INTERNSHIP REPORT

ON

ASHUGANJ POWER STATION COMPANY LIMITED

By

Tasreef Bari 2007-3-80-009
Md. Rakibur Rahman 2008-1-80-012
Md. Mamunur Rashid Shanta 2009-1-80-006

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

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Approved By

_____	_____
Academic Advisor	Department Chairperson
Dr. Anisul Haque	Dr. Mohammad Mojammel Al Hakim

ASHUGANJ POWER STATION COMPANY LTD. (APSCL)

(An Enterprise of Bangladesh Power Development Board)

APSCL

Certificate

For

Industrial Attachment Program

This is to certify that Tqueef Bari, ID No. 2007-3-80-009 B.Sc in Electrical and Electronic Engineering from East-West University, Dhaka has successfully completed the Industrial Attachment Program held from 22-12-2012 to 08-01-2013. 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.

ASHUGANJ POWER STATION COMPANY LTD. (APSCL)

(An Enterprise of Bangladesh Power Development Board)

APSCL

Certificate

For

Industrial Attachment Program

This is to certify that Md. Rakibur Rahman, ID No. 2008-1-80-012 B.Sc in Electrical and Electronic Engineering from East-West University, Dhaka has successfully completed the Industrial Attachment Program held from 22-12-2012 to 08-01-2013. During the training period, he paid due attention to the practical work.

I wish him every success in life.

Manager (HRD)
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Certificate

For

Industrial Attachment Program

This is to certify that Md. Mamunur Rashid Shanta, ID No. 2009-1-80-006 B.Sc in Electrical and Electronic Engineering from East-West University, Dhaka has successfully completed the Industrial Attachment Program held from 22-12-2012 to 08-01-2013. 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.

Approval Letter

To whom it may concern

This is to certify that Tasreef Bari student ID 2007-3-80-009, Md. Rakibur Rahman student ID 2008-1-80-012, Md. Mamunur Rashid Shanta student ID 2009-1-80-006, are students of B.Sc in Electrical and Electronic Engineering from East West University, Dhaka have successfully completed the industrial training held from 22.12.2012 to 08.1.2013.

_____

Dr. Anisul Haque

Professor

Department of Electrical & Electronic Engineering

ACKNOWLEDGMENT

We would like to express our heartfelt thanks to Mr. Md. Nurul Alam, P.Engg., Managing Director of Ashuganj Power Station Company Limited (APSCL) for giving us the opportunity to attend our industrial training in their company. We very much appreciate the assistance given to us by all levels of people at APSCL, particularly Mr. Md. Kamruzzaman Bhuyan, Manager (E & IC) of Combined Cycle Power Plant (CCPP) and Mr. Saifur Rahman, Assistant Engineer of Instrumentation and Control (I & C). We are also grateful to the APSCL management for providing us accommodation in their training center dormitory.

I would like to thank our supervisor Dr. Anisul Haque, professor of the Department of Electrical & Electronic Engineering, East West University, for giving us the opportunity to do this internship report under his supervision and guiding us through his assistance. We are also very grateful toward him for being patient with us.

The preparation of this report would not have been possible without the valuable support of our friends and family, so we would also like to thank them.

EXECUTIVE SUMMARY

To obtain a B.Sc. in Electrical and Electronics Engineering from East West University we have to do thesis or industrial training. We chose industrial training and we chose to do it at Ashuganj Power Station Company Limited (APSCL). Our training duration was of about 15 days. We stayed at the dormitory of the training center of APSCL.

This report consists of a brief description of the works, visits of the different sites and of the knowledge that we acquired at APSCL. We came to know about the different power plants, its operation, its production and output capacity.

Our training was divided into three parts. In the first part we learned about how water from the Meghna River is treated and boiled by burning gas from Bakhrabad to produce steam, which is used to drive steam turbine to run the generator to produce electric power. In the second part we learned how gas is burned to be used at the gas turbine and the exhaust from it is used to fuel another steam turbine. Lastly in the third part we learned how gas and air is used in a gas engine to produce electric power. This internship gave us the opportunity to verify by theoretical and practical knowledge and experiences to enhance understanding of academic course.

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CHAPTER 1: INTRODUCTION

1.1 Objective of Internship

The main objective of this internship is to gain practical knowledge and experience to enhance understanding of academic topics related to power station and switchgear by application of the theoretical knowledge. This internship gave us the opportunity to familiarize with the working environment and will influence our interest to select career. In this internship report, we focused on the power generation system, protection and maintenance of the power plants of Ashuganj Power Station Company Ltd. (APSCL). The daily training schedule of our internship program is given in table 1.

Table 1: Daily schedule of the industrial training.

Date	Section	Time	Mentor
24-12-2012	Instrumentation and control/Auto Control	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
25-12-2012	Instrumentation and control/Auto Control	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
27-12-2012	Instrumentation and control/Auto Control	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
28-12-2012	Control Room (unit 3, 4 and 5)	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
29-12-2012	Instrumentation and control/Auto Control	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
30-12-2012	Instrumentation and control/Auto Control	8.00am- 4.00pm	Mr. Saifur Rahman Assistant Engineer (I & C)
31-12-2012	Generator Division	8.00am- 4.00pm	Mr. Kazi Abdul Kaium Assistant Engineer (Generator division)
01-01-2013	Generator Division	8.00am- 4.00pm	Mr. Kazi Abdul Kaium Assistant Engineer (Generator division)

Date	Section	Time	Mentor
02-01-2013	Generator Division	8.00am- 4.00pm	Mr. Kazi Abdul Kaium Assistant Engineer (Generator division)
03-01-2013	Generator Division	8.00am- 4.00pm	Mr. Kazi Abdul Kaium Assistant Engineer (Generator division)
04-01-2013	Control Room of combined cycle power plant/Gas engine plant	8.00am- 4.00pm	Mr. Md. Mizanur Rahman Shift Charge Engineer (CCPP)
05-01-2013	Combined cycle power plant/Gas engine plant	8.00am- 4.00pm	Mr. Md. Kamruzzaman Bhuyan Manager (E & IC)
06-01-2013	Combined cycle power plant/Gas engine plant	8.00am- 4.00pm	Mr. Md. Kamruzzaman Bhuyan Manager (E & IC)
07-01-2013	Combined cycle power plant/Gas engine plant	8.00am- 4.00pm	Mr. Md. Kamruzzaman Bhuyan Manager (E & IC)
08-01-2013	Combined cycle power plant/Gas engine plant	8.00am- 4.00pm	Mr. Md. Kamruzzaman Bhuyan Manager (E & IC)

1.2 Company Profile of APSCL

APSCL is the second largest power station in Bangladesh. It is situated in Ashuganj, Brahmanbaria right by the side of the Meghna River over an area of 263.55 acres. The present total power (electricity) generation capacity of its nine units is 778 MW. As a part of the Power Sector Development and Reform Program of the Government of Bangladesh, APSCL was incorporated under the Companies Act 1994 on 28th June 2000. Ashuganj Power Station (APS) Complex (with its Assets and Liabilities) had been transferred to APSCL through a Provisional Vender's Agreement signed between Bangladesh Power Development Board (BPDB) and APSCL on 22nd May 2003. All the activities of the company started formally on 1st June 2003. From that day the overall activities of the company along with operation, maintenance and development of the Power Station are vested upon a management team consisting of the Managing Director, the Director (technical) and the Director (finance) [1].

According to the Article of Association of the Company, 51% of the total shares are held by BPDB and the rest 49% is distributed among Ministry of Finance, Ministry of Planning, Power Division, MOPEMR (ministry of power, energy and mineral resources) and Energy Division, MOPEMR of Government of Bangladesh (GOB). The authorized capital of APSCL is Taka 15,000 millions and the paid up capital is Taka 1 million. The total Manpower of the company is 525 as on 30.06.2011 [1].

The electricity generated in this power station is supplied to the national greed and it is distributed to the consumers through the whole country through the national greed. This power station plays a significant role in the national economic development by generating more than 10% of the total demand for electricity in the country. In this power station, natural gas from Titas Gas Transmission & Distribution Company Ltd. is used as fuel. Water from the Meghna is used through intake channels for steam generation and cooling of generated steam and used water (used for cooling) is again thrown into the Meghna through discharge channels. Huge water from the discharge channels are used for irrigation in the dry season. It is known that about 36,000 acres of land of Ashuganj are irrigated by this water [1].

1.3 Future Plans of APSCL

APSCL is planning to increase its overall power generation capacity to 2102 MW by 2015. APSCL is going to construct one 225 MW combined cycle power plant with its own fund which is expected to be completed by April 2014. APSCL will establish two 450 MW combined cycle power plants known as 450 MW combined cycle power plant south project and 450 MW combined cycle power plant north project. The project will be completed by December 2014 and October 2015 respectively. Another 200±10% MW modular power plant will be established, which is expected to be completed by July 2013 [2].

CHAPTER 2: STEAM TURBINE POWER PLANT

2.1 Working Principle of Steam Turbine

In this chapter we will see how APSCL produces power from steam power plants. We will also see main equipments of steam power plant, their functions and how water is collected and purified and then boiled to produce steam. We will also see how turbine works in steam turbine plant in APSCL. Now we will discuss the overall function of steam power plant in APSCL in this chapter.

Ashuganj power station generates steam using water from the Meghna River. First of all water is collected and sent to the water treatment system.

