22 Acres
Installed Capacity	777 MW
Number of plants	4
Number of Units	9

The installed capacity by its 9 units is 777MW and present de-rated capacity is 731MW. Ashuganj Power Station fulfills about 15% of power requirements of the country [2].

1.1.1 Power Production

Within 311.22 acres of land APSCL has established total 4 plants for power generation. These are two thermal power plants, a combined cycle power plant and a gas engine power plant. Two thermal power plants consist of 5 units, where units 1 to 5 are steam turbine units. Combined cycle power plant has 3 units. These are 2 gas turbine units and 1 steam turbine unit under combined cycle power plant. As the source of fuel, natural gas is used at APSCL, which is supplied by Titas Gas Transmission and Distribution Co. Ltd [2]. The brief description about all the plants of APSCL is given in the following subsections:

1.1.1.1 Plant 1: Thermal Power Plant (TPP)

Primarily, APSCL established two units in thermal power plant. These units mainly use the purified river water for generation of the electricity.

- Unit#1(steam)–capacity 64MW of electricity and was established in 1970.
- Unit#2(steam)– capacity 64MW of electricity and was established in 1970.

The source of water is the Meghna River. These power units (Unit-1 and Unit-2) are under Plant 1. They produce total 128 MW powers [2].

1.1.1.2 Plant 2: Gas Turbine and Combined Cycle Power Plant (CCPP)

APSCL established two gas turbine units to increase power generation to keep up with the demand. These two gas turbine units are referred as combined cycle power plants. These two gas turbine (GT-1 and GT-2) units are under Plant 2. The total capacity of this combined cycle power plant is 146 MW [2].

- Gas Turbine Unit-GT1 - capacity 56MW of electricity and was established in 1982.
- Gas Turbine Unit-GT2 - capacity 56MW of electricity and was established in 1986.
- Steam Turbine (ST) unit of combined cycle - capacity 34MW with waste heat recovery boiler and was established in 1984.

1.1.1.3 Plant 3: Thermal Power Plant (TPP)

Recently APSCL has established 3 more units comprising of latest technology. These power producing units are Unit 3, 4 and 5 in thermal power plant under Plant 3 [2]. The total installed capacity of those plants are 450 MW. These three units are:

- Unit # 3 (steam) – capacity 150MW of electricity and was established in 1986.
- Unit # 4 (steam) – capacity 150MW of electricity and was established in 1987.
- Unit # 5 (steam) – capacity 150MW of electricity and was established in 1988.

1.1.1.4 Plant 4: Gas Engine Power Plant

To satisfy the high demand of electricity, recently APSCL has established one Gas Engine Power Plant.

- Unit # 9 (gas engine) – capacity 50MW of electricity and was established in 2011.

We have visited all of the above mentioned power plant except for Gas Turbine and Combined Cycle Power Plant (CCPP) and Gas Engine Power Plant during our internship.

1.2 Future Plan of APSCL

APSCL has started their journey much successfully. They are determined to keep up this pace with the increasing demand to satisfy the consumers. They have planned to increase the total power supply to the national grid. They expect that the generation capacity of APSCL will be 1500MW by the year 2015. To fulfill these requirements they have taken some steps. These are, producing more power in the future by developing plants and establishing three more combined cycle power plants. Other significant plans of APSCL are:

- Ashuganj 450MW Combined Cycle Power Plant (South).
- Ashuganj 450MW Combined Cycle Power Plant (North). To narrow the ever increasing gap between the demand and supply of electricity through gas based low cost generation in the North East zone of the country.
- Ashuganj 200±10% MW Modular Power Plant Project.
- Ashuganj 225MW Combined Cycle Power plant.

These projects will be self funded by APSCL.

1.3 Scope and Methodology

To fulfill our graduation requirement from the department of Electrical and Electronic Engineering (EEE) of East West University (EWU), we need to complete either industrial training or thesis work. We chose to do intern in power sector because we want pursue career in this field. Industrial training in this sector provides the work experience opportunities to university students who are willing to work in power sector. Keeping this in mind, we have already completed the power related major courses of our academic schedule. We gathered related theoretical knowledge and gained practical experience during our internship period at APSCL.

This report mainly focuses on Instrumentation and Control division of Ashuganj Power Station Company Ltd. This report has been prepared on the basis of:

- Information collected from primary sources (primary information has been collected through personal interview as well as discussion with the senior engineers of APSCL)

- Information from secondary sources (secondary data has been gathered by using company website).

1.4 Objective of the Internship

The first objective of the internship is to fulfill the graduation requirement of EEE program. In this internship report, we have attempted to give a view of the Instrumentation and Control division of Ashuganj Power Station Company Ltd. The experience of industrial training aims at some objectives, which are as follows

- Learning about the company management policy.
- Gaining knowledge about power generation process.
- Experiencing the protection methods.
- Gathering experience of controlling the power generation unit.
- Learning the maintenance procedure.
- Getting a partial idea that the production of power can be improved to fulfill the loads of the country.

1.5 Internship Report Organization

This report contains the general overview of Instrumentation and Control Division of APSCL. Chapter 1 is about the APSCL. It contains the company profile, a brief description of different types of power plants of APSCL and their power production capacity, the future plan of APSCL and our objective of industrial training. Chapter 2 is about the control elements of Instrumentation and Control division of APSCL. There has been an individual discussion about various sensing elements and the control valves used in Instrumentation and Control division. Chapter 3 has discussed about the supply and circulation of water inside the plant for generation of steam. This chapter includes discussion about the pumps, purification of water and the circulation of cooling water. Chapter 4 has discussed about various components of boiler. It contains general discussion about the burning process of gas inside the furnace, production of steam, air supply in the furnace, pressure and temperature control of steam, ignition process of the burner and the management of the draining of the waste water. Chapter 5 has discussed about the steam turbine section of APSCL. This chapter includes elaborate description on the mechanism used in steam turbine for protection, control of pressure and temperature. In chapter 6, we have discussed about the fault experiences that

we gathered during our internship. Three types of fault (HP bypass fault, Trip of Circulating Water Pump and False Signal due to Shaft Vibration) are discussed. Finally, in chapter 7, we discussed different problems we had faced during our internship period and our recommendations for the future trainees who are willing to complete internship in power station.

Chapter 2: Control Elements

To smoothly continue the power generation process it is essential to employ control system at different parts of the power plant. The main task of the control system is to check whether the desired or maximum output and the actual output from the process or plant is same or not and to take necessary actions to minimize the difference between them or to set an alert system. So basically the control system should consist of,

- Measuring or sensing equipments: They measure the actual output of the process. Different kinds of sensors such as LVDT, tachometer, temperature sensors, liquid level sensor, and pressure sensor are used at APSCL. The outputs of the sensors or measuring equipments are termed as the *Process Value* (PV). PV is the actual output of the process or plant.
- Comparator or error checker: The elements that differentiate between the desired value or set value and the actual value of a process are termed as error checking elements. Generally, *Set Point* (SP) is used to indicate the desired value at which a process variable is to be maintained.

$$\text{Error} = |\text{Set Point (SP)} - \text{Process Value (PV)}|$$

- Actuators such as different types of motors, valves etc to carry over the control action.

2.1 Signal Conditioning

A signal conditioner is an electronic instrument used for automation. It usually converts the signals generated from sensor or transducer into industry standard control signals which are used in the industries. For example an analog to digital converter (ADC) is a signal conditioner. Apart from ADC, other signal conditioning elements are used for the purpose of amplification, filtering, converting, range matching, isolation etc. Signal conditioning equipments are widely used in the power plants.

An analog meter is used for signal conditioning at APSCL. For signal conditioning, the analog meter acts like a comparator. The meter consists of two hands as shown in Figure 2.1, where fixed hand contains Set Point value (SP) and the movable hand contains Process Value (PV). When the magnitude of the oscillating Process Value (PV) exceeds the magnitude of

Set Point value (SP) then the movable hand touches the fixed hand and then a feedback signal is produced. If the magnitude of the oscillating Process Value (PV) higher than Set Point value (SP) than the feedback signal is "HIGH" and if not then "LOW". It creates an alarm and thus an exception is detected at the control room.

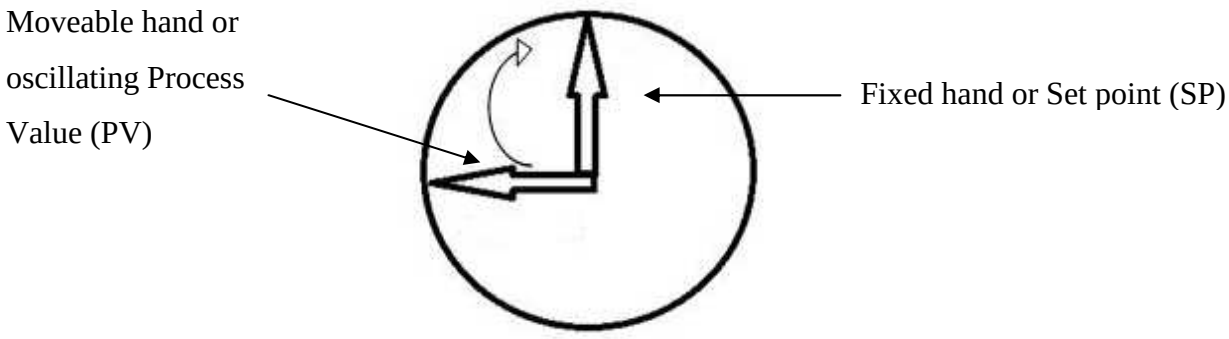

Figure 2.1: Schematic diagram of an analog meter for signal conditioning.

2.2 Different Kinds of Sensors at APSCL

Different kinds of sensors are used to measure and detect the analog signals such as voltage, current, pressure, speed etc. Some of the major sensors used at APSCL are tachometer, linear variable differential transformer (LVDT), selection output controlled sensor etc. These sensors are briefly described in the following sections.

2.2.1 Tachometer

Tachometer measures rotational speed and converts the speed into the proportional voltage [3]. The speed is measured as revolution per minute (RPM). In the plant, the tachometer is directly coupled with the turbine shaft, which allows the tachometer to rotate at the turbine speed. As a result, a voltage, proportional to the turbine speed is produced [4]. Thus, low or high turbine speed situation can be detected at the control room.

2.2.2 Linear Variable Differential Transformer (LVDT)

Linear Variable Differential Transformer (LVDT) is one kind of sensing element that is broadly used in controlling the opening of the valves. An LVDT comprises of 3 coils; a primary and two secondary coils. The primary winding is excited with an AC supply. The transfer of current between the primary and the secondary coils of the LVDT is controlled by the position of a magnetic core, shown in Figure 2.2. LVDTs, the two secondary coils are connected in opposition as shown in Figure 2.2. When the magnetic core is at the center, the

induced voltage at two secondary coils are equal, but out of phase, resulting in zero output from the sensor. As the core moves away from the center, the result is an increase in the induced voltage in one of the secondary coil and a decrease in the other, which results variable output voltage. On the other hand, phase of the output voltage also changes [5]. Thus depending on the output voltage the linear displacement is determined.

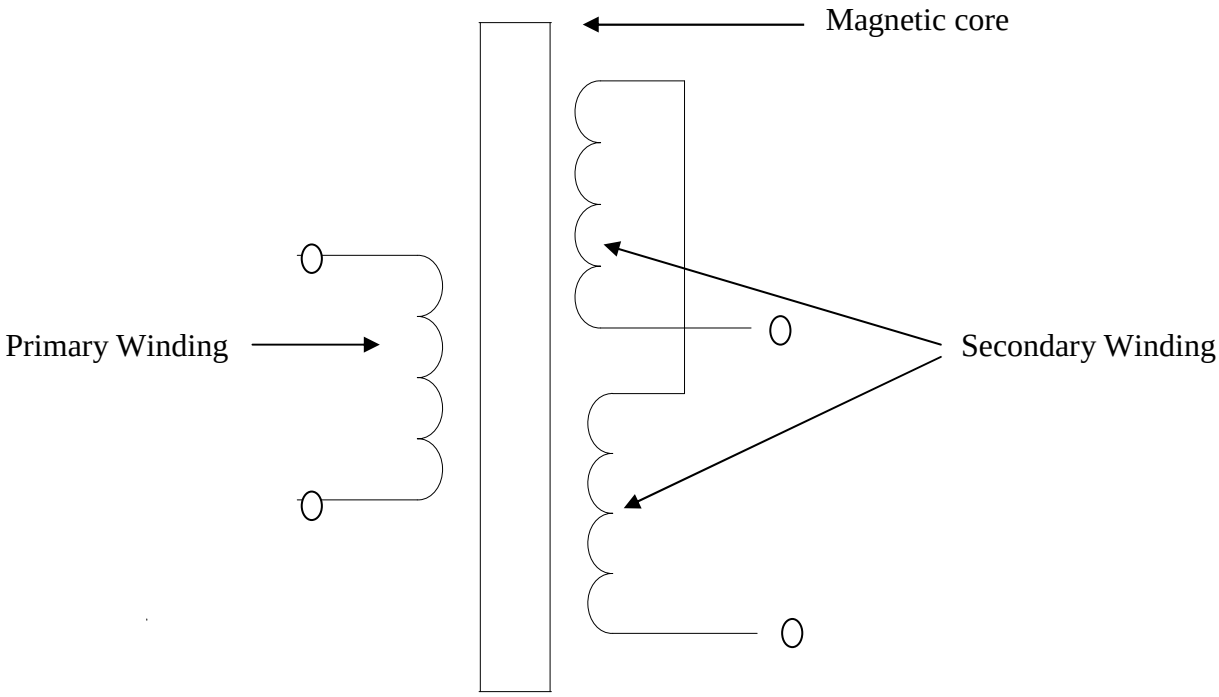

Figure 2.2: Linear Variable Differential Transformer (LVDT).

The core is externally connected to the valve. Thus, the motion of valve's opening or closing makes a linear displacement of the core. This linear displacement of core, creates a proportional electrical output. LVDT is used to measure displacement ranging from fraction millimeter to centimeter. LVDT can be used as a device to measure force, weight and pressure etc.

2.2.3 Selection Output (S/O) Controlled Sensor

Selection output controlled sensor is used to measure or sense the opening or closing of the valve. The sensor is attached with the valve. There is a lid on the valve. S/O controlled sensor is placed beside this lid. When the valve opens, then the lid opens and the magnetic field area inside the valve spreads outside and when the valve closes, the lid closes and the magnetic field area inside the valve cannot spread outside or magnetic field area decays. This spreading of magnetic field area allows the sensor to measure the opening or closing of the valve.

2.3 Actuators and Valves

Actuator is an important part of a control system. It plays a significant role in control system as the final control element. Some automated valves are controlled by actuator. In this section we discuss about actuators and different types of valves.

2.3.1 Actuators

An actuator is a type of motor for moving or controlling a mechanism or a system. It is operated by a source of energy, usually in the form of an electric current, hydraulic fluid pressure or pneumatic pressure, and converts that energy into some kind of mechanical motion. There are 3 types of actuators. They are:

- Electric Actuator: operates the valve using electrical signal.
- Pneumatic Actuator: operates the valve using compressed air.
- Hydraulic Actuator: operates the valve using oil pressure.

At APSCL all these 3 types of actuators are used. But electrically actuated systems are widely used in control system because they are easier to interface with the control systems.

2.3.2 Automated valves at APSCL

A valve is a device that regulates, directs or controls the flow of gases and liquids by opening, closing, or partially obstructing various pipelines. Fluid flows in a direction from higher pressure to lower pressure through an open valve. Automated valves regulate the flow rate through a pipe line with the help of the actuator. An actuator is the main control element of a valve.

2.3.2.1 Control Valve Sizing

Control valve sizing is an important consideration because depending on where the valve is going to be used or what type of valve has to be used, the size of the control valve should vary. The selection of valve size depends on the features of the valves and the requirements of the pressure, flow rates in the pipelines. Engineers select valves based on their calculation with the help of the manual which is provided by the valve manufacturing company.

2.3.2.2 Types of Valves used at APSCL

The followings valves are used in APSCL.

Non Return Valve: The non-return valves are used in units 3, 4, and 5. This valve is also called check valve or one way valve. The size of the valve is 200 mm, rated pressure is 30

bar and rated temperature is 80°C. This valve is two-port valve, which means it has two openings in its body, one for the fluid to enter and the other for the fluid to leave [6]. This valve is used in water pipelines and used to control the flow of water in one direction only. Figure 2.3 shows a non-return valve.

Figure 2.3: Non- Return valve at unit 5.

Globe Valve: The globe valves are the type of valve which is used in units 3, 4 and 5 for regulating the flow of the water in the pipelines.

Figure 2.4: Globe valve at unit 5.

It consists of a movable disk-type element and a stationary ring seat in a general spherical body. The movable disk inside the globe valve allows the water flow from high pressure to low pressure region. Figure 2.4 shows the globe valve.

Pneumatic Valve: Pneumatic valves are extensively used in power station because these valves can be operated by the compressed air pressure or compressed inert gases with the help of pneumatic actuator. The force of compressed air against a diaphragm is opposed by the force of a spring to control the area of the opening for a fluid stream. From APSCL control room electrical signal within the range of 4-20mA is sent to the field where the input converter converts these electrical signals into pneumatic signals. Actuators control the valve opening depending on the amount of pneumatic signals. Figure 2.5 shows a pneumatic valve.

Figure 2.5: Pneumatic valve at unit 5.

Temperature Controlled Valve: Temperature controlled valve is a special type of valve which is controlled by temperature.

Figure 2.6: Temperature controlled valve of waste water basin at unit 3.

These valves are mostly used in waste water basin. It is used to reduce the temperature of hot waste water by opening the valve of cooling water pipelines. When heat of the water is too high, the valve receives a signal from the heat sensor and opens the cooling water spray lines automatically. When water heat becomes normal it closes automatically. The purpose of the cooling of water is to prevent unexpected environmental effect. Figure 2.6 shows the temperature controlled valve.

Butterfly Valve: The butterfly valve is used for isolating or regulating the flow of water. For quick shut-off capability.

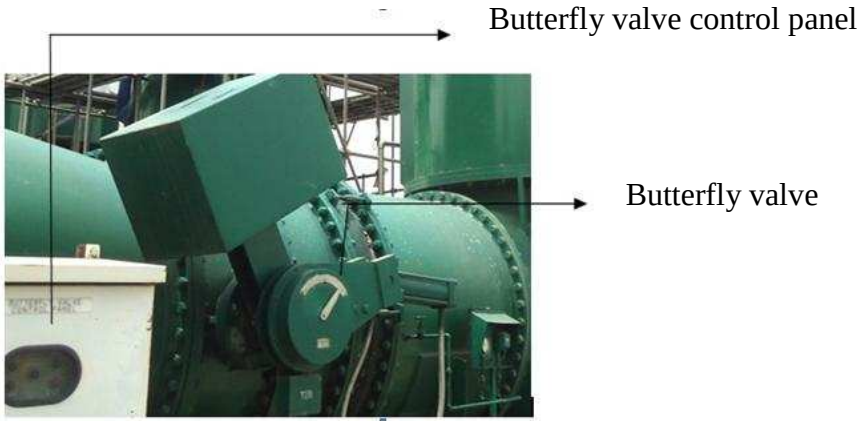

Figure 2.7: Butterfly valve with control panel at CW pump.

It is also known as quick operate valve. There is a moving disk inside a butterfly valve. The movement of the disk opens or closes the valve. Figure 2.7 shows the butterfly valve along with its control panel.

Pressure Relief Valve: The pressure relief valve is a type of valve which is used to control or limit the pressure of gas.

Figure 2.8: Pressure Relief valve at unit 4.

This valve is normally in closed position. When gas pressure is too high, the valve gets opened up by the pressure of the gas. Then the gas passes through the bypass pipeline and thus the maximum pressure of the gas is controlled. The pressure relief valve has a spring inside it which mainly helps the valve to open and close. This kind of valves is used in the gas pipelines at the boiler of the thermal power plant.

Chapter 3: Collection and Processing of River Water

We visited the water collection pump and the circulating water pump on August 26, 2012. APSCL uses the water collection pump for pulling up the water from the Meghna river and supplying it to the plant. The circulating water pump is being used to circulate the reservoir water throughout the plant for generation of steam and cooling purpose.

3.1 River Water Collection

Through water collection pump water from the Meghna River is supplied to APSCL. This water is then used to produce steam for generating electricity and also for cooling purpose [2]. Figure 3.1 shows the water collection pump.

Figure 3.1: Water collection pump of APSCL.

The water is stored in a reservoir. However the collected river water contains many types of fishes, iron, mud and natural components. Therefore, before sending it to circulating water pump, the water should be filtered.

Figure 3.2: Reservoir of river water.

The reservoir contains a filter to remove these components. Figure 3.2 shows the reservoir water which is used at APSCL. A damper motor is used to remove the waste from water.

After filtering, the circulating water pump delivers this filtered water throughout the whole plant.

3.2 Control System of Water Circulation by Circulating Water Pump

The circulating water pump is used to circulate water throughout the plant. This pump usually collects water from the reservoir which is being continuously filled up by the water collection pump. The pump is powered up by the electricity generation (generator) section of the power plant. Figure 3.3 shows the circulating water pump at APSCL. In this figure the green colored metal cylinder is the circulating water pump and the white colored box is the cooler to cool the pump.

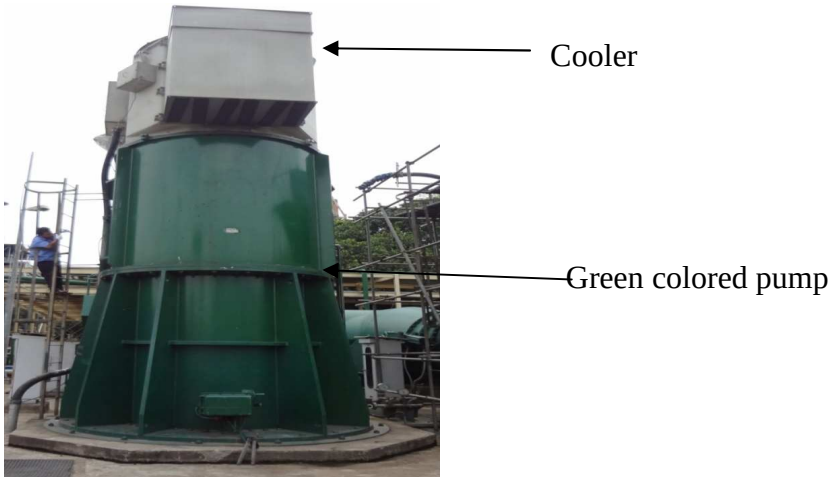

Figure 3.3 : Circulating water pump.

Due to continuous operation the pump gets heated. Therefore, to protect the winding of circulating water pump from overheating a cooler is used.

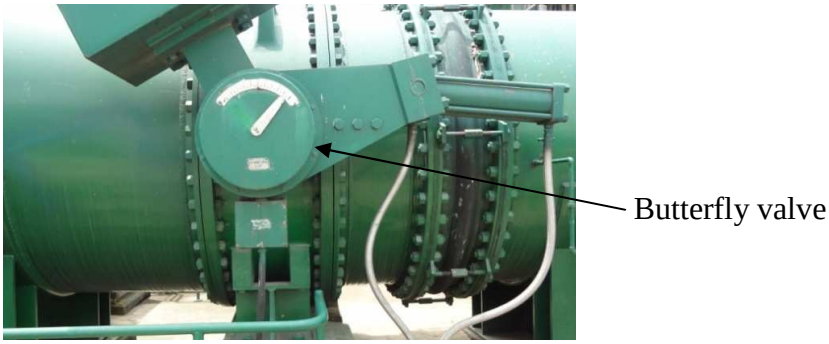

Figure 3.4: Water flow control valve.

On the other hand, the temperature of the pump is monitored by the operator from time to time as well as from the control room. From the pump, the water is delivered to the rest of

the plant using the pipes around the plants. The flow of water is controlled by a butterfly valve which was discussed in chapter 2. Figure 3.4 gives another view of a butterfly valve.

3.3 Purification of River Water

To generate steam the boiler needs to be supplied with pure water. The source of boiler feed water of APSCL is generally Meghna river, which contains suspended and dissolved gases, ions, salts, sediment and other components. This is very important to remove those components from the water and soften the water by chemical treatment before delivering it to the boiler.

Figure 3.5: Water treatment.

The water from the circulating water pump is first stored in a storage tank of the water treatment plant of APSCL. In the water treatment plant, the component of water such as ions, salts and sediment are being removed by the anode, cathode formation. In Figure 3.5, the three green colored cylinders perform the task of removal. The left most cylinder removes the ions of the water. Then the middle one removes the chemicals and salt of water. The right most cylinder removes the sediments of the water. Thus 100% pure water comes out and this water is known as distilled water.

3.4 Circulation of cooling water

The water cooling system of APSCL plays a vital role of protecting the overall machineries of the boiler including the machineries of other units. There are two categories of cooling system which are accommodated in this power plant especially in the boiler unit because most of the heat is produced in the boiler unit.