At the water treatment system de-mineralized (demi) water is produced after the water goes through several processes. It is highly purified to be boiled and ideal for the generation of steam. Then this water is taken to the boiler using a pump. At APSCL water tube boiler is used. Air and fuel is needed to operate the burner and produce steam. Air through forced draft fan (FDF) and methane (CH_4) gas as fuel is used, which is supplied by Bakhrabad.

As a result steam is produced and its temperature is 170-175° C and pressure of the produced steam is almost 30 bars. The steam is then taken from the boiler and with the help of super heater (SH) its' temperature is increased to 521° C and pressure is increased to also 135 bars. Next it is sent to the high pressure turbine (HPT) and the exhaust steam is taken to re-heater (RH). Now its temperature decreases to 335° C and pressure decreases to 33 bars. Using RH the steams temperature becomes 521° C and pressure becomes 135 bars. After that the steam is sent to the intermediate pressure turbine (IPT) and then to the low pressure turbine (LPT). At this time the turbine starts to rotate the generator shaft and a speed of 3000 rpm is maintained. Then electricity is produced. The exhaust of LPT enters intothe condenser. Now temperature and pressure becomeequal to 46° C and 0.1 bars respectively. Next it is taken to low pressure heater one (LPH1) and low pressure heater two (LPH2) at temperature 126° C and pressure is very low. This steam is taken from boiler feed pump (BFP) to boiler drum through high pressure heater one (HPH1) andhigh pressure heater two (HPH2) and again in turbine. Figure 2.1 shows a schemetic diagram of the arrangement of the different equipments of the water and steam cycle.

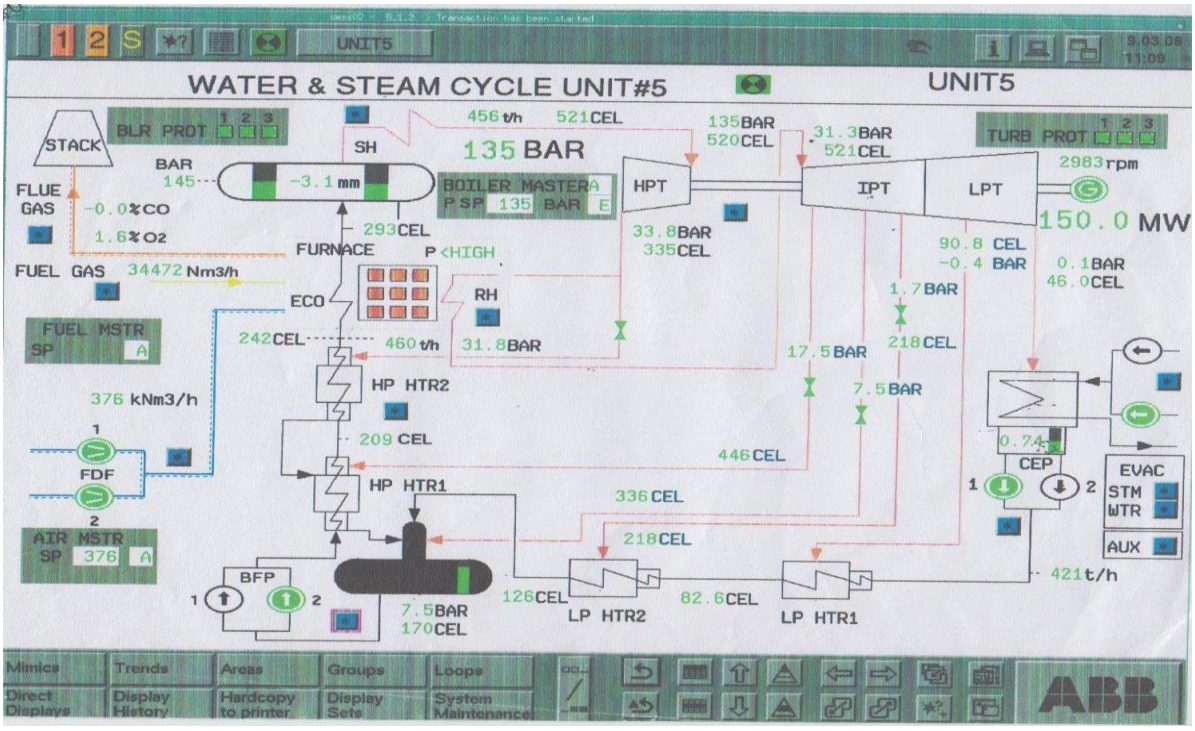

Figure 2.1: Schematic diagram showing water and steam cycle of unit 5.

2.2 Water Treatment System

We observed the water treatment plant in APSCL, which is shown in figure 2.2. The water treatment plant is used to produce clean water, which is used for cooling purposes, and demi-water, which is used for steam production. The main source of water is the Meghna River, which provides the required 421 ton/hour water. The river water contains many suspended particles and dissolved gases. Therefore, it is very important to filter the water and purify the water.

Figure 2.2: Water treatment plant.

In this section we discuss about the three parts of the water treatment plant. These are as follows.

1. Primary filter,
2. Pump,
3. Final filter.

2.2.1 Primary Filter

Water is the most important element in a steam power plant at APSCL. Water is first collected from the Meghna River through primary filter. This water is used mainly for generation of steam, for condenser, cooling of overall system, cooling of lubricating oil etc.

There are three stages in the primary filter system.

a. Heavy duty bar screen,

b. Rotating bar screen,

c. Travelling bar screen.

a. Heavy duty bar screen: The first stage of the screening system is heavy duty bar screen. In this stage water is screened by trust rack. Heavy wastes like wooden pieces, dead animals, water hyacinth are removed from the water in this stage.

b. Rotating bar screen: In this stage scrapers are used to screen the water. Smaller wastes, which the heavy-duty bar was not able to remove, are removed from the water in this stage.

c. Travelling bar screen: Small wastes like small pieces of stone, sand are removed from water in this stage. Here 57 baskets are arranged in such a way that screens the water by passing water through net. It is the most effective and modern screening process. The wastes are separated from nets by spraying water. A tray is placed below the baskets to collect separated wastes.

2.2.2 Pump

There are two raw water pumps, circulating cooling water pumps and clean water pumps in the water treatment plant. With the help of the two raw water pumps, water is first collected from the Meghna River, and then water is sent to the intermediate basin with the raw water pump. The circulating cooling water pumps are used to send water to the condenser, lube oil system and jacking oil system for cooling purpose. Clean water pumps are used to send water to the intermediate basin for the final filtering.

2.2.3 Final Filter

From the intermediate basin, we use some chemical dosing to get demi-water. In this process we have to follow some steps to get demineralization. These are given below.

a. Gravel filter: In the gravel filter, un-dissolved substance from the clean water is removed.
b. Scavenger filter: In the scavenger filter, organic substance such as bacteria, oil etc. is removed.
c. Cation filter: The cation filter removes dissolved slot of cation part such as Ca^{2+} from $CaSO_4$.
d. Anion filter: In the anion filter, SO_4^{2-} ions from the $CaSO_4$ is removed.
e. Mixed Bed filter: Both anion and cation ions are removed in this stage.

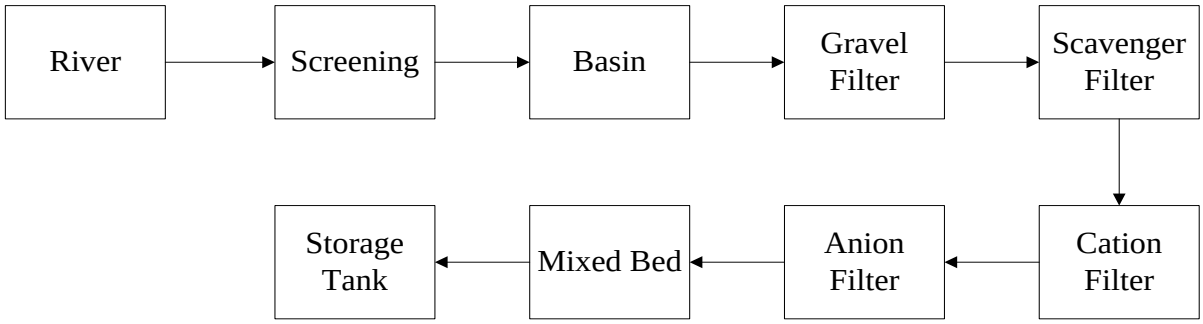

Figure 2.3: Flowchart showing the whole filtering processes of water.

Once the water is taken from the river, it is screened and then sent to the basin. From there the water is sent to cation and anion filters through the gravel and scavenger filters. Finally the water is stored in the storage tank through mixed bed. Figure 2.3 shows a flow chart of the processes and filter the water goes through before it is suitable for used in the power station.

2.3 Boiler

There are two types of boilers, one is fire tube and other is water tube. In APSCL water tube boiler is used. In every steam power plant there are three stages of water tube boilers. At APSCL, the boilers we saw are manufactured by the Babcock & Wilcox Company. After the water is treated at the water treatment plant, the treated water is introduced to the boiler. The basic purpose of a boiler is to turn water into super-heated steam. The steam gets collected into the steam drum, which is a part of the boiler. The steam enters through the primary pipe and flows in the superheated tubes. It is further heated and is finally taken out through the

main stop valve. This steam is then used to drive the steam turbine. The steam temperature at the inlet is about 521^{o} C. Figure 2.4 shows a diagram of a boiler of unit 4 that we saw at APSCL. The boiler is controlled by two different ways, one is manually and other is digitally. Most of the equipments are controlled both manually and digitally.