Figure 3.6: A Condenser at APSCL.

The first kind of cooling system is the regular cooling system. In this case, the water collected from the river is sent to the circulating water pump, then to the condenser. Inside the condenser each of the pipe lines consists of two hollow cores.

Figure 3.7: Circulating cooling water pump.

The inner hollow core passes live steam and the outer hollow core transports the river water to cool the live steam passing through the inner core. The temperature of river water is about 18^{o}C. Low pressure turbine exhales some exhaust steam, which also goes to the condenser and changes into water through this cooling process and gets out to the river through pipe lines or local draining system of the plant. Here Figure 3.6 shows a condenser which belongs to the water cooling system inside the boiler.

The other type of cooling system is the most important cooling system in the whole plant. Because, this cooling process protects the machineries against excessive heat. For example winding temperature of large pumps, valve temperature and other equipments which gets too much heated are being cooled by this process. For cooling these equipments, cooling water

must enter through these equipments. Therefore distilled or pure water is required here. We have discussed the purification of water in section 3.4 earlier. First, the distilled water is cooled using compressed air compressor and SF6 gas. Then the cooling water is sent to the circulating cooling water pump inside the boiler area. This pump then circulates the cooling water through the equipments for cooling. As seen from Figure 3.7, the circulating cooling water pump is at the back side of the blue colored pump.

Chapter 4: Boiler

Boiler is the part of a plant where water is heated to generate steam. It is a closed vessel in which water is heated. Thermal energy released by combustion of fuel is used to make steam at the desired temperature and pressure. At APSCL, Steam temperature is maintained at 523°C. The manufacturer of the boiler is Ishikawajima-Harima Heavy Industries Co. Ltd, Tokyo, Japan. At APSCL, water-tube boilers are used.

In water tube boilers, water passes through the tubes called water tubes. Fuel is burnt in the furnace to create hot flue gas. The water passing through the tubes, gets heated by the flue gas. This type of boiler generally has high steam production rate [7].

To produce steam some components are used inside the boiler. These components are discussed in the following sections.

4.1 Furnace

Furnace in the boiler is a chamber where combustion takes place. In the furnace natural gas is burnt for producing flue gas. Flue gas is the heated gas resulting from the burning of the natural gas. This burning is mostly controlled by the presence of air. A certain air to gas ratio should be maintained for burning. The air-gas ratio can be defined as 10:1.

Figure 4.1: Furnace chamber of a boiler.

We visited the furnace side of the boiler. We have observed that every turbine power plant consists of nine furnaces. The temperature inside the furnace was about 1200-1500°C. We have learnt that the temperature might slightly vary depending on the gas circulation. The water from the feed water tank which is filled up by the feed water pump, first goes to the economizer then to the furnace chamber through the water tube. The water passing through

the water tubes is heated by the produced heat inside the furnace chamber. After a certain period of time the water changes into steam. When the steam comes out from the furnace chamber its temperature stays at 523°C. Initially to start the burning process an ignition system is used which is placed outside of the furnace chamber. To produce spark inside the furnace or burner chamber a small amount of gas is needed. This small amount of gas is known as the ignition gas. When ignition is done the ignition line is turned off and the gas supply line to the furnace chamber is turned on for continuing the burning process. The produced live steam is then passed to the boiler drum [7].

4.2 Flue Gas Heat Exchanger

Flue gas heat exchanger plays a vital role for the boiler. It is used to increase or decrease the heat of the steam. It is placed inside the boiler. When steam is over heated it reduces heat and when the steam is not properly heated it increases the heat.

4.3 Economizer

Economizer is used to efficiently increase the production. It is a division of boiler where heat is reused.

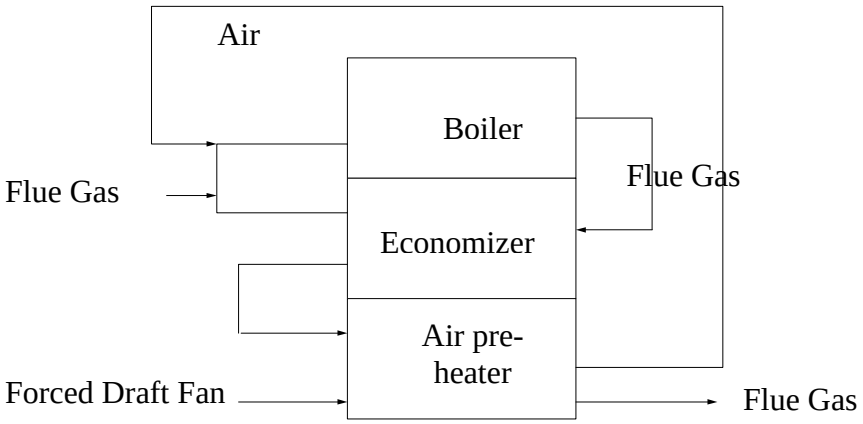

Figure 4.2: Economizer.

After the burning process is done the flue gas comes out through the chimney as hot exhaust gas. This heat of the exhaust gas is then reused to raise the temperature of the feed water within the economizer. As a result steam is produced more quickly, which consequently saves time and decreases the use of natural gases that are being used for burning. It has been estimated that for each 5.5 to 6°C rise in the temperature of feed water, there is a gain of about 10% in the plant efficiency [8]. Figure 4.2 shows the arrangement of the economizer.

4.4 Super Heater

While traveling through the pipes the temperature of the steam decreases considerably, but it is necessary to maintain constant steam temperature throughout. This job is done by the super heater. The super heater is placed at the bottom of the boiler plant, where the highest exhaust gas temperature can be obtained. The steam produced at the boiler is sent to super heater to be heated again and to become dry steam. At super heater extra heat is added to the live steam that traveled a distance up to the turbine and the moisture content from the steam is removed. Therefore the quality of the live steam improves. The quality of steam is measured by its dryness. This measurement is taken in percentage. If the percentage of dryness of the steam is higher than the live steam, the quality is referred as satisfying. For example, when there is no moisture in the steam, the steam quality is 100 percent. The measurement is taken from the control room by the operators. At APSCL the exhaust gas temperature through the pipes is 400°C. The steam temperature is increased, by the super heater and is sent to the high pressure (HP) turbine, at a temperature of 500°C and at high pressure of 40bar.

4.5 Fans

Combustion chamber is supplied with certain amount of air for maintaining and shaping of the flame. The boiler contains an induced draft fan and a forced draft fan.

Figure 4.3: Windbox.

In large boiler two induced draft fans and two forced draft fans are installed. The induced draft fan maintains air circulation in the whole boiler. The forced draft fan supplies air to the combustion chamber. The wind box distributes air to the combustion chamber and inside the whole boiler. The wind box also has damper adjustments to improve combustion. The ratio of damper (air to gas) is 10:1. The Figure 4.4 shows the windbox of a boiler.

4.6 Piping and Instrumentation Diagram

A piping and instrumentation diagram (P&ID) is a diagram in the process industry which shows the piping of the process flow together with the installed equipment and instrumentation. It provides an identification of measurement and functions that is needed to be controlled. The design contains check list which contains all the instruments and functions. The features of piping and instrumentation diagram are as follows

Figure 4.4: Pipe-lines of HP Bypass.

- Key piping and instrument details,
- Control and shutdown schemes,
- Safety and regulatory requirements and
- Basic start up and operational information.

Table 3: Indicators of Piping and Instrumentation Diagram.

Symbols	**Indicating parameter**	**Symbols**	**Indicating parameter**
TI	Temperature indicator	G	Position
Z	Protection	H	Hand operated control
S	Switching	X	Variable
R	Recorder	C	Analog control
A	Alarm	D	Differential
HH	High High	Q	Integration
LL	Low Low	RA11	HP By pass line 1
F	Flow	RA12	HP By pass line 2
P	Pressure	RA10	Turbine line

The control system may consist of panel mounted instruments, a distributive control system, logic system or a combination [9]. In piping system, numbers or alphabets are used to denote the various pipes and instruments so that it becomes easier for the engineers to find out the actual location of the pipes and instruments under a plant. There are tags in the P&ID, which usually have numerical values like 11, 12, 10 etc. Figure 4.3 shows the tags written on the pipe lines. For example, in Piping and Instrumentation diagram, when T tag is shown on the surface of RA11 pipe line, this indicates, there is a temperature sensing valve or meter on that position of the RA11 pipe line and similarly P indicates the position of pressure sensing valve or meter on the line. Here are some indicators listed in Table 3, which are frequently used on P&ID, which we have learned during our internship period.

4.7 Control Strategies of Boilers

As stated earlier, a boiler has to ensure necessary heat to produce steam from water. For this purpose there is a need to control the gas and air flow rate as well as their pressure to achieve desired heat from the hot gas. Not only that, the water level inside the boiler drum, furnace pressure, and valve operation should also be maintained properly. Moreover safety precautions are given the highest priority as a control parameter.

4.7.1 Control of Air and Gas Flow

The desired ratio of gas and air flow rate is 1:10. This ratio is perfect for the burner system of the boiler. To maintain the desired ratio the following elements are used.

4.7.1.1 Transmitter

Transmitters are used for measuring the air and gas pressure and transmit information to the control room. The gas flow transmitter measures the pressure of gas passing through the pipe.

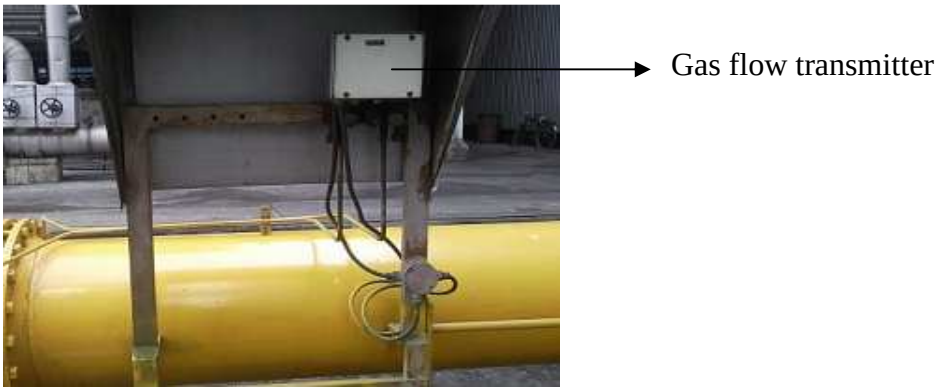

Figure 4.5: Gas flow transmitter of APSCL.

The transmitter measures the gas flow by using differential pressure of the pipeline at different points and transmits the information to the control room. In Figure 4.5 the gas flow transmitter is shown. Air flow transmitter is an electrical device which is used for the purpose of measuring the air flow rate through the inlet vent section of the force draft fan and for transmitting the information to the control room. Like a gas flow transmitter, an air flow transmitter measures the air flow rate by using differential pressure. Figure 4.6 shows the air flow transmitter, which is used at APSCL.

Figure 4.6: Air flow transmitter of APSCL.

4.7.1.2 Ratio Controller

Ratio controller is placed in the main gas and air pipelines of the boiler. It is used for maintaining the pressure ratio of gas and air as 1:10. One of the ratio controllers is in the gas pipelines and another is in the air pipelines. That ratio is continuously monitored by another master controller.

4.7.2 Interlock Circuitry

Interlock circuitry is a method of preventing undesired situation in a boiler. In most applications an interlock in a device is used to help prevent a boiler from harming its operator by stopping the machine when tripped. This is the conditioning limit, which is prerequisite to operate all kinds of instruments of boiler. For example, if the gas pressure in the combustion chamber is imperfect, then the ignitions in the furnace will not occur/start. At APSCL, the gas pressure in the gas pipelines is maintained at 6.6 bars and at 135 bars for the boiler combustion chamber.

To start the operation of the boiler feed pumps it must be ensured that water is available in the source pipelines and the delivery lines of the feed pump is open. Otherwise the boiler feed pump will not operate. The safety requirement of the boiler is ensured by the characteristic of interlock circuits. They ensure whether all the requirements for safe operation have been met or not.

4.7.3 Water Level inside the Boiler Drum

Boiler feed water is supplied to a boiler to generate steam. At thermal power station of APSCL the feed water is obtained from river.

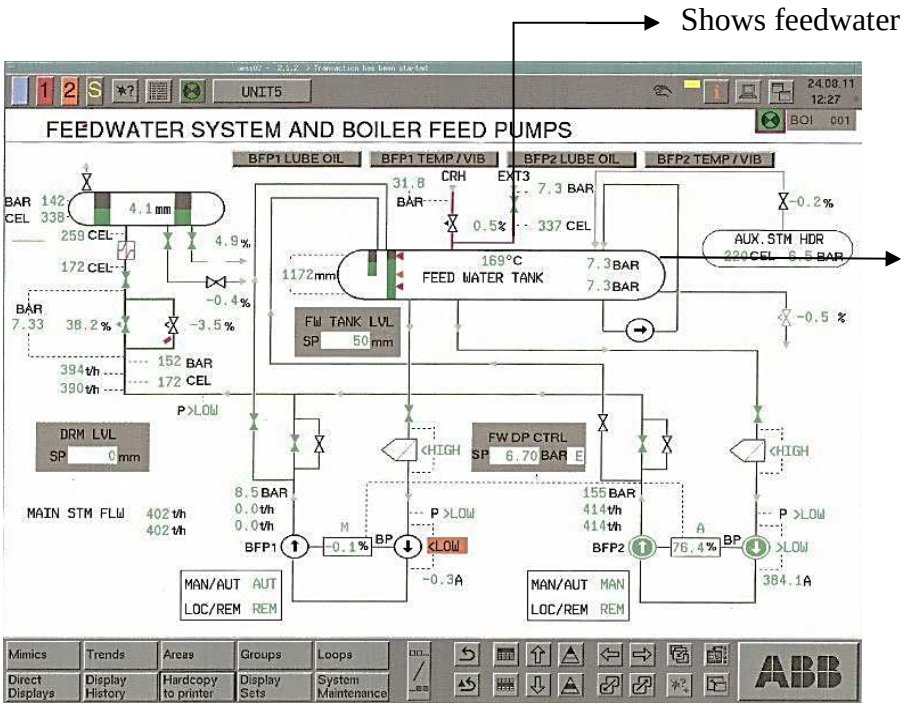

Figure 4.7: Feed water system and boiler feed pumps control system at Unit – 5.

After purification it is then stored, condensed, pre-heated and conditioned in a feed water drum and then passed to the feed water tank. From the feed water tank purified water (feed water) is forwarded to the boiler by a boiler feed water pump. The water level inside the feed water drum must be controlled to the relevant level otherwise if the water level does not stay within this limit, water over flow might occur. If the level exceeds the limits, boiler water might enter into the super heater or the turbine and might cause damage resulting in extensive maintenance cost. If the water level is too low, overheating of the water wall tubes may cause raptures and serious accident might occur resulting in system failure, expensive repair and unexpected injury. So for safety purpose when the water level is too low; the boiler will shut down to prevent damage. A variety of sensors such as differential pressure-based indicators and transmitters are usually applied to monitor the drum water level. The control system obtains input signals from the sensors in order to regulate feed water flow to maintain feed water level in the boiler drum. The normal temperature of the feed water inside the drum is 169°C with 7.3 bar pressure. Feed water level is controlled in two ways, one is single element level control and the other is double element level control. Figure 4.7 shows the feed water system in the unit-5 control room.

4.7.3.1 Single Element Level Control

A single-element level control system is the simplest drum level control system. In the boiler drum, there is both water and steam. The steam leaves the boiler drum and goes to the turbine. The water which did not turn to the steam is then circulated. The water level is controlled by adjusting the flow of feed water. There is a comparing function which compares the amount of steam and water by the level transmitter in boiler drum. Then control valve gets information from it and adjust the flow of water. A single element control system measures the actual level of water in the boiler drum. Then compares the measurement to the desired level set point and makes adjustment to feed water flow rates by controlling the valve.

Single element control system is not able to respond quickly enough in all situations to keep the level at the set point. In some situations, with a single element drum water level control system, changes in supply and demand of water can occur so rapidly that the water in the boiler drum water will either overflow into the super heater or the drum becomes dry.

4.7.3.2 Double Element Level Control

In order to protect the boiler from damage the double element level control plays important role. Single element control system only responds after changes in drum level have taken place but double element level control system can predict changes in demand and make adjustment before the change causes the level of water in the drum to change drastically. It is possible because in double element level control system the amount of water and steam is measured by feed water flow transmitter and steam flow transmitter. The flow of feedwater and steam is also compared by comparing function in the pipelines. Then the control valve will operate after getting the signal from transmitter. So the feedwater can flow in boiler drum more efficiently.

4.8 Burner Control System

Burner is also known as the furnace. It is in the combustion chamber where the fire is produced by the burning of gases and generates heat, which ultimately helps to transform water into steam. Natural gas or coal in the burner burns in the presence of air for producing heated gas or flue gas. APSCL uses natural gas as the fuel. At APSCL, each furnace has nine burners. The temperature inside the burner is 1200-1500°C. Flue gas releases heat to the water and the water becomes saturated steam whose temperature is 260°C. Figure 4.8 shows

the software of burner control system in unit 5. From the control room, the condition of gas pressure, forced draft fans, combustion air, cooling air, boiler load, air control, fuel control and overall burner control systems can be monitored.

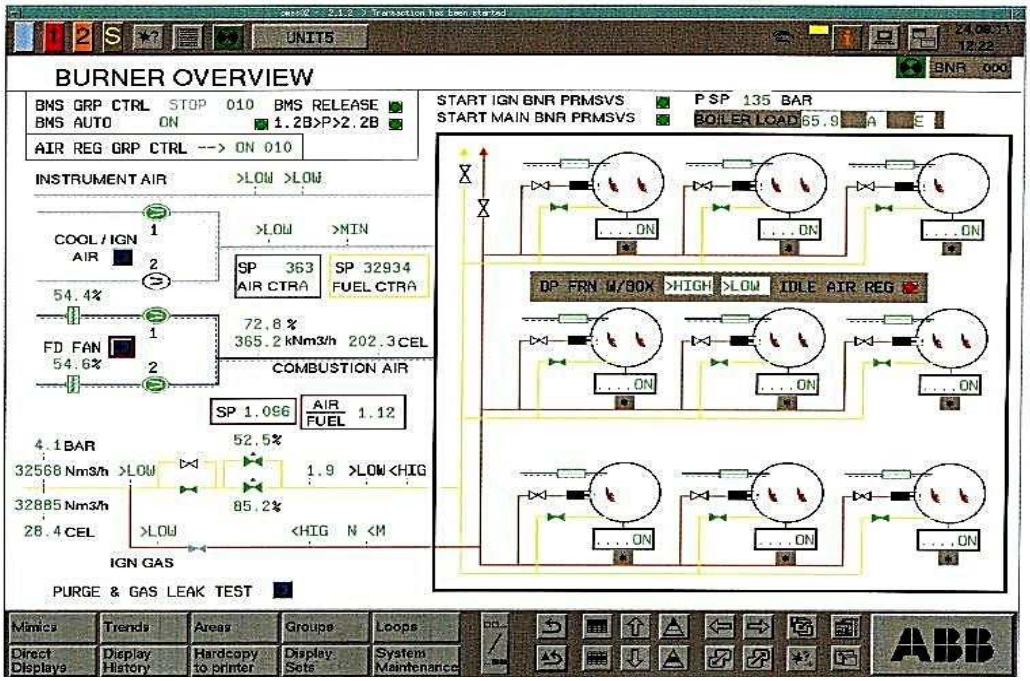

Figure 4.8: Burner arrangement at unit 5 in control room.

4.8.1 Furnace Pressure Controller

The purpose of the furnace pressure controller is to maintain a constant pressure in the boiler furnace. The boiler furnace pressure control is used to prevent flame excursion and to avoid excessive fire to prevent unexpected injury. For this purpose sometimes it is required to suck out excessive flue gas by using negative furnace pressure. The furnace pressure varies as the loads are changed and due to the changes of air flow rates of the forced draft fan to the furnace. As the firing rate increases, more air is supplied by the forced draft fan which in turn increases the pressure in the boiler furnace. The furnace must be airtight to avoid any leak to the atmosphere. A small leak under such circumstances will deteriorate the material around it, eventually destroying the furnace walls and creating an operational hazard. Boiler sides are made pressure tight by using welded inner casing, sealed between the furnace wall and the flow tubes. There are also sealed windows to observe the flame and condition of the furnace.

4.8.2 Purge Control

Purge control is required before ignition of the first burner to clear any combustible elements that may have accumulated in the furnace of combustion chamber components. Gas pressure

and flow rate are also controlled before purging. Purge control system gives the information on purge demand, furnace purging condition, and purge progress rates.

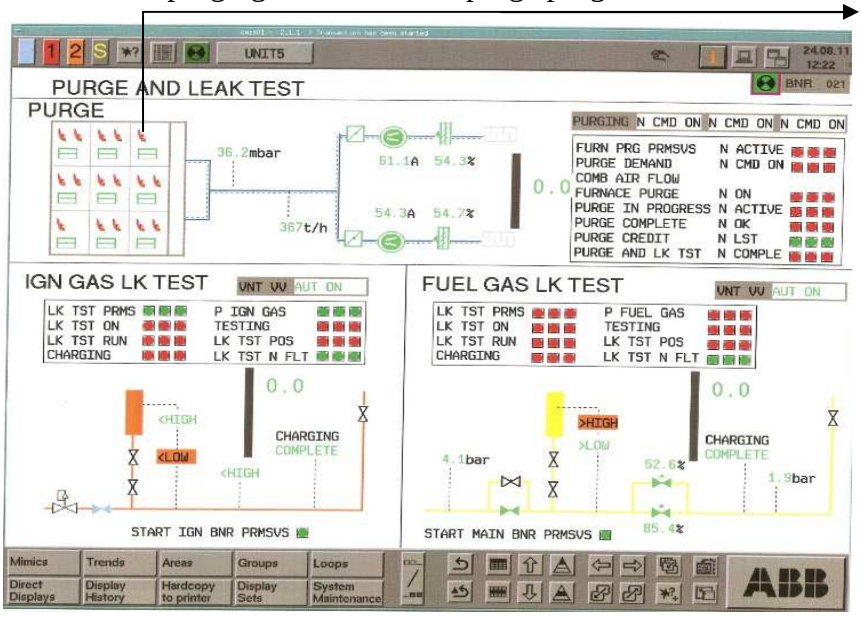

Figure 4.9: Software control operation of Purge and Leak test.

Before purging, leak test is also important in order to avoid unexpected accident and boiler trip. Leak test ensures that there is no existence of leakage gas. Figure 4.9 shows the purge and leak test condition observed from the control room of unit 5.

4.8.3 Ignition Transformer

The ignition transformer creates high voltage in the combustion chamber. This high voltage of ignition transformer helps the bulb to spark in the furnace of the burner. This bulb is called sparking bulb, which helps to start the fire. Ignition transformer may provide 1000V to 2000V to the sparking bulb. The ignition transformer basically keeps same output power as the input power and resistance is zero at the output side.

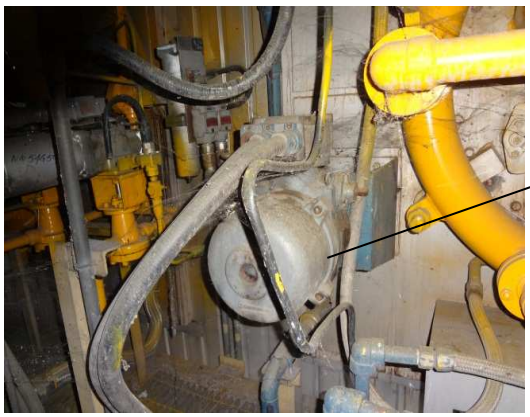

Figure 4.10: Ignition Transformer at APSCL at Unit 5.

4.8.4 Ignition Sparking Rod

Ignition sparking rod is to help the occurrence of spark to initiate the firing in the proper place in the combustion chamber.

Figure 4.11: Ignition sparking rod of APSCL at Unit 5.

After getting the voltage from the ignition transformer, the ignition rod pushes the electric sparking bulb inside the combustion chamber in the proper zone of the burner.

4.8.5 Flame Detector

The flame detection plays an important role for burner control system to ensure safety. The main purpose of the flame detector is to monitor the condition of flame in the burner. The primary responsibility of a flame detector is to identify where the flame is potentially in excessive condition to avoid any explosion. In unit 5 of APSCL the flame sensing detectors have self-checking intelligence. Boiler flame detection system is also called flame scanner. Flame detector or scanner consists of various types of optical devices.

4.8.6 Air Resistor

Air resistor is also an important safety part of the burner. Before firing the burner the air resistor removes unwanted air and regulates air flow.

Figure 4.12: Air Resistor of APSCL at unit 5.

These devices ensure perfect purging and boiler protection from unwanted situation.