Manual and digital operational equipments are given below.

1. Boiler drum,
2. Super heater 1, 2 and 3,
3. Burner,
4. Spark rod,
5. Boiler master,
6. Air,
7. Gas,
8. Economiser,
9. Re-heater,
10. Measuring Equipment,
11. Controlling Equipment.

Figure 2.4: Boiler section of steam turbine unit 4.

2.4 Boiler Equipments

2.4.1 Boiler Drum

Boiler drum is used to reserve water which comes from the economiser. The level of water in the drum is measured with the help of the level transmitters. If the level crosses the upper limit or goes below the lower limit then the plant will trip. Boiler drum is a steam separator, so it is very important to control the level of the saturated steam. This is done by an automatic system.

2.4.2 Super Heater 1, 2 and 3

In APSCL for steam generation purpose, three super heaters are used. A super heater is a device used to convert wet steam into dry steam. Therefore super heater provides super-heated steam. This super-heated steam is used for rotating the turbine. If wet steam goes to the turbine then this steam can damage the turbine blade. The temperature of the super-heated steam inside the super heater is about 521° C and pressure is 135 bars.

2.4.3 Economiser

The economiser is a device which serves to recover some of the heat being carrying by exhaust flue gases. The recovered heat is utilized to raise the temperature of feed water that is being supplied to the boiler. It needs less heat to convert the water into steam. As a result consumption of fuel decreases and it increases the steaming capacity of the boiler. The economiser used in APSCL is used for the same reason.

2.4.4 Re-heater

Re-heater is a part of the boiler similar to economiser. Re-heater heats the steam that comes from the high pressure turbine. The steam coming from the high pressure turbine has temperature of 335° C and pressure of 33.8 bars respectively. The re-heater heats the steam and sends to the intermediate pressure turbine which has temperature of 521° C and pressure of 31.3 bars respectively.

2.4.5 Burner

Burner is known as a furnace. Burner is the chamber in the boiler where natural gas is burned with the presence of air for producing heated gas or flue gas. In APSCL water tube burner is used to generate heat for making steam. The temperature inside the furnace chamber is about 1200°-1500°C. The treated water from the feed water tank through economiser enters the boiler.

2.4.6 Spark Rod

A spark is needed in the burner to start the fire. This is done with the help of spark rod. A high voltage is produced between two points which creates an arc or spark. This arc is good enough to ignite the burner. During the ignition process, the spark rod goes into the burner and ignites. Then the rod is pulled back. For this process it uses small amount of air and gas, which is provided by a separate pipe line. A labeled diagram of the spark rod is shown in figure 2.5.

Figure 2.5: Spark rod.

2.4.7 Boiler Master

The steam pressure system is sometimes called the boiler master. The boiler master maintains the steam pressure by adjusting the amount of gas and air flow to meet the desired pressure.

2.5 Boiler Control System

2.5.1 Air Control System

To burn gas in the boiler, we need oxygen which is collected from air. The equipments that are used in air control system are listed below.

a. Forced draft fan,

b. Air pre-heater.

a. Forced draft fan: Forced draft fan (FDF) is used to collect air from nature. In the steam power plant there are two forced draft fans that are used to collect air. In the forced draft fan, there are inlet vane actuators which control air collection. Forced draft fan is used for feeding air from the nature into the furnace for the burning of natural gas. When generator load increases, then it increases air collection from nature. A typical forced draft fan of unit 4 is shown in figure 2.6.

b. Air pre-heater: In the air pre-heater chamber, air is heated to remove moisture from air. There is a drive in the chamber which uniformly distributes heat all over the chamber. The collected air is pre-heated before it is sent to the furnace for combustion. If the motor's speed is less than a preset value it gives a signal to the control room. If the speed falls and continues, after 3 minutes it will trip the boiler. A tachometer is connected with the driver to measure the speed.

Purging: When the burner is fired for the first time or when it is fired after it was kept closed for a long time, it is necessary to clear the burner of any unwanted gas which may have been accumulated. If this unwanted gas is not removed then there might be an explosion when the burner is fired. This will damage the burner. The process that is used to remove the unwanted gas is called purging. With the help of forced draft fan air is blown in the burner which forces the unwanted gas out.

Figure 2.6: Forced draft fan.

2.5.2 Gas Control System

In APSCL natural gas is used as a fuel for ignition and combustion in the boiler to produce heat. The natural gas is supplied by Bhakrabad gas transmission of Bangladesh. The mixture of gas and air are burned in the boiler to produce heat. There are many types of equipments that are used in gas control system. Three are given below.

Control gas line valves: Control gas line valves control the gas flow into the boiler by changing position of valve in the pipe. It can be controlled manually or automatically.

Gas flow meter: Gas flow meter measures the amount of gas flowing into the pipe per hour.

Gas heater: Gas heater is used to dry the natural gas. Gas pipe is passed through the boiler so that the gas is heated by hot steam. This heat also removes moisture and different particles from gas.

2.5.3 Temperature

Resistance temperature detector: At APSCL, resistance temperature detector is used for accuracy and long-term stability. The resistance temperature detector is called resistance thermometer. It is a temperature sensor that detects any change in electrical resistance of some materials with changing temperature. Resistance is measured by applying a constant current and measuring the voltage drop across the resistor [3].

2.5.4 Controlling Equipments

Safety valve: If there is excess pressure more than a specified limit in the boiler, then the safety valve will open up and release some of the steam into the atmosphere. This prevents building up of excessive pressure in the boiler. The safety valve is located above the steam space in the boiler. The safety valves operate on the principle that a valve is pressed against its seat through some agent such as screw or spring by external weights or force. When the steam force due to boiler pressure acting under the valve exceeds the external force, the valve gets lifted off its seat and some of the steam rushes out until normal pressure is restored again. Figure 2.7 shows a safety valve that we saw at APSCL.

Figure 2.7: Safety valve.

There are two pumps for controlling oil.

1. Lube oil pump: It is mainly used for pumping lube oil. It pumps more lube oil into the system if the pressure of the lube oil falls. The lube oil pump needs to be able to operate over a wide range of temperature and liquid viscose conditions.

2. Jacking oil pump: A jacking oil pump is commonly used for pumping of jacking oil to the shafts of steam driven turbine and generators, prior to start up or after shutdown of the power plant. It also helps to maintain the oil film between shaft and the bearing for cooling.

2.5.5 Measuring Equipments

Pressure gauge: Each boiler has a pressure gauge, as shown in figure 2.8, which measures the pressure of the steam that is being generated in the boiler. The transmitter is usually mounted at the front top of the boiler drum. The gauge has to be clearly visible to the attendant so that he can easily record the pressure reading. These gauges are used to measure gas and air pressures.

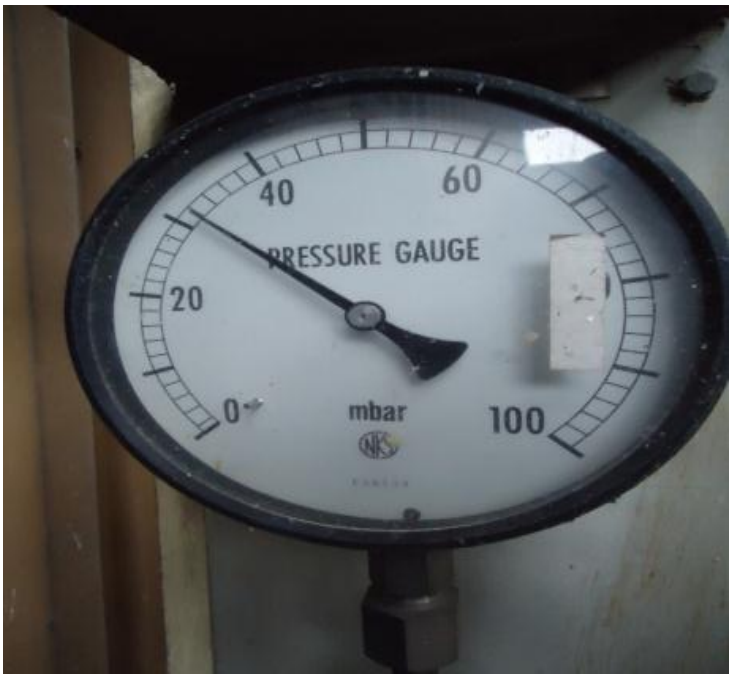

Figure 2.8: Pressure gauge.

Limit switch: Certain switches are needed to be operated when a particular amount of object passes through it. This is done by the limit switch with a preset value. This controls switching of machine and to count objects passing through a particular point. At APSCL these types of switches are used to operate steam and gas valves [4]. An example of limit switch that we saw at APSCL is shown in figure 2.9.

Figure 2.9: Limit switch.

2.6 Steam Turbine

A steam turbine is a mechanical device that extracts thermal energy from pressurized steam and converts it into rotary motion. The turbine mainly consists of rotary and stator blades wheels. The steam is expanded from a high pressure to a low pressure either in nozzles or in the blades where it is transformed into the mechanical work. The steam power plant of APSCL has a casing cover around the blades that contains and controls the working steam.

Figure 2.10: Steam turbine.

The steam turbines at APSCL have two types of blades, which are stator blades and rotor blades.

Stator blades: The fixed or variable incidence blades attached to the axial-flow compressor stator casing.

Rotor blades: The blades which are attached to the rotor of the steam turbine are called rotor blades. By exerting a force on the blades with the steam causes the rotor to rotate. Figure 2.10 shows the rotor blades and we can also see that the blade sizes are decreasing step by step.