4.9 Waste Water Drain Management

After collecting water by circulating water pumps, the water is circulated continuously in pipelines. A huge amount of water is supplied to the boiler. But all the water is not used for making steam and other purpose. Some water is wasted from the boiler and stored in the waste water basin. So it is essential for draining the waste water from waste water basin and sent it back to the river with the help of drainage pumps.

4.9.1 Waste Water Basin

Waste water basin is situated in front of the boiler. The waste water is stored in the basin and its temperature is generally higher than the ambient temperature like 70°C. This hot water cannot be directly discarded to river because it will have bad impact on the environment. Before draining from the basin to river the waste water temperature should be lowered to the natural temperature of about 30°C to 35°C. To maintain the desired temperature as well as for draining the waste water some instruments or equipments such as drainage water pump, water level sensor, heat sensor, temperature controlled actuator valves are used.

Figure 4.13: Drainage pumps of waste water basin at unit 3.

Here two drainage pumps are present, one is running and one is standby for emergency purpose. When waste water level exceeds a specific level of the waste water basin the drainage pump automatically turns on. Figure 4.13 shows the drainage pumps.

4.9.2 Water Level Sensor

Water level sensor senses the water level in the waste water basin. Here, two water level sensors are present. One sensor is place at the upper side of the basin, which senses whether

the water level exceeds a certain level and other sensor is at the lower side of the basin which senses whether the water level falls below a certain level. When the waste water reaches a maximum level, the upper limit sensor senses it and gives a signal to start the pump to the drainage of water.

Figure 4.14: Water level sensor of waste water basin at APSCL.

When water level goes below the minimum level then another sensor senses and the pump stop draining. Figure 4.14 shows the water level sensors.

4.9.3 Heat Sensor

Heat sensor senses the waste water heat in the waste water basin. When water is stored in the basin its general temperature is 50°C. Here, two heat sensors are used. One heat sensor senses the minimum set point temperature between 30°C - 35°C. When the sensor finds out that the waste water temperature is in the desired range it sends signal to the actuator valve for turning on the drainage pump. Another temperature sensor has a set point temperature below 45°C. When waste water temperature exceeds that limit sensor sends a signal again to the actuator valve for stopping the pump. Figure 4.15 shows the temperature sensors.

Figure 4.15: Temperature sensor of waste water basin at APSCL.

Chapter 5: Turbine Control and Protection

5.1 Introduction

Senior Engineer Shafiqual Islam gave us an elaborate description of the turbine protection and control system of APSCL on 25th, 27th, 30th August and 4th September 2012. APSCL produces electricity by converting chemical energy contained in fuel into heat energy which is used to produce steam and the steam is the source of mechanical energy in turbine. The mechanical energy is then converted to electrical energy by the generator. APSCL plant operators are responsible for maintaining proper turbine operation to ensure that the energy conversion process takes place safely and efficiently. To ensure the control and protection of turbine, APSCL uses different types of valves, vibration measurement equipments, temperature sensors etc.

5.2 Turbine Control System

Turbine control is one of the most important parts of control system and power generation. We visited this control system on 4th September 2012. Turbine control system is composed of a number of components that work together to regulate the flow of steam through the turbine. To understand the control operation of the turbine we must know about the major components of the control system. In this section we discuss about turbine control and protection system.

5.2.1 Turbine Control Valves

When we visited turbine sector, unit 1 was switched off and turbine of unit 1 was open. We observed different control valves there. During turbine operation, the speed of turbine must be controlled. The turbine speed is regulated by the amount of steam flowing through the turbine. The flow of steam is controlled by the opening and closing of the valves. This type of valve is mainly one way valve. This one way valve contains stem and disc. The position of the control valve disc determines the amount of steam admitted in the turbine. Depending on the disc opening and closing, steam flows through the turbine.

5.2.2 Hydraulic Actuator and Pilot Valve

Hydraulic actuator is one of the main and most commonly used controlling devices. Hydraulic actuator includes casing, piston, spring and control oil line. Spring produces

pressure in downward direction and oil creates pressure in the upward direction. The spring tries to close the valves and the oil pressure tries to open the valve. When the forces of the spring and the oil are balanced, the valve remains in a stationary position.

Figure 5.1: Hydraulic Actuator and Pilot valve.

Figure 5.1 shows a hydraulic actuator and a pilot valve. The function of the pilot valve is to regulate the flow of oil in or out of the actuator. Pilot valve consists of a cylinder, valve, disc, supply oil line and drain line, control oil line.

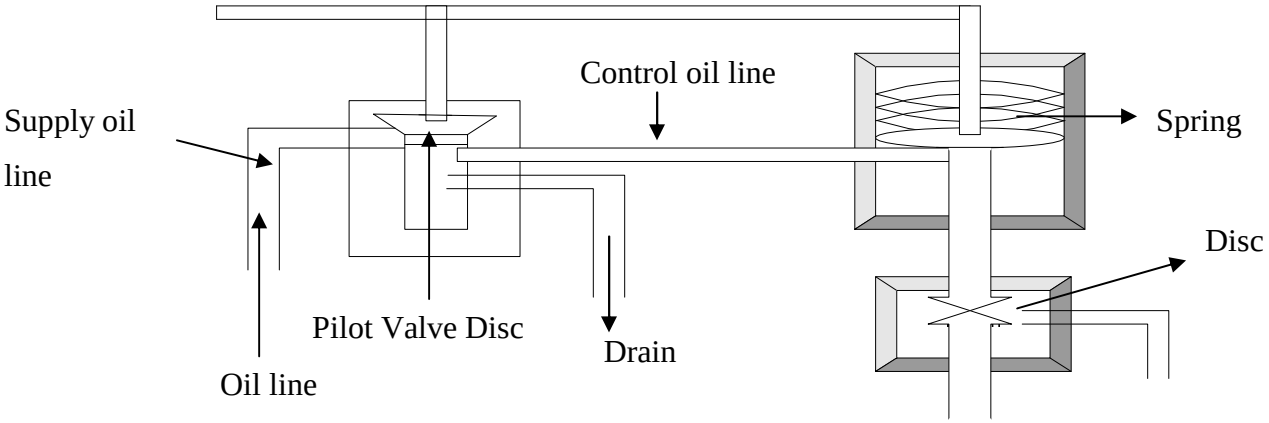

Figure 5.2: Schematic diagram of Pilot valve.

Figure 5.2 shows the schematic diagram of pilot valve. The loss of oil pressure below the hydraulic actuator piston allows the spring to expand, which pushes the piston downward. Lowering the hydraulic actuator piston decreases the opening of the control valve.

Two devices are typically used to operate the pilot valve on a turbine control system. These devices are governor and speed chargers. There are mainly three types of turbine governor. These are

- Mechanical Governor,
- Hydraulic Governor and
- Electric Governor.

At APSCL mechanical type governor is used.

5.2.2.1 Mechanical Governor

Eng. Shafiqual Islam discussed about the operation of mechanical governor. When the generator is disconnected from the power system, the mechanical governor responds (automatically operate) to decrease the flow of steam. This operation helps to decrease the speed of turbine. Mechanical governor consists of

- Flyweight
- Bracket and
- Spring

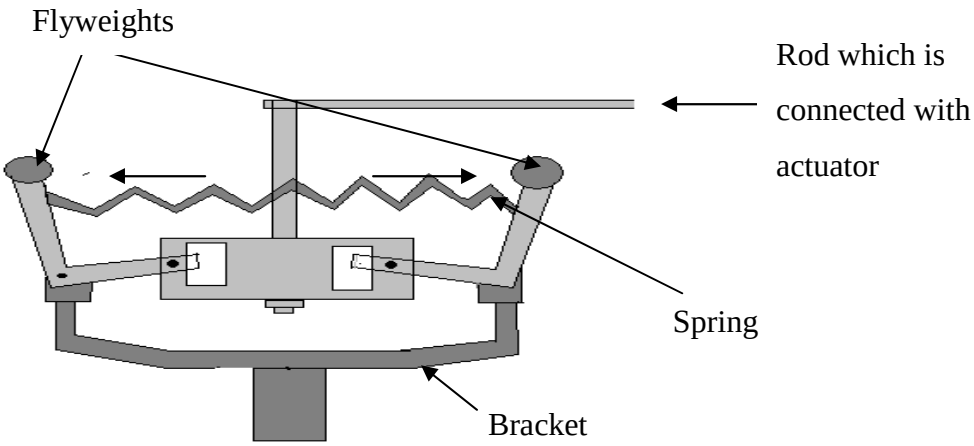

Figure 5.3: Schematic diagram of Mechanical Governor Flyweight.

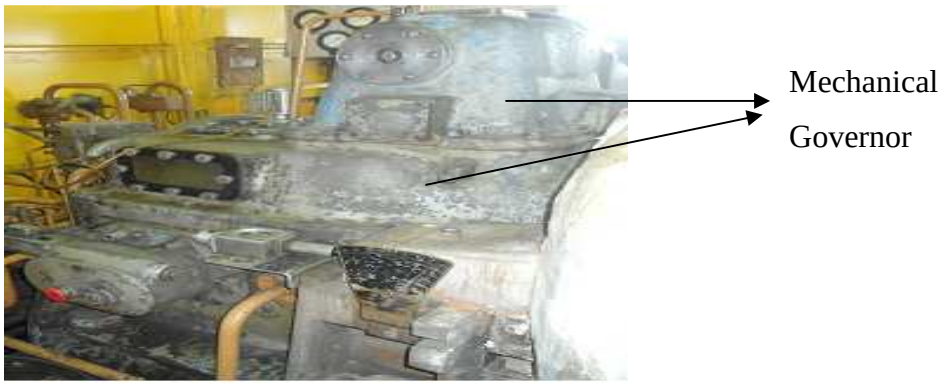

Figure 5.4: Mechanical Governor.

Figure 5.3 shows the mechanical governor flyweight. When turbine speed increases, the centrifugal force increases and the flyweights move outward. When turbine speed decreases, the centrifugal force also decreases and the flyweights remain fixed in position [10]. Figure 5.4 shows the mechanical governor of unit 1 of APSCL. The governor controls the speed of the turbine by operating the pilot valve. When the turbine is rotating at 3000 rpm, the centrifugal force acting on the flyweights is balanced against the tension of spring and the flyweights remain fixed in position.

5.2.3 Speed Charger

Speed chargers mainly create pressure to the rotational speed of the shaft of turbine. At APSCL, when the turbine is online, speed charger performs mainly two functions:

- They adjust turbine speed and
- They allow the generator to increase its load without changing the speed at which turbine rotates.

Speed charger is found in all turbine control system. Speed charger is assembled with mechanical governor. Speed charger consists of a motor, a gear arrangement and connecting rod that fit around pilot valve disc [11].

Figure 5.5: Speed Charger at unit 1.

Motor is used to move the sleeve up and down the pilot valve disc. Figure 5.5 shows the speed charger of the mechanical governor. When the speed charger is energized, its shaft rotates gear. The rotation of the gear moves the rod either up or down depending on the direction of motor rotation. Speed charger can be controlled both manually and automatically. At APSCL speed charger works automatically. In automatic control, a remote controlled device is connected. In manual operated charger, the control switch is moved left or to the right to open or close the valve.

5.3 Turbine Temperature and Pressure Control

We learnt about turbine temperature and pressure control on 30th August 2012. We also observed the sensing elements in turbine control system. The instruments commonly used to measure the process variable associated with turbine operations includes gauges, flow indicators and thermometer. The types of variables measured by temperature measuring instruments include turbine temperature, metal temperature, bearing temperature. Steam

pressure, vacuum pressure and oil pressure are measured by gauges and flow indicator indicates the flow rate of steam or oil or other liquids.

5.3.1 Turbine Temperature

At APSCL three types of turbines are used. They are High pressure (HP), Intermediate Pressure (IP) and Low Pressure (LP) turbine. Steam which comes out from boiler first enter into HP turbine. The exhaust steam from HP turbine then enters into IP turbine. Temperature of this steam is lower than HP steam temperature. Exhaust steam of IP turbine then enters into LP turbine. Temperature in HP turbine, IP turbine and LP turbine is respectively 526˚C, 520˚C and 515˚C.

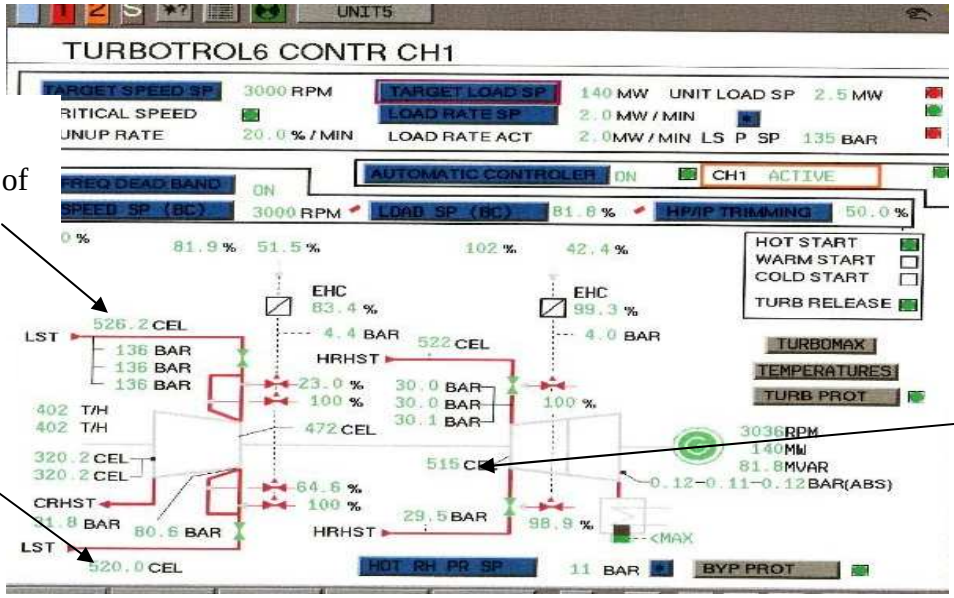

Figure 5.6: Software controlled turbine control system.

The change of temperature that occurs during turbine operation is generally within the limits set by the turbine manufacturer. Problems occur when the turbine metal expands due to excessive heat. That is why temperature is measured continuously and displayed in the control room where an operator can see them and can take steps to avoid any untoward situation. Figure 5.6 shows the software controlled turbine control system of unit 5 of APSCL. Using Asea Brown Boveri (ABB) software, temperature, pressure and the condition of automated valves can be monitored from the control room.

5.3.2 Steam Temperature

Steam temperature at APSCL is generally 515˚C before entering the turbine. But in live steam line temperature varies from 513˚-526˚C. Steams are spread into the turbine through

nozzle. In nozzle, steam temperature is typically taken by temperature sensors. Temperature sensors are also installed on the main steam supply line.

a) Top view. b) Front view.

Figure 5.7: Temperature sensor.

Figure 5.7 shows the temperature sensor, a) top view and b) the front view. These sensors are used to determine the steam temperature in a turbine.

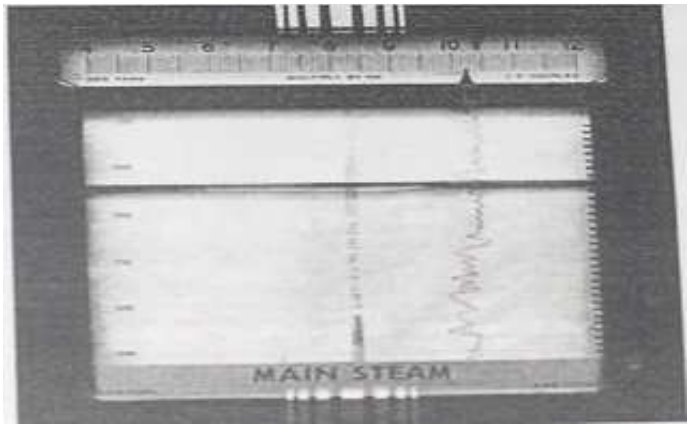

Figure 5. 8: Temperature recorder.

The thermocouples generate electrical signals proportional to the steam temperature. The electrical signals are transmitted to the meter which works as the temperature recorder. Temperature recorder is shown in Figure 5.8. In APSCL the scale on the recorder has a range of 4 to 12. The indications must be multiplied by a multiplier (here 100) to determine the actual temperature. The range of actual temperature is 400˚F – 1200˚F (204.44˚C-648.89˚C).

5.3.3 Metal Temperature

The allowable metal temperature of APSCL turbine is within 320˚C to 515˚C. If metal temperature is more than 630˚C then trip circuit will be active. Thermocouples are used in the turbine metal to measure turbine metal temperature. At APSCL, they use four sensors to measure metal temperature. One sensor is connected at the metal's inner wall, another one is at the outer wall and the other two sensors are in the middle of the metal. Difference between

the values of four sensors gives the temperature generation along the thickness of the metal wall.

5.3.4 Bearing Temperature

Bearings are made of metal which has low melting point. Bearing operated at excessively high temperature might fail. If bearing temperature is more than 450˚C then bearing trip circuit will be active at APSCL. Two types of temperature measurements are used to monitor turbine bearing temperature. These are

- Bearing oil temperature measurements and
- Bearing metal temperature measurements

Generally bearing oil temperature is 380˚C. Bearing gets heated up in normal operation. This heat is generally removed by the cooling lubricating oil. A thermometer is placed in the cooling oil leaving path. The thermocouple develops electrical signal correspond to the oil temperature which is transmitted to meter.

Bearing metal temperature is also monitored by thermocouple. Generally bearing metal temperature is 440˚C. Thermocouples transmit signal to the recorder. Increase in bearing oil temperature indicate problem with bearing. Bearing metal temperature goes higher with bearing oil temperature. Increase in metal temperature of bearing may fail the bearing.

5.3.5 Steam Pressure Control

At APSCL, the steam pressure is maintained at 135 bars in the HP turbine side. In the LP side the steam pressure is less and can rise up to 30 bars only. Pressure above this normal limit causes abnormal pressure drops across each stages of the turbine. These conditions can be avoided by monitoring the turbine pressure and making sure that they are maintained within normal limits. Figure 5.9 shows a pressure gauge. Pressure gauge is a kind of meter which measure pressure in unit bar. At APSCL the pressure in turbine is measured using pressure gauge.

Figure 5. 9: Pressure gauge at unit 1.

5.4 Turbine Protection

Turbine protection systems are designed to protect turbines automatically during emergency condition. An emergency condition is a condition at which action must be taken immediately in order to protect the turbine from damage. Operators also continuously monitor turbine operation and can manually trip the turbine if necessary.

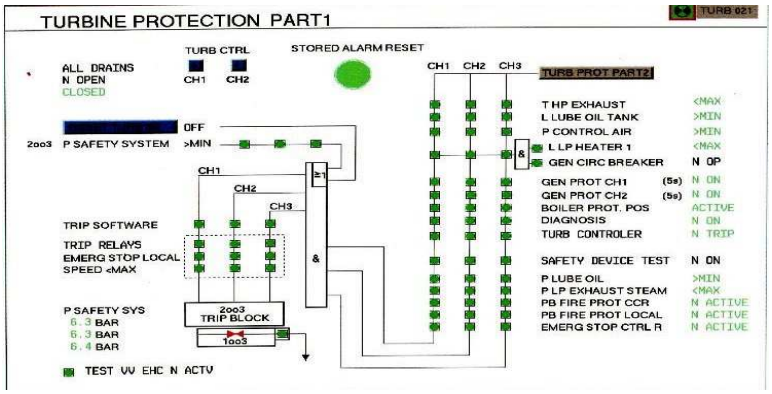

Figure 5. 10: Software controlled protection system.

Software controlled protection system is shown in Figure 5.10. Software shows the activations and deactivations of trip circuit in turbine control system. It also shows the activation of safety devices, lube oil protection, fire protection etc.

5.4.1 Turbine Trip

A turbine trip mechanism is the mechanism for immediate closing of the turbine's steam valves. Turbine trip mechanism shuts down the turbine by stopping the flow of steam. The main stop valves, the control valves, the reheat stop valves (which stop reheating of steam), and the live steam valve all close when the turbine trip occurs. Three types of turbine trip mechanisms are discussed in the following sections.

5.4.1.1 Over Speed Mechanism

Under normal operating conditions, rotation of turbine is 3000 rpm. Under some emergency conditions, such as the generator suddenly being disconnected from the power system, the turbine could gain over speed. The turbine governor senses the speed increase and immediately begins to close the main stop valve. Over speed trip usually occurs at 109-111% of rated speed. When the speed of the turbine exceeds the rated value, the centrifugal force overcomes the force which could close the main stop valve. Figure 5.11 shows the main stop valves (left and right). A trip circuit is connected with this main stop valve.

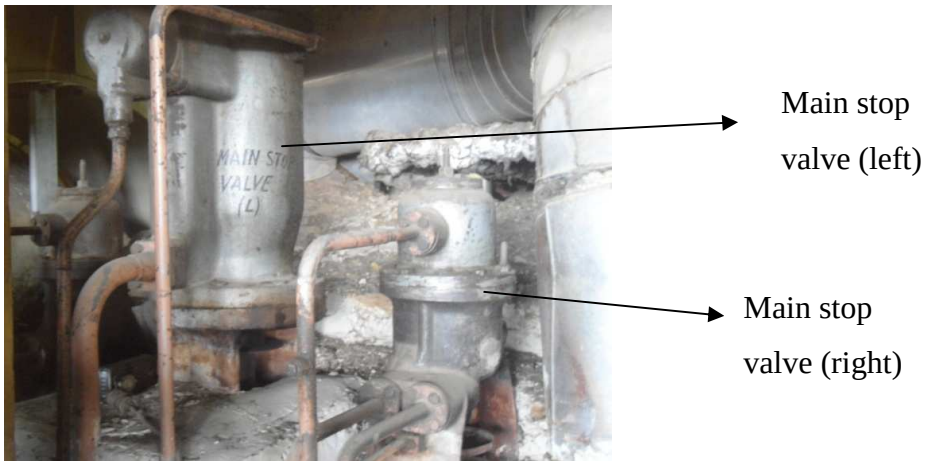

Figure 5. 11: Main stop valves.

5.4.1.2 Manual Trip

Manual trips are the trips that are activated by an operator. Manual trip can be used to trip a turbine at any time. After a manual turbine trip has occurred, the emergency condition that has actuated the trip system must be corrected before the turbine can be returned to service.

Figure 5. 12: Operator activating manual trip.

Figure 5.12 shows the activation of manual trip. First step is to correct the unexpected condition, second is returning the turbine to service and at last, reset the trip mechanism. This is typically done by pulling a reset handle.

5.4.1.3 Solenoid Trip Mechanism

A solenoid trip is operated by electrical input which occurs automatically when an emergency condition arises. A solenoid trip can also be initiated by an operator in the control room. Solenoid trip mechanism is used in lubricating oil protection system, low vacuum protection system and high vibration protection system. Solenoid trip mechanism consists of coil circuit and plunger. Solenoid trip mechanism is shown in Figure 5.13. Here the plunger cannot be seen. When the coil circuit is energized, the plunger moves. The movement of the plunger activates the solenoid trip mechanism.

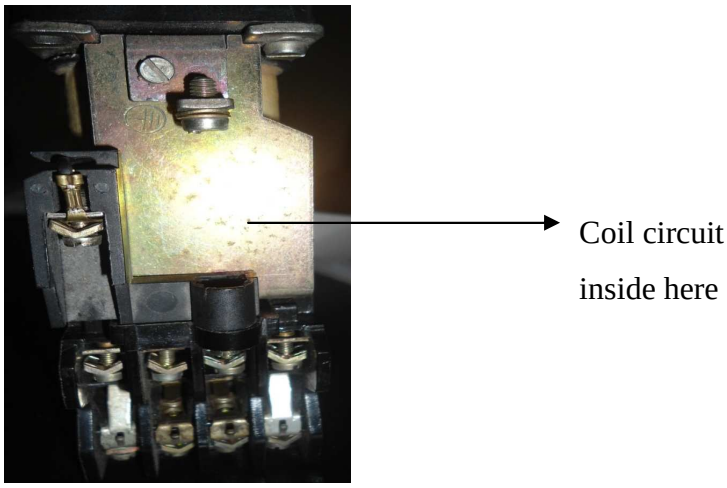

Figure 5. 13: Solenoid trip mechanism.

5.4.2 Protection against Low Pressure of Bearing Oil

Turbine bearings are designed to operate within an oil pressure supply range of 20 bars to 30 bars. If the oil pressure drops below this range, an insufficient quantity of oil is delivered to the bearings. If the lube oil pressure is not restored to normal the bearing could be seriously damaged.

When oil pressure drops, backup pumps start working to restore the pressure within the normal range and an alarm is energized to notify the operator of the low pressure condition.

The alarm alerts the operator about the situation and allows time to take corrective action. If the pressure continues to decrease despite the corrective action, contacts in a second pressure switch are closed and a solenoid trip is energized in order to remove the turbine from service.