Sections of steam turbine: The steam turbines used in APSCL are kept in three different sections or chambers. The size and characteristics of the blades of the turbines in these sections are different from each other.

2.6.1 High Pressure Turbine

From the super heater the high pressure steam first enters to the high pressure turbine. The blades in the high pressure turbine are the smallest of all turbine blades, this is because the incoming steam has very high energy and occupies a low volume. The blades are fixed to a shaft and as the steam hits the blades it causes the shaft to rotate.

2.6.2 Intermediate Pressure Turbine

From the re-heater the steam goes to the intermediate pressure turbine. The steam has expanded and has less energy when it enters this section, so here the turbine blades are bigger than those in the high pressure turbine. The blades are fixed to a shaft and as the steam hits the blades it causes the shaft to rotate. From here the steam goes straight to the next section of turbine set.

2.6.3 Low Pressure Turbine

From the intermediate pressure turbine steam enters into the low pressure turbine and continues its expansion. The blades of the turbine of this section are larger than the previous two sections but the energy of steam is less than the previous two sections.

2.6.4 Steam Control Valves

Control valve controls the flow of steam. Three types of valves are described below.

Live steam valve: Live steam valve controls the initial flow of steam and then it is transferred to the main stop valve.

Main stop valve: Main stop valve controls the flow of steam then it is transferred to two different regulating valves. This main stop valve can also control the trip block, if the steam generation and flow increases or decreases about a pre-set value. Figure 2.11 shows a main stop valve in the middle of the figure.

Regulating valve: Regulating valve controls the flow of steam. The two regulating valves are situated on both sides of the main stop valve. It controls how much steam enters the turbine. Figure 2.11 shows the two regulating valves.

Figure 2.11: Main stop valve (middle) and regulating valves (left and right).

2.6.5 Governor

Governor is a device that regulates and controls the speed of the steam turbine by controlling the flow of the steam into the turbine. Depending on the speed requirement governor sends signal to the steam control valves to open or close so that the required amount of steam is supplied to the turbine.

2.7 Turbine Equipments

2.7.1 Condenser

There are two condensers used in APSCL where one is left condenser and the other is right condenser. Both work in the same way. If one is damaged then the other does the work. A condenser is a device which condenses the steam at the exhaust of the turbine. The steam is converted to water by the condenser. Very low pressure at the exhaust of the turbine with the help of vacuum is created, which pulls the steam towards the condenser. Circulating water flows through the condenser tubes to remove heat from the condenser, which causes the exhaust steam to condense. The condensed water is supplied to the feed water tank, which can be used as feed water to the boiler. Left condenser and right condenser are shown in figure 2.12.

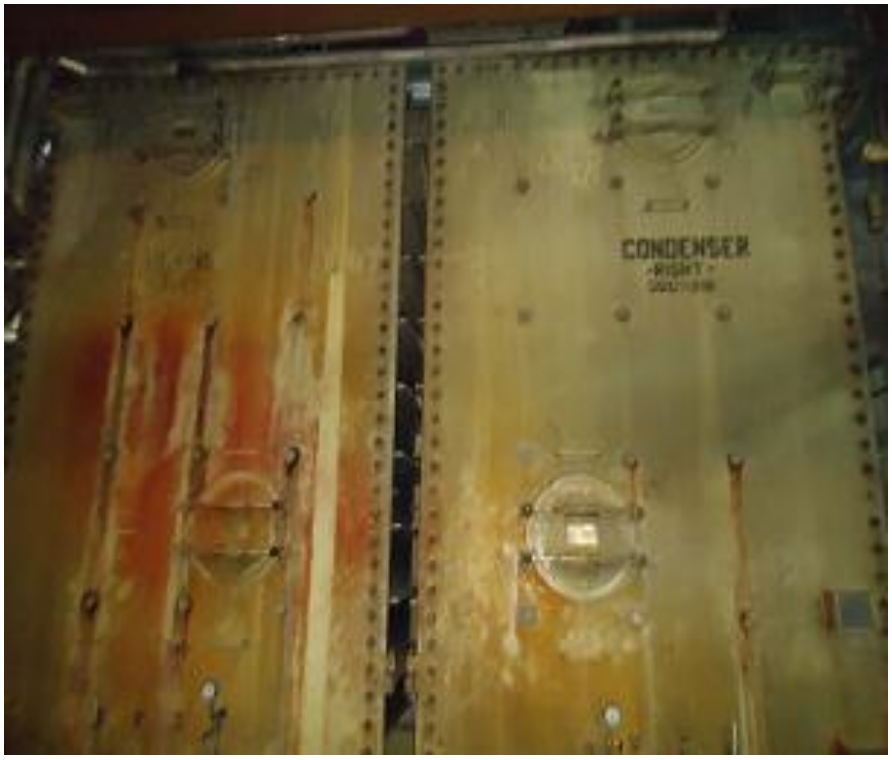

Figure 2.12: Left condenser and right condenser.

2.7.2 Hot Well Tank

The condensate steam is collected in the hot well tank which is located at the bottom of the condenser. The hot well tank stores the condensate for re-use and recirculation in the cycle. A hot well tank is shown in figure 2.13.

Figure 2.13: Hot well tank.

2.7.3 Low pressure heater

The water that is taken from the hot well tank and given to the feed water tank is heated with low pressure (LP) heater. There are two LP heaters in the steam power plant of APSCL. The heat for the LP heater is provided by some of the steam exiting from the low pressure turbine (LPT) and intermediate pressure turbine (IPT). Steam of 222° C and 91.2° C from LPT and IPT respectively is extracted by extraction line and flowed over the tubes which carry feed water. The temperature of feed water rises to about 127° C when it passes through the LP heater. Figure 2.14 shows a low pressure heater of unit 4.

2.7.4 High pressure heater

Feed water is pumped from the feed water tank by boiler feed pump (BFP) into the high pressure (HP) heater. Steam from high pressure turbine (HPT) and intermediate pressure turbine (IPT) are extracted by extraction line and flowed over the tubes which carry feed water. The steam releases heat and feed water receives heat.

There are two HP heaters in the steam power plant of APSCL, one of which is shown in figure 2.15.

Figure 2.14: Low pressure heater.

The HP heaters of unit5 are out of service so a bypass line is installed in the boiler to bypass the feed water from feed water tank to economiser. Because of this fault of the HP heater, the

production of unit5 has decreased to 140 MW from 150 MW. Here 10 MW power is enough to meet the total power demand of a district in Bangladesh. So it is a large amount of power loss for the power plant.

Figure 2.15: High pressure heater.

2.7.5 Feed Water Tank

The feed water tank is a reserve tank. Water from hot well tank through low pressure one (LP1) and low pressure two (LP2) heater is brought to this tank. From feed water tank feed water is transferred to the high pressure (HP) heater. Boiler feed pump (BFP) is used to transfer feed water to the HP heater.

2.7.6 Lube Oil and Jacking Oil

Lube oil means lubrication oil. It is used to protect the turbine bearing by lubricating them. During normal operation, main oil pump driven by AC motor supplies the lubrication oil. A standby pump driven by AC motor supplies lubricating oil if there is any failure of main oil pumps. When main oil pump and stand by oil pump cannot provide lubricating oil with required pressure, an emergency oil pump driven by DC motor supplies the lubricating oil. Lube oil is also used for cooling purpose. A lube oil tank is shown in figure 2.16 which is used for storing the lube oil.

Figure 2.16: Lube oil tank.

Jacking oil: Before the generator and the prime mover shaft starts to rotate, the shaft lies low in close contact with the bearings. Jacking oil helps to lift the shaft up a bit and also maintains the oil film between shaft and the bearing till the rotor speed is adequate enough.

2.7.7 Journal Bearing

A journal bearing basically is a cylinder which surrounds the shaft and it is filled with a type of fluid lubricant. In this bearing a fluid could be the medium that supports the shaft to avoid metal to metal contact.

CHAPTER 3: GENERATOR

3.1 Working Principle of AC Generator

AC generator works on the principle of electromagnetic induction, that is, a potential difference can be produced across a conductor if it is placed in a varying magnetic field. In general the voltage is produced by rotating a coil in a magnetic field. At APSCL this is done either by burning fuel to make steam from water for rotating the turbine or by burning fuel to use its kinetic energy for rotating the turbine. The name plate data of the different generators that we saw at APSCL are shown in table 2.

Table 2: Generator ratings of steam power plant and combined cycle power plant.

Description	Steam power plant		Combined cycle power plant	
	Unit 1 and 2	Unit 3, 4 and 5	Gas turbine unit 1 and 2	Steam turbine unit
Name of the manufacturing company	BBC (Germany)	ABB (Germany)	GEC (UK)	GEC (UK)
Rated terminal output	64 MW	150 MW	56 MW	34 MW
Rated terminal Voltage	11 KV	15.75 KV	13.8 KV	13.8 KV
Rated current	4200/4690 A	6965 A	2911 A	1799 A
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Number of poles	2	2	2	2

3.2 Generator Components

3.2.1 Stator

The stator is a stationary part of the generator. It either contains a permanent magnet or an electromagnet. When the stator is an electromagnet, it contains wire winding which are energized with the help of AC or DC supply. Depending on the type of the generator, the stator can also be the armature. The stator will be the armature if the voltage output is

generated there. At APSCL, the generators have the stator as armature and are made of cast iron and mild steel plates. The stators have numerous slots so that the armature windings can be placed there.

3.2.2 Rotor

Rotor is the rotating part of the generator. They may contain windings depending on the type of the generator. These windings are excited with the help of external power source to produce magnetic field. As the rotor rotates, a changing polarity induces an AC at the stator. At APSCL the rotor is used as the field exciter. The rotor is driven by the generator prime mover, which are the steam turbine, the gas turbine and the gas engine.

3.2.3 Slip Ring

Slip rings are metal rings which are fitted over the shaft of the rotor and are insulated from the rotor. They rotate as the rotor shaft rotates and one end of the rotor winding is connected to the slip ring. These rings help transfer of electricity from the stationary brushes to the rotating rotor.

3.2.4 Carbon Brush

Carbon brush as we can see in figure 3.1, is a block made of carbon compound. Carbon brushes are placed over the slip rings and these brushes glide over the slip rings and conduct electricity. The carbon brushes are also fitted with springs, so that when brushes go down by friction over time, carbon brushes will still remain in contact with the slip rings.

Figure 3.1: Carbon brush.

3.3 Excitation system of AC Generator

An electric generator requires a magnetic field. This magnetic field is either provided with permanent magnet or by field coil. When a field coil is used, a current is flown through the coil to generate the magnetic field. This process of generating a magnetic field with the help of an electric current is called excitation. At APSCL all the generators use field coils for excitation system. Some of the units are self-excited, where some of the power output from generator itself is rectified and used for the field coils. Figure 3.2 shows an outside view of the excitation system of unit 2. Unit 1 of APSCL uses a similar excitation system.

Figure 3.2: Excitation system of unit 2.

3.3.1 AC Excitation

This system contains an AC generator which provides current for the field coil of the main generator and it is placed on the same shaft as the main generator. The field coil of the AC generator is energized with the help of pilot exciter, which is one kind of brushless exciter.

3.3.2 DC Excitation

In DC excitation system, a portion of the AC from each phase of the generator itself is fed back to the field windings as DC through a rectifier. Initially before the generator starts generating power, an external DC source, such a batteries are used for the field windings.

3.3.3 Brushless Excitation

In brushless excitation system, there are permanent magnets which are mounted on the rotor shaft and a 3 phase winding on the stator. When the rotor rotates a current is induced in the three phase windings on the stator, as the windings cut the magnetic field lines of the

permanent magnet. This induced current is fed to the field circuit of the main exciter through a three phase rectifier, which controls the main field coil of the generator. This system makes the generator completely independent of external power source. Pilot exciters, which are used in APSCL, are one kind of brushless exciter. The arrangement of a pilot exciter is shown schematically in figure 3.3.

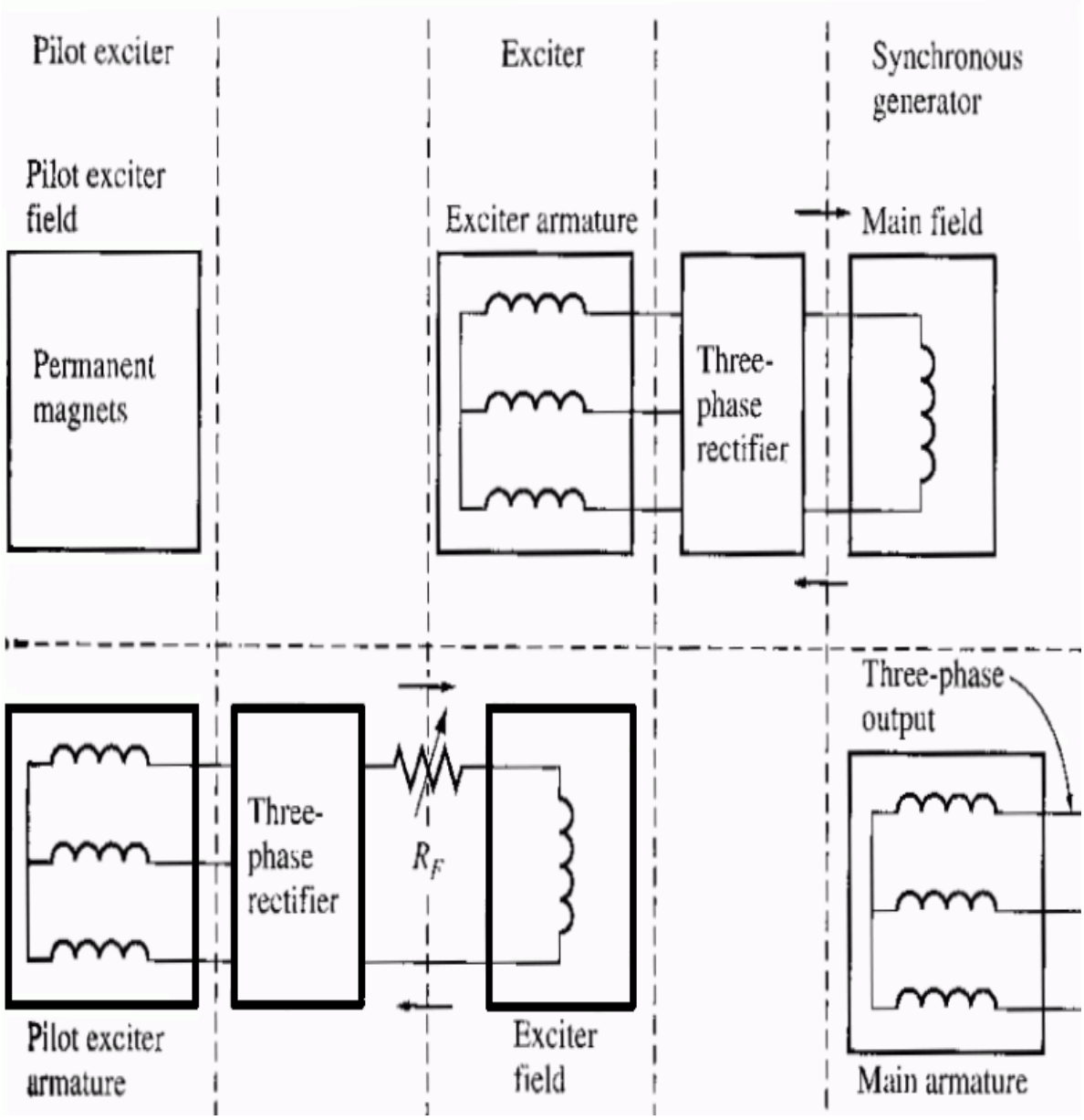

Figure 3.3: Circuit diagram of a brushless exciter [3].

3.3.4 Rectifier Room

The alternating current that is taken from other power station is converted into direct current for DC excitation and storage. This room contains large rectifier units for the rectification of three-phase AC, which is then converted to DC. A rectifier unit is shown in figure 3.4.

Figure 3.4: A rectifier unit.

3.4 Battery Backup System

APSCL uses its own generated power and power from other power stations to run its electrical equipments. In case of any power generation failure of its own and the other power stations, the emergency power supply is provided from a large number of backup batteries stored in the battery room. In figure 3.5 we can see the batteries arranged on the rack of the battery room.

If the generator stops suddenly, the hot shaft will tend to bend and will be damaged. To prevent this, the shaft must be kept running at a low speed of 12 revolutions per minute and this is done with a motor which is powered from the battery backup system.

The batteries those are used in the battery backup room are nickel cadmium (Ni-Cd) type. The voltage of each of the Ni-Cd battery is 1.2 V. In the battery backup room there are about 184 batteries stacked on metallic shelves, which provide approximately 220 V.

Figure 3.5: Batteries stacked in the battery backup room.

3.5 Synchronization

The power that is generated by the power plants of APSCL and all other power stations in the country is supplied to the main grid. Generators must be connected in such a way that generated power does not interfere with one another and for this purpose output power must be synchronized. If generated parameters are not synchronized properly, the generator, the prime mover and the windings may get damaged. The generator may start consuming power from the grid instead of supplying it.

There are four factors of synchronizing a generator, which are listed below.

1. Synchronization of frequency,
2. Synchronization of voltage,
3. Synchronization of phase sequence and phase angle.

3.5.1 Frequency

The frequency of the power output must match with that of the national grid, which is 50 Hz. Since the generators of APSCL have 2 poles, to match the grid power, generator must run at a speed of 3000 rpm ($Ns = \frac{120\,f}{P}$ where N_s is the speed, f is the frequency and P is the number of poles). With the help of the governor this speed is always maintained.

3.5.2 Voltage

The generator output voltage that is supplied to the national grid must be equal to the grid voltage. This voltage is maintained by controlling the excitation current of the main generator.

3.5.3 Phase Sequence and Phase Angle

The phase sequence of the generator output must match with the phase sequence of the national grid. The phase sequence is generally denoted by R-Y-B. If the phase sequences do not match, then a large current will flow in the phases, which will damage both the generator and the grid. The phase angle of the generator must be same as that of the national grid.

3.6 Cooling System

The generators of APSCL run continuously for a long period of time and high current flows through the windings and the conductors of the generators. This produces a large amount of heat. If this heat is not removed it can damage the windings and other parts of the generator. For this reason cooling system is required to keep the temperature of the generator in control.

There are three types of cooling systems that are used at APSCL for generator cooling purpose. These are given below.