5.4.3 Thrust Bearing Protection System

The thrust bearing protection system protects the turbine from excessive thrust. Excessive thrust could damage the thrust bearing and cause friction between the moving and the stationary parts of the turbine. If excessive thrust occurs, the solenoid trip circuit is energized and the turbine is tripped before contact occurs between the stationary parts and the moving parts.

5.4.4 High Vibration Protection System

Excessive vibration of the shaft is dangerous for turbine. Asea Brown Boveri (ABB), manufacturer of APSCL turbine, set the maximum allowable vibration in a range of 7 mils to 10 mils. A turbine should be removed from service immediately if vibration exceeds the specified limit. In most cases, vibration recorders are preset to actuate an alarm in the control room. The alarm provides an operator to adequate time to react a high vibration condition.

Chapter 6: Fault Experience during Internship

6.1 Introduction

Fault analysis and troubleshooting is a critical part of a power plant operation. There are several types of electrical problems that could cause an unscheduled interruption in plant operations. During our internship we observed the occurrence of three types of faults. These are circulating water (CW) pump trip, high pressure (HP) bypass fault and turbine shaft vibration fault. The reasons of the respective faults and their solutions taken by APSCL engineers are discussed in details in this chapter.

6.2 HP-Bypass Fault

Live steam comes out from the boiler and goes to the turbine. In normal condition 100% of the live steam goes through the HP bypass line to the turbine. During our internship, when we were in training, a fault occurred in a HP bypass line. As a result live steam from the boiler was not fully supplied to the turbine. 25% of the steam was going through the HP drain line resulting in the decrease of production in unit 5. That time was peak hour and the demand of electricity was very high. So it was necessary to increase the production quickly. It was not possible to handle the fault from the control room.

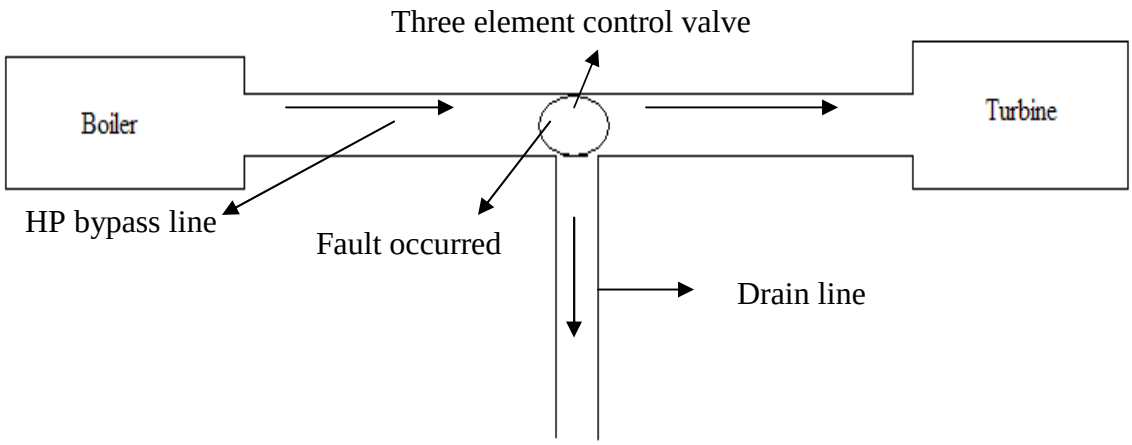

Figure 6.1: HP-bypass fault position.

6.2.1 Fault Position Identification

To identify the exact position of the fault, the engineers took the following steps:

- Checked the P&ID diagram of APSCL.
- Checked the reading of the valves between the boilers to the turbine.

- Finally they found it was the live steam line (RA10) valve which was showing the undesired reading.

6.2.2 Approach Taken by the Engineer

The opening or closing of the valve can be externally controlled by changing the resistivity of the potentiometer. At first the engineers manually varied that potentiometer of the valve so that steam could go through the HP bypass line. But they were unable to make the valve 100% open.

Then they studied the P&ID diagram of the HP Bypass line. This HP Bypass line contains three element controlled valve. These control elements are:

- One way control
- Two way control (Two line can be controlled) and
- Solenoid control (Use solenoid to control the opening or closing of valve).

When the valves were checked one by one, they found that solenoid control was not operating and it was damaged. But it was not possible to replace the solenoid valve at that peak hour. So as a temporary measure they fully closed the HP drain line to ensure 100% flow of steam to the turbine. Then they took further step to replace this solenoid valve.

6.3 Trip of Circulating Water Pump

During our internship another faulty situation occurred at CW pump. The operating temperature of circulating water pump is 50˚C -52˚C. To cool the bearing of CW pump lube water (cooling water) is used. So the CW pump must have some lube water inside, otherwise pump will have to be shut down.

6.3.1 Cause of Trip

The engineers found out that the faulty situation occurred due to insufficient circulation of lube water. That is why temperature of circulating water pump rose and reached to 85˚C. The engineers assumed the following causes that could lead to insufficient supply of lube water.

- Lube water circulation pipes might have had leakage and fittings might have jammed due to prolong usage.
- There might not have any lube water supply in the packing side of the bearing.

6.3.2 Trip Solution

When the engineers understood that this fault occurred due to passive causes, they took steps to change the narrow pipes and fittings to ensure the flow of lube water which controls the temperature of bearing of circulating water pump.

6.4 Faulty Signal due to Shaft Vibration

During our internship another faulty situation occurred at APSCL. Naturally if any of the process value exceeds set point a control signal is generated. One of the process values in the turbine section is shaft vibration. During our internship a control signal due to shaft vibration at unit 4 was found to be generated but was not continuously present. The signal was getting off automatically after a certain period of time. This situation continued for more than 4 hours. This fault occurred due to unbalanced weight of the shaft and fluctuation of rotation.

6.4.1 Measured Value

In unit 4, turbine shaft vibration was more than its tolerable limit. It was not possible to control shaft vibration from the control room. In the vibration measuring meter shaft vibration is shown in voltage (0.2V-1V). In the vibration measurement scale, the tolarabale limit of vibration is 7-10 mils. For 7-10 mils, the voltage they got was 0.344V which was within the limit. After calculation, engineers took the final decision that the signaling instrument or other sensing elements were working normally. The vibration of shaft was fluctuating.

6.4.2 Approach Taken by the Engineer

- Engineers measured the vibration at different times. They calculated the percentage of risk with respect to voltage and found that the percentage of risk was very low.
- They decreased some weight of shaft by removing some piece of metal from shaft.
- They increased the set point of vibration from 7 -10 mils to 12-15 mils in the measuring meter.

Chapter 7: Conclusion

This chapter is designed to give an overview about the problems and findings at APSCL during the internship period. These will be discussed briefly and then there are some recommendations which could be regarded as a suggestion from our point of view.

7.1 Problems

During our internship program we faced, practical participation of different works and overhauling of equipment would give us experience but APSCL does not provide this type of facility to their apprentice.

7.2 Recommendations

Some recommendations are given below for the students to do their internship program in a better way.

- Internship program should be scheduled in such a way so that it does not clash with the university regular classes.
- Student should complete the relevant courses to their internship program before doing internship.
- The tenure of our internship program with APSCL was only for 15 days. 15 days is not enough to be able to understand the functions of a power plant efficiently.
- Electrical and Electronic Engineering department of East West University should sign MoU (Memorandum of Understanding) with prospective companies like Energypac, Summit Power etc. for ensuring internship program for the students.

7.3 Conclusion

We passed some remarkable days at APSCL during our internship program. APSCL can be regarded as the practical ground of learning about a power station. The theories that we learned at the university were observed at APSCL. We consider ourselves very much lucky to have our internship program with a reputed power station company like APSCL. It gave us an opportunity to apply our theoretical knowledge in practice. In case of power generation,

APSCL is the combination of steam, gas and combined cycle plant. We visited steam power plant at the very first of our internship program. In steam power plant we observed how water is collected, purified and then boiled to produce steam. There are several switch gear rooms and control rooms to control the overall system and power generation. Various types of relays are used for protective purposes that are also controlled from the control room. Next we visited gas turbine of APSCL. There we have seen how fresh air and natural gas, supplied by Titas Gas transmission and distribution company limited (TGTDCL), is used as fuel to burn gas. After burning, the produced hot gas is used to rotate the turbine for power generation. For protective measures, relays are also used and controlled in switch gear room.

Our achievements from APSCL are:

- Industrial training provided by APSCL has enriched our practical knowledge.
- It has opened our eyes about practical operation of different equipment of a power station.
- APSCL gave us the unique experience of observing the equipment closely.

The authorities of APSCL were very concerned about all kinds of safety. The friendly environment at APSCL encouraged us to cooperate with each other. We learned a lot and obtained practical knowledge from our internship at APSCL, which will help us in our future career path.

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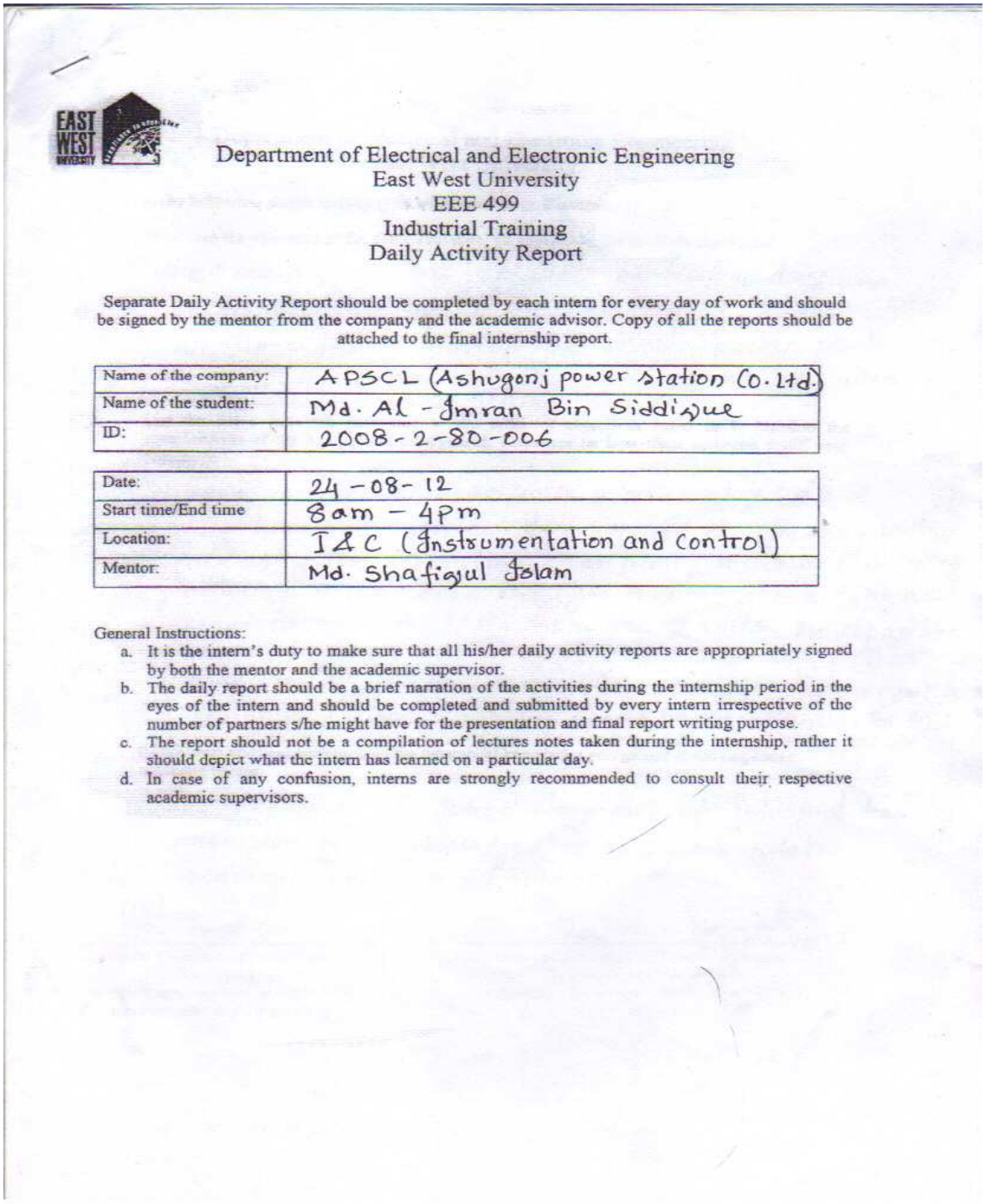
Appendix- I

- Scanned copy of daily activity reports:



Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL (Ashugonj power station Co. Ltd.)
Name of the student:	Md. Al - Imran Bin Siddique
ID:	2008-2-80-006

Date:	24-08-12
Start time/End time	8am - 4pm
Location:	I&C (Instrumentation and control)
Mentor:	Md. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The main objective of that particular day was to acKnowladge about the history of APSCL. We spacifically visited the whole power plant and Introduction with the officers. we have also acKnowladged the future plans.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

APSCL started on 1970 with a minimal of 64 MW generation and later on ~~it~~ continued its journey with increasing its generation. Specifically there are 3 types generating units. Those are gas turbin, steam turbine & combined cycle. All total there are 9 units. The capacities of those stations/units are : ① unit 1,2 -64 MW ② unit-3,4 -150 MW ③ unit 5 - 150 MW ④ Gas turbine - 56 MW (unit 1,2) ⑤ Gas ~~Engine~~ turbine 3 -34 MW ⑥ Gas Engine -50 MW. The in total generation is 774 MW. Avarage 620 MW is supplied.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The Knowladge of Introductory part of Industrial training previsiously acKnowladged to us by our related academic courses of power.