1. Hydrogen cooling,
2. Water cooling,
3. Air cooling.

3.6.1 Hydrogen Cooling

This cooling system is only used in unit 1 and unit 2 of APSCL. The thermal conductivity of hydrogen is higher than other gases. It also has high specific heat capacity, low density and low viscosity, which is very good for cooling purpose. APSCL has its own hydrogen production plant where water is broken down to produce hydrogen, which is then filled into cylinders and is supplied to unit 1 and unit 2.

3.6.2 Water Cooling

In this cooling system de-mineralized water is continuously pumped through the hollow structured slots of the stator and the shaft of the generator. As the de-mineralized water comes in contact with the hot parts, it absorbs the heat and then it is sent to the cooling chamber, from where it is recirculated after cooling. De-mineralized water is used since it does not cause corrosion of the pipes.

3.6.3 Air Cooling

This cooling system is mainly used in the combined cycle power plant. Air from the atmosphere, which is cooler than the generator, is passed through it. As the air passes through and comes in contact with the surface of the hot parts, it absorbs the heat and exits.

3.7 Generator Protection

3.7.1 Over Current Protection

At APSCL differential relays are used for over current protection of the generators. These relays are used to protect the generator and its equipments from damage, when a high current flows through it. This occurs when there is a short circuit due to breakdown of winding insulation or due to overload on the supply system. A current transformer is connected to the output of the generator. When current higher than the preset value flows through it, the over current relay is activated, which trips the circuit breaker and disconnects the generator from the bus bar.

3.7.2 Over Voltage Protection

If there is a sudden loss of the generator load, the speed of the generator shaft will increase and consequently output voltage of the generator will increase. The over voltage protection is provided by two over voltage relays. These relays have two units, one is the instantaneous relay which is set to operate at 130-150% of the rated voltage and the other is IDMT (inverse definite time relay) which is set to operate at 110% the of rated voltage [5].

3.7.3 Over and Under Frequency Protection

At APSCL, if the generator frequency exceeds ±5% of the rated frequency then the protection system activates.

Over frequency occurs when there is the excess generation. This condition is corrected by flowing less steam and burnt gas through the turbines with the help of the governor [5].

Under frequency occurs when there is excess load on the generator. The rate at which the frequency drops with the increase of load is very fast and cannot be corrected manually. So an automatic load shedding scheme is used. According to the scheme loads are dropped (loads are disconnected) in stages, starting with the least essential load, dropping 20 to 50 % of the total load on the power plant [5].

3.7.4 Stator Earth Fault

This fault usually occurs when the insulation of the stator windings wear out or get damaged. This can also be caused by moister or oil in combination with the dirt, which settles on the surfaces of the wire windings outside the stator slots. Since this creates a short circuit and high amount of current flows through the windings it can cause serious damage to the stator windings. At APSCL the generator neutral is grounded through a current transformer. When earth fault occurs and current flows through the current transformer, it measures the current and detects the stator earth fault state and the same current is used to energize the relay to trip. This system is used for all the generators of APSCL.

3.7.5 Rotor Earth Fault

As the generator operates for a long time, the rotor may be affected by vibration and stress. These stresses can cause the windings to wear out and the windings can get earthed. The rotor earth fault protection device consists of a current injection device which applies an AC voltage to the rotor windings by means of a slip ring fitted on the rotor. The current is applied to the rotor through a coupling capacitor. In the normal condition, the system is floating and the current flowing through the device is zero as the resistance is high. When a fault occurs,

the current increases causing the relay to operate. The relay can be configured for alarm or trip depending on the criticality [5].

3.7.6 Reverse Power Relay

The function of the reverse power relay is to prevent a reverse power condition. Reverse power condition is also known as motoring. In this condition, power flows from the bus bar into the generator. This occurs when there is a failure in the prime mover of the generator. At APSCL the reverse power relays are set to operate at 20-40% of the power required by the generator to drive the prime mover at the rated rpm of 3000.

CHAPTER 4: COMBINED CYCLE POWER PLANT

4.1 Working Principle of Combined Cycle Power Plant

The combined cycle power plant (CCPP) of APSCL is composed of two gas turbine units and one steam turbine unit. At first air is compressed and then this compressed air is sent to the combustion chamber. In the combustion chamber the compressed air is used to burn the natural gas, which produces burnt gas with high amount of kinetic energy. This burnt gas is used to rotate the turbine. The exhaust gas that comes out of the turbine has enough energy to boil water to produce steam. This steam is used to rotate the steam turbine of the CCPP. Figure 4.1 shows the position and the arrangement of gas turbine section, steam turbine section and boiler of the CCPP.

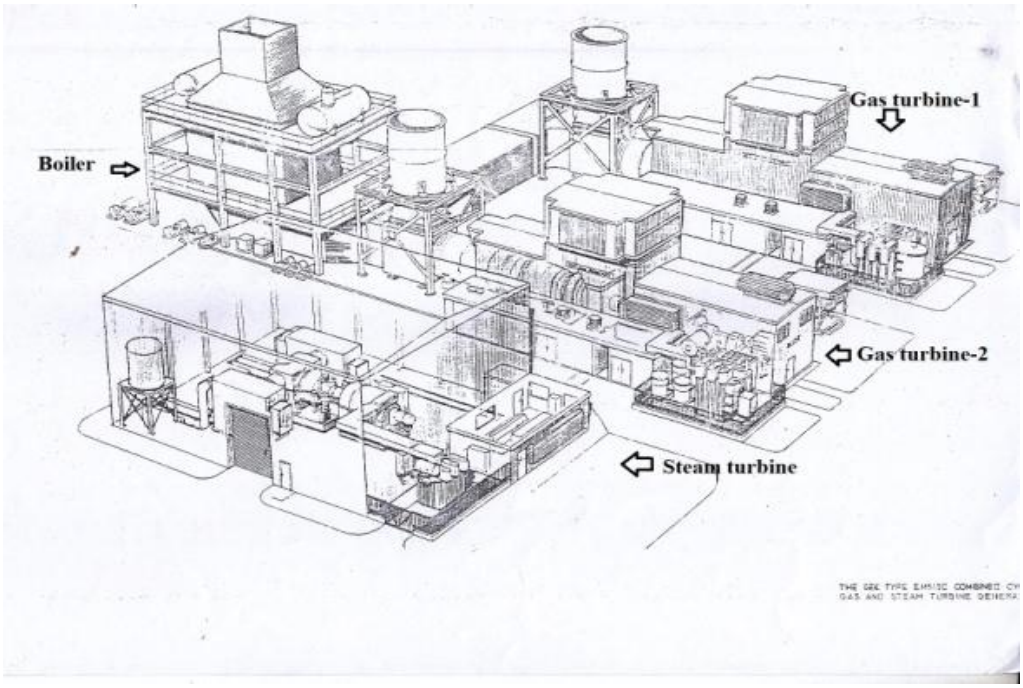

Figure 4.1: Top view of CCPP.

4.1.1 Gas Turbine1

There are two types of gas turbines. These are given below.

1. Shaft power gas turbine,
2. Jet engine gas turbine.

The two gas turbines that we saw at APSCL are of shaft power type. The gas turbines are driven with the help of burnt gas. This burnt gas is produced by burning natural gas (methane). For this burning process, air is needed which is taken from the atmosphere through air filter. The air is also compressed by an axial compressor.

The gas turbine has two types of blades. These are stationary blades and rotating blades. The gas turbines of APSCL have 16 stages. Each stage consists of 59 fixed and 59 rotating blades. As the burnt gas passed through the turbine, the gas particles hits the turbine blades exerting force and thus makes the turbine to rotate. The temperature of the exhaust gas that comes out of the turbine is 500° C. The rated speed of the generator to which the turbine is connected, is 3000 rpm and has a rated output voltage of 13.8 KV. The arrangements of the different components of the gas turbine unit are shown in figure 4.2.

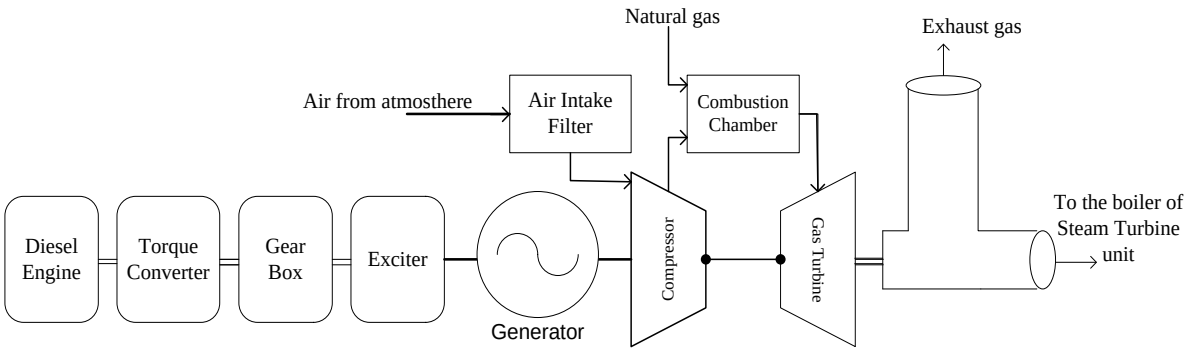

Figure 4.2: Schematic diagram of the arrangement of the components of gas turbine unit.

4.1.2 Steam Turbine

The steam turbine used in the CCPP is almost same as the steam turbine used in the steam turbine power plant.

In CCPP of APSCL there is one steam turbine. This steam turbine has two sections or chambers. These are given below.

1. High pressure turbine chamber,
2. Low pressure turbine chamber.

The exhaust gas that comes out from the gas turbine has very high temperature which is used to produce steam. This steam is used to run the steam turbine.

The only difference between the steam turbines of the CCPP and the steam turbine power plant is that the steam turbine power plants have furnace for producing the flue gas but the CCPP does not, as it utilizes the exhaust gas to produce steam.

4.2 Gas Turbine Equipments

4.2.1 Combustion Chamber

Combustion chamber is an enclosed vessel where air and gas are burned to produce burnt gas. There are ten burners in the combustion chamber. At APSCL the air and gas are supplied

to the combustion chamber at a ratio of 15:1. The temperature of the burnt gas that is produced in the combustion chamber is about 1000° C.

4.2.2 Compressor

The compressor that is used in the CCPP of APSCL is of axial type and has working principle same as the compressors used in the steam turbine power plant. The compressor consists of 13 stages of blades, each stage having both stationary and rotating blades. The compressor compresses the air and increases its pressure. The compression ratio is 8:1.

4.2.3 Diesel Engine

At APSCL, diesel engine is used to run the compressor. The compressor, turbine and the diesel engine all are connected to the same shaft. As the turbine starts to rotate and as its speed reaches 1800 rpm, the diesel engine is disconnected, because this speed is sufficient for the turbine to run the compressor. Figure 4.2 shows a diesel engine of gas turbine section.

Figure 4.3: Diesel engine.

4.2.4 Exhaust Stack

The exhaust gas that comes out of the gas turbine is normally used for boiling water in the steam turbine section of CCPP. After the thermal energy of the exhaust gas is used in the boiler, the exhaust gas which now has a temperature of 100° C is released to the atmosphere through the exhaust stack.

When only the gas turbine unit of CCPP is operated, the exhaust gas of high temperature (500° C) is released directly into the atmosphere. A motor driven gate is used to control the flow of exhaust gas of gas turbine. This gate controls whether the exhaust gas will go to the steam turbine unit or the atmosphere directly.

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4.2.5 Torque Convertor

Torque convertor is one kind of coupling that is used between the diesel engine and the gas turbine shaft. It consists of fluid in an enclosed box, where the shaft of both the diesel and gas turbine are sealed into it from opposite ends. As the diesel engine shaft starts to rotate the fluid inside it also start to rotate in the same direction, this rotating fluid makes the turbine shaft to rotate.

4.2.6 Air Intake Filter

The air from the atmosphere that is sent to the compressor is filtered first. This is done with air intake filter. It removes any unwanted particles that can come in with the air that is sucked in from the atmosphere, so that it does not cause improper combustion. The filters of CCPP are capable of filtering out object as small as 0.1 mm.

4.3 Steam Turbine Equipments

There are several equipments that are used in the steam turbine section of CCPP. The arrangement of the equipments and, the flow of water and steam are shown in figure 4.4.

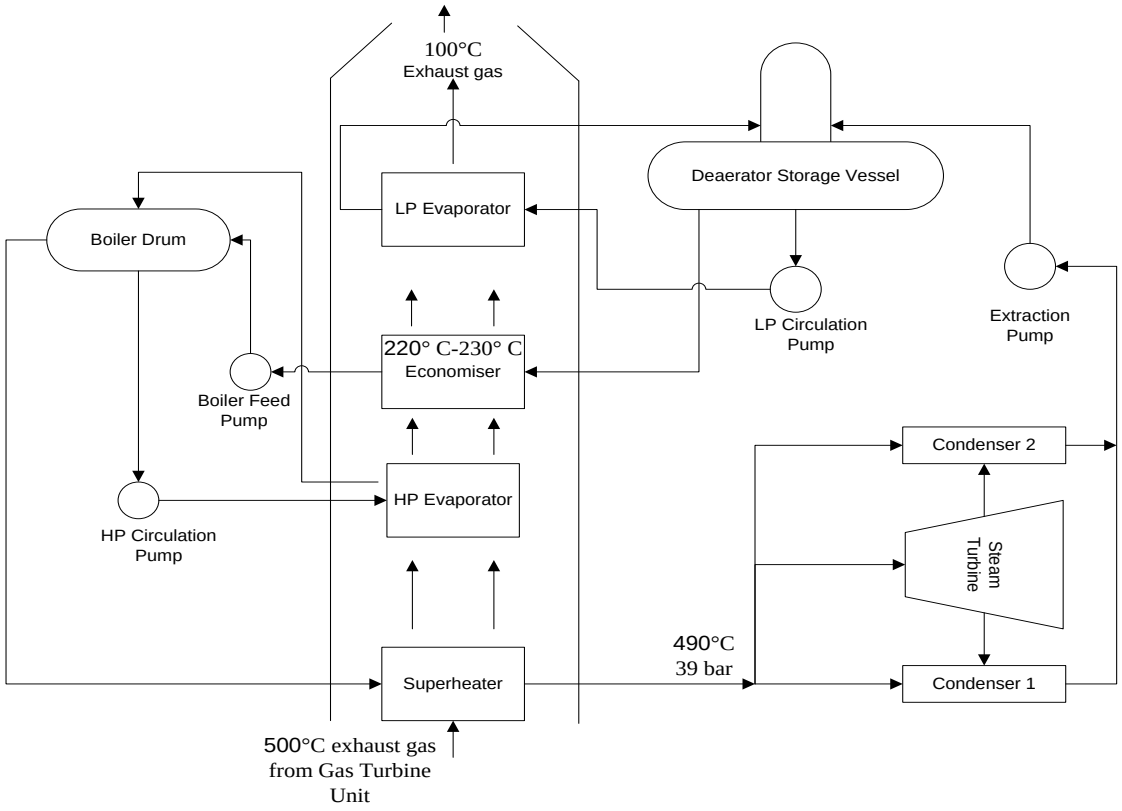

Figure 4.4: Schematic diagram showing the water and steam flow in the CCPP.

4.3.1 Boiler Drum

The boiler drum of the steam turbine unit of CCPP is used for the same purpose as that of the steam turbine power plant. Compared to the steam turbine power plant, the size of the boiler of CCPP is smaller.

4.3.2 Low Pressure Evaporator

The demi water that is used for making steam is heated in stages. In the first stage this is done with low pressure (LP) evaporator. This increases the temperature of the demi water to 118-120˚ C. At CCPP the LP evaporator is placed at the top of the boiler, where the temperature of the exhaust gas is lowest and has a value of 120˚ C. From the LP evaporator the demi water is sent to the economiser.

4.3.3 Economiser

Economiser is used to raise the temperature of feed water that comes from the deaerator storage vessel. This economiser is capable of raising the temperature of the feed water to 220-230˚ C. At CCPP the economiser is placed at the top of the boiler just below the LP evaporator. The thermal energy of the exhaust gas from the gas turbine is used to raise the temperature of the feed water.

4.3.4 High Pressure Evaporator

High pressure (HP) evaporator is the next stage of the demi water heating process. At this stage the thermal energy of exhaust gas is used to convert demi water to steam. The HP evaporator is placed just above the super heater in the boiler, where the temperature of the exhaust gas is 240˚ C.

4.3.5 Super Heater

The super heater is a device that is used to convert the wet steam into dry steam. The super heater is placed at the bottom of the boiler because at this place the temperature of the exhaust gas entering the boiler is highest and has a value of 500˚ C. The super heater also increases the pressure of the steam to 39 bars. From the super heater the super heated steam is supplied to the steam turbine.

4.3.6 Condenser

At CCPP a condenser is used to condense the exhaust steam coming out of the steam turbine. This is done so that the steam that is condensed to water can be re-used. The exhaust steam has a temperature of about 45° C. The condenser also creates a low pressure of about 0.5 bars so that the exhaust steam can rush out of the turbine. In CCPP there are two condensers, the

first condenser is active all the time and the other is used only when the first one fails or malfunctions.

4.3.7 Deaerator

Deaerator is a device that is used to remove air and other dissolved gases from the feed water. The feed water that enters the deaerator has a temperature of 40˚ C. From the deaerator the feed water is stored in the dearator storage vessel, where the water has a temperature of 50˚ C.

CHAPTER 5: GAS ENGINE

5.1 Gas Engine Working Principle

The gas engines at APSCL are run by natural gas. At first air and natural gas are mixed at a ratio of 11:1 and then compressed by a compressor which is initially run by a motor. The compressed mixture is passed through an inter cooler and is sent to the compressor for further compression. This process is continued until the mixture is compressed to a desired ratio of 10:1. Then this compressed air is fed to the internal combustion (IC) engine where combustion takes place and the engine shaft starts rotating, the same shaft is coupled to a generator. The exhaust gas coming out of the gas engine is used to drive an additional gas turbine, which is a part of turbocharger. This additional turbine is coupled to the compressor of the gas engine, so that the compressor can be driven by the exhaust gas of gas engine. As the gas turbine starts running, the motor running the compressor is disconnected automatically. The gas engine of APSCL has 16 IC engines.

5.2 Gas Engine Equipments

5.2.1 Compressor

Compressor is a device that increases the pressure and reduces the volume of the air or gas that is passed through it. The compression ratio of the compressor input and output volume is 11:1. The compressor contains blades just like the turbines but the blades are place in reverse order, ascending to descending in terms of blade size. After compression the pressure of the fixture becomes about 6 bars. At APSCL a DC motor is used to run the compressor. Once the gas engine starts running, the exhaust is used to run a turbine which is coupled with the compressor. When the speed of the turbine reaches 1500 rpm the DC motor is automatically disconnected.

5.2.2 Four Stroke IC Engine

At APSCL, there are 16 V-shaped 4 stroke engines each having 20 cylinders. These engines have four strokes or moments, which are intake stroke, compression stroke, combustion stroke and exhaust stroke. During the intake stroke compressed air and gas mixture is entered into the cylinder and the piston moves to the rear end. In the compression stroke the piston is pushed to the near end, while the volume of the mixture is reduced and pressure is increased. Then in the combustion stroke the compressed mixture is ignited with the help of spark plug. As combustion takes place a high amount of pressure is produced which pushes the piston

towards the rear end. The pistons of the neighboring cylinders are connected in such a way that this combustion stroke make compression stroke in the adjacent cylinder. Finally during the exhaust stroke the spent exhaust gas is cleared out of the cylinder. As the stokes repeat and the process continues, the piston connected to the shaft through crank converts liner motion into rotating motion and thus makes the shaft to rotate. Figure 5.1 shows one of the 20 cylindered 4 stroke gas engine.

Figure 5.1: Four stroke gas engine.

5.2.3 Generator

The gas engine which acts as prime mover has its shaft coupled with the generator. As the engine runs it drives the generator to produce power. The gas engine generator at APSCL produces 53 MW in total. There are sixteen generators each producing 3.345 MW. The generators have 4 poles and run at a rated frequency of 50 Hz and speed of 1500 rpm.

5.2.4 Silencer

Silencer is a device that is used to reduce the noise of the gas engine. The exhaust of the gas engine produces a lot of noise. To reduce the noise a silencer is fitted at the exhaust end of the engine.

5.2.5 Turbocharger

The gas engines at APSCL use turbocharger to increase efficiency. The turbocharger is a device that uses the exhaust gas coming out of the engine to run a small gas turbine. This turbine is connected to a pump that packs more air-gas mixture into the gas engine. As more combustion takes place more exhaust is produced, faster the gas turbine rotates and more air-gas mixture is poured into the engine cylinder.

5.2.6 Pre-Heater

The air and the gas that are being mixed and fed to the engine cylinder are heated to increase thermal efficiency. This is done with the help of pre-heater.

5.3 Gas Engine Cooling System

5.3.1 Air Cooling

The external surface of the combustion cylinder is fitted with fins, which are made of metal that are good conductor of heat. The heat that is generated during the combustion process in the engine conducts through the metal fins and when air is passed over the fins, the heat is absorbed by the air.

5.3.2 Water Cooling

The water is also flown through the jacket like structure fitted with the engine. The water coming in contact with the hot surface absorbs the heat and moves on as the flow is continuous. This water is then cooled with help of radiator and fans.

5.3.3 Radiator Fan

The radiator fan is used at two different places. It is installed over the fin like structure of the combustion cylinder to accelerate the radiation process. The water storage tank used for water cooling is also fitted with radiator fans to cool the water. Each fan consumes 6.6 KW power with 6.6 KV rated voltage.

5.3.4 Ventilation Fan

The rooms where the gas engines are kept get heated beyond the comfort of the operator and maintenance people. The physical property of some of the materials may change due to excess heat in the engine room. For this, ventilation fans are installed on the walls of the room to cool down and make condition good enough for work. The sixteen IC engines are kept in two different rooms. Each room is installed with four ventilation fan. Usually the room temperature is above 40° C but the fans can reduce the temperature by an amount of 10° C.

5.3.5 Oil Tank

Oil tank stores and supplies all the oil needed for the gas engine power plant. It supplies the jacking oil for the generator, lube oil for the bearing. The lube oil is also used for cooling by supplying a continuous flow of this oil through certain parts which over heats. The oil is also used in the piston and cylinders so that they do not heat up by friction and seize the system.

CHAPTER 6: CONTROL ROOM

Control room is one of the most important parts of a power station. The control room is used to operate the switchgear, generator, motor, relay, turbine etc. at APSCL. There are 5 different control rooms at APSCL.

1. Control room of the steam turbine unit 1 and 2,
2. Control room of the steam turbine unit 3 and 4,
3. Control room of the steam turbine unit 5,
4. Control room of the combined cycle power plant,
5. Control room of the gas engine.

6.1 Control Rooms of Unit 1, 2, 3, 4 and 5

There are three different control rooms in the steam power plant section of APSCL. Control room 1 is used for operating unit 1 and 2, control room 2 is for unit 3 and unit 4, and control room 3 is for unit 5.

Control room 1 is the oldest and uses an analog system. From the control room all the equipments such as boiler, burner, condenser, feed water pump, low pressure and high pressure heater etc. can be controlled. If fault or problem occurs, the control room operators have to fix it manually, as the damaged parts and equipments are no longer manufactured by the manufacturer. This is one of the reasons why this control room is operated by senior engineer of APSCL.

The control room 2 is used for controlling unit 3 and 4. This room contains different types of analog meter to keep track of the system behavior. There are also indicators which tell whether the temperature, pressure and other values of the system are too high or too low. Depending on the state of the indicators, necessary steps or programs can be initiated to stabilize the system. If any necessary steps are not taken, the system will start an alarm to alert the operator. If still no action is taken then the whole system will be automatically tripped and power generation will be halted.

The room also contains recorder which continuously record every meter readings and system behavior. This helps for future analysis of the system and helps to figure if any control room operator failed to take the required steps in case of a fault.

Control room 5, which is used for controlling unit 5, is completely computerized. All the indicator, meters and operation status are all shown on a computer screen. The system behavior and all the other recordings of unit 5 are stored in the computer.

6.2 Control Room of CCPP and Gas Engine

In corner of the combined cycle power plant, there is the control room. In figure 6.1, we can see the meter panel board, which is part of the operation desk, displaying different readings of the system, Here all the metering and controlling systems of this plant are maintained. In the control room, equipments are operated from operating desk. In the operating desk there are some test buttons like lamp test, leak test, purging etc. This room also contains different equipments such as fault checking display, meter panel, temperature checking panel, vibration checking meter and boiler water level checking meter. The different types of pump, valve and fan are controlled from this room. Cooling water pump, high pressure (HP) and low pressure (LP) dosing pump, HP and LP mixer pump, make up water pump, lube and jacking oil pump, HP and LP circulation pump, feed pump, main condenser extraction pump are all controlled from this room.

Combined cycle power plant control system is analog and backdated controlling technology. So its efficiency started going down. Now a day it is very difficult to maintain and repair it.

Figure 6.1: Panel board of combined cycle power.

Control system of the gas engine power plant is totally digitalized and controlled by computer. The system will automatically trip if any fault that can be rectified from the control room is not rectified. This control room controls the 16 IC engines. The gas that is used for the engine needs to be more than 94 percent methane. This is also monitored from the control room. The air and gas mixture and compression ratio is also monitored and maintained from this room. There are 18 digital control panels for the 16 gas engines where 8 control panels are controlled by a master control panel. At APSCL two master control panels are used for the 16 gas engines.

CHAPTER 7: CONCLUSION

APSCL is the second largest power station in Bangladesh, which is playing an important role in producing power for the nation and thus contributing to the country's economy. APSCL produces and supplies 778 MW of electric power to the national grid. Its contribution to the country is about 15% of the total national power generation sector. APSCL is a combination of steam, gas and combined cycle plants for the power generation purpose. It has a total of nine units, where six are steam turbine units, two gas turbine units and one gas engine unit. Control units 1, 2, 3, 4 and 5 are used to control steam power plants. Combined cycle power plant and gas engine power plant have their own control rooms.

At first we visited steam power plant. There we saw how water is collected, purified and then boiled to produce steam. This steam is then used to rotate the turbine for power generation. There we also observed how air is collected from nature and filtered so that it is suitable to be mixed with natural gas, for burning to generate heat for the boiler. There are several switchgears and control rooms to control the overall system for producing steam and power generation. We have observed various protection schemes which are used for the protection of the equipments.

We also visited gas generator division, motor winding shop, rectifier room, battery room and various types of relays used for protection at the generator division. There we also learned about the different excitation systems of the generators and motors. Maintenance of the generator is the main challenge in a power station.

Next we visited combined cycle power plant (CCPP) where mixture of air and natural gas is burnt to drive a turbine for power generation and the exhaust hot gas is used in the boiler to boil water for producing steam.

At last we visited gas engine power plant where gas engines are used as prime mover to drive generators.

APSCL is a large power station in Bangladesh, so we were very lucky to get a chance to work with a group of communicative people in APSCL. We got an enriched practical knowledge during our intern times which will be helpful in our future working life.

7.1 Problems

1. Participation in different practical works in APSCL is prohibited by the policy of APSCL. So we could not participate practically, we were just able to observe.

2. We could not collect some important information in which we were much interested in because of the company confidentiality policy.

3. The mentors, who were assigned to train us, were only able to give us time when they were free from their official work.

4. Sometimes it was very hard to understand the matters as our mentors were unable to show the internal configurations and parts of the machinery properly.

7.2 Recommendations

Our internship time was only 100 hours which was not sufficient for gaining proper practical knowledge. Considering the benefits of practical knowledge, the Electrical and Electronic Engineering department of East West University should take necessary steps to extend the duration of internship.

Before going to internship, students must complete the related course that will help them to understand the topic much better. Students should also go through books and topics such as generator and its principle and switchgear, which were studied in the previous semester to get a better idea about industrial application.

If the academic advisor could give some suggestions related to the power station and an outline of what to learn during the internship before the internship program, it would be very helpful for the students taking EEE 499 (industrial training).

References

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