24-08-12
Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior engineer
Contact Phone #: 01711977093

Tahseen Kamal 2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Md. Al - Imran Bin Siddique
ID:	2008-2-80-006

Date:	25-08-12
Start time/End time	8am - 4pm
Location:	IAC Division
Mentor:	Md. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activity:

1. Know about I2C divison
2. Steam turbine visit.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of the days activity are following:

1. Discussion of water and steam cycle
2. Necessity of river water as cooling water.
3. Idea about how control system works.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The days activities was related with the power station (EEE-441) course.

25-08-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior engineer
Contact Phone #: 01711 977093

Talveen Kamal
25-09-2012

Signature of academic supervisor with date
Name: Talveen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Md. Al Imran Bin Siddique
ID:	2008-2-80-006

Date:	26-08-12
Start time/End time	8am - 4pm
Location:	IAC Division
Mentor:	Md. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objectives of ~~the~~ the day:

1. How to read the P&ID (pipe & Instumentation diagram).
2. Introduce to the symbols of P&ID.
3. condensate pump, boiler feed pump, cooling water pump visiting.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

The list of days activity: Abbreviation of P&ID words:

- # TI → Temparature Indicater
- # Z → Protection
- # S → Switchinch
- # R → Recorder
- # A → Alarm
- # H → high ; HH → high high
- # L → Low , LL → low low
- # F → Flow
- # P → Pressure
- # G → Position
- # H → Hand operated control
- # X → variable
- # C → Analogue control
- # D → Differential
- # Q → Integration

* Pipe lines:

- RA11 → HP bypass
- RA10 → turbine steam line.
- NA01 → Tank to drum pipe live.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

- The topic discussed is related with the power courses.

26-08-12
Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior engineer
Contact Phone #: 01711977073

Tahseen Kamal 25.09.2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Md. Al-Imran Bin Siddique
ID:	2008-2-80-006

Date:	27-08-12
Start time/End time	8am - 4pm
Location:	I4C Division
Mentor:	Md. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

- The objective of the day :
  1. Signal conditioning
     - Analogue signal
     - Binary signal.
  2. Visit to the Unit-4,5 boiler section.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of activities :-

1. Analog Signal
   (a) LVDT (Linear Variable differential transformer)
   (b) S/o control valve
   (c) Tecometer
2. Binary signal
   (a) Flip Flop(SR)
   (b) Turbine trip Logic Logic circuit using binary power station.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The topic was related to the course studied power station and digital Logic design.

17-08-12
Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior engineer
Contact Phone #: 01711 777093

Tahseen Kamal
25, 09, 2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Md. Al-Imran Bin Siddique
ID:	2008-2-80-006

Date:	28-08-12
Start time/End time	8am - 4pm
Location:	ILC Division
Mentor:	Md. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day was to know about burner and feed water pump.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

The day's activities were:

1. Burner: (a) Natural gas delivary and trans
   (b) Air resister
   (c) Spraking rod
   (d) Ignition tranformen
2. Hp ~~bybap~~ bypass hydrolic Unit
3. waste drain tank
4. Boiler feed pump → (a) Interlock → (i) source line, (ii) Delivery line

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The related topic was simillar to the theoritical courses of power station. 4

02-08-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior engineer
Contact Phone #: 01711977073

Tahseen Kamal 25.09.2012

Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Laturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

. Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Ashugonj Power Station Company Ltd.
Name of the student:	Sams Zubayer Mridha
ID:	2008 - 2-80 -059

Date:	29/ 08/12
Start time/End time	8am ~ 4pm
Location:	Instrument & control (IEC) Division
Mentor:	Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activites was the introdution of logic gates, symbols, flipflops used in common puspases and how to read logic diagram.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of the dayh activities:

① LP bypass function diagram:

→ Spray, → Flow nozzle

→ Solinoid operated valve

≥1 → OR gate

TO → off delay timer

& → AND gate

→ ORIFACE

① XU → Physical signal

② XB → O/P feed back

③ XG → Physical Contact

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

few parts are related with DLD coursen.

29-08-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior Engineer
Contact Phone #: 01711977093

Halima Begum 4/11/12

Signature of academic supervisor with date
Name: Dr.Halima Begum
Designation: Assistant Professor
Department of EEE
East West University

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

. Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Ashuganj Power Station ~~Ltd~~ Company Ltd.
Name of the student:	Sams Zubayer Mridha
ID:	2008-2-80-059

Date:	30/08/12
Start time/End time	8am ~ 4pm
Location:	Instrument & Control (I&C) division.
Mentor:	Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activities was the introduction to control system and the elements of control loop.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of the day's activity:

Control System :

(I) Controller
(II) Sensing element
(III) Hand operated valve
(IV) Automatic control valve
(V) Process
(VI) Final contact element

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

These practical activity is related with the academic Control system EEE-402 course.

30-08-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior Engineer
Contact Phone #: 01711977093

Halima Begum 4/11/12

Signature of academic supervisor with date
Name: Dr. Halima Begum
Designation: Assistant Professor, Department of EEE, East West University

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Ashuganj Power Station Company Ltd.
Name of the student:	Sams Zubayer Mridha
ID:	2008-2-80-059

Date:	31/08/12
Start time/End time	8am ~ 4pm
Location:	I&C Division
Mentor:	Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activity was the fault analysis of circulating Water (CW) Pump; trip and solution.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Cause of trip:

(i) Increase the temparature of the bearing of cw pump.
(ii) Circulation of Lub water was not sufficient in packing side.
(iii) Pipes of packing side was leaked and fitting was jamed.
(iv) Over vibrating of the shaft of the motor.

Trip Solutions:

changing narrow and old pipes of the packing side for better flow of Lub water, and temparture is undercontrolled in 50~58°C from 85°C. And vibration was checked by TICI.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

These practical activity is related with our EEE301 courses.

31-08-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior Engineer
Contact Phone #: 01711977093

Halima Begum 4/11/12

Signature of academic supervisor with date
Name:
Designation:

Dr.Halima Begum
Assistant Professor
Department of EEE
East West University

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Ashugonj Power Station Company Ltd.
Name of the student:	Sams Zubayer Mridha
ID:	2008-2-80-059

Date:	01/09/2012
Start time/End time	8am ~ 4pm
Location:	Instrument & Control (I&C) division
Mentor:	

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

The days activities was to know about the different Control parameters and introduction to logic drive cards.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of days activities :

(i) Thermocouple : which measure the voltagen.
(ii) RTD : (Resistance Temparature Detector)
(iii) PB (Proportional)
(iv) D (Differential)
(v) Integral : Reset port.
(vi) Actuator : (a) open limit switch (b) close limit switch (c) open troque switch (d) close torque switch (e) potentiometer (f) Thermostate.
(g) Pressure Release valve.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

These practical activity is related various academic courses.

01-09-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior Engineer
Contact Phone #: 01711977093

Halima Begum 4/11/12

Signature of academic supervisor with date
Name:
Designation:

Dr.Halima Begum
Assistant Professor
Department of EEE
East West University

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Ashuganj Power Station Company Ltd.
Name of the student:	Sams Zubayer Mridha
ID:	2008-2-80-059

Date:	02/09/12
Start time/End time	8am - 4pm
Location:	I&C Division
Mentor:	Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was Know about different protection, control and test.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

The List of the days activities :

1. Inter posing relay;
2. Steam circuit;
3. Motor starting circuit
4. Timer relay;
5. 3 level control;
   Set value for;
   - ① Feed water
   - ⑪ Steam Water
   - ⑪ Drum Water
6. Leak Test
   - ① Purge Test
7. Pressure release valve.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

That practical activity with the theoritical knowledge was related with power station course and other's logical courses.

02-09-12

Signature of the mentor with date
Name: Shafiqul Islam
Designation: Senior Engineer
Contact Phone #: 01711977093

Halima Begum 9/11/12

Signature of academic supervisor with date
Name: Dr.Halima Begum
Designation: Assistant Professor
Department of EEE
East West University

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Kishor Kumar Barai
ID:	2008-2-80-003

Date:	03-09-12
Start time/End time	8am-4PM
Location:	IRC division
Mentor:	Eng. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activities was the maintenance, components of boilers.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Inter Furnace Components:

i) Burning chamber, burner opening, inspection doors
ii) Bottom ash hopper
iii) Waterwall

Hot Gas Path Component:

i) Super heater
ii) Ash removal
iii) Baffles, Reheater
iv) Economizer

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The theoretical knowledge we gained is related with Power Station (EEE441) course.

03-09-12
Signature of the mentor with date
Name:
Designation: Senior Eng.
Contact Phone #: 01211972093

Tahseen Kamal 13.09.2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Kishor Kumar Barmi
ID:	2008-2-80-003

Date:	04-09-12
Start time/End time	8am - 4pm
Location:	I & C division
Mentor:	Eng. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the days activities was turbine control & protection.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Basic Turbine Components:
a) Stop valve b) Control valve
c) Journal bearing d) Stationary blading
e) Moving blading.

Turbine Control Valve:
a) Main stop valve b) Control valve
c) Steam lines to nozzle block. d) Reheat stop valve
e) Intercept Valve

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Turbine control & protection are related with power station (EEE 441) course.

04-09-12
Signature of the mentor with date
Name:
Designation: Senior Eng.
Contact Phone #: 01711777093

Tahseen Kamal
13.09.2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Kishor Kumar Barai
ID:	2008-2-80-003

Date:	05-09-12
Start time/End time	8am- 4pm
Location:	I&C division
Mentor:	Eng. Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

the objective of the day's activities was to know about unit-5 of APSEL.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of day's activities:

i) Bond scaning system
ii) Flue Gas analyzer
iii) Compresser
iv) Lube oil cooler
v) Storage tank
vi) Cooling water Expansion tank
vii) Induction fan
viii) Feed water tank
ix) Flash barrel
x) Combustion chamber
xi) condenser
xii) stack
xiii) Down comer reheater
xiv) Boiler drum.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course

These topic and components are related with our power related course.

05-09-12
Signature of the mentor with date
Name:
Designation: Senior eng.
Contact Phone #: 01711972093

Tahseen Kamal
12.09.2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Kishor Kumar Barai
ID:	2008-2-80-003

Date:	06-03-12
Start time/End time	8am-4pm
Location:	I & C
Mentor:	Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activities was to visit control room and analysis fault of unit 5.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of the day's activities:

i) Drive card
ii) 24V DC power supply panel for I&C control
iii) Cable junction & distribution panel (Marshalling Rack)
iv) Binary and analog signal cubical.

Fault analysis:

Due to valve open of HP bypass, oil flow throw the bypass line.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The theoretical knowledge we gained is related with academic power courses.

06-09-12
Signature of the mentor with date
Name:
Designation: Senior Eng.
Contact Phone #: 01711977093

Tahseen Kamal, 6.09.2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	APSCL
Name of the student:	Kishor Kumar Barai
ID:	2008-2-80-003

Date:	07-09-12
Start time/End time	8am - 4pm
Location:	I & C
Mentor:	Eng Shafiqul Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1. What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activities was to visit substation and familirize with different different components.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

List of the day's activities:

i) Auxiliary transformer
ii) Potential transformer
iii) Current transformer
iv) Sheay wire
v) Lighting arrester
vi) Bus bar
vii) Circuit breaker
viii) Single Phase transformer
ix) Earthing transformer
x) Wave trap

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

The knowledge we gained is similar to the theritical knowledge that we know in our power courses.

07-09-12
Signature of the mentor with date
Name:
Designation: Senior Engr.
Contact Phone #: 01711977093

Yahseen Kamal
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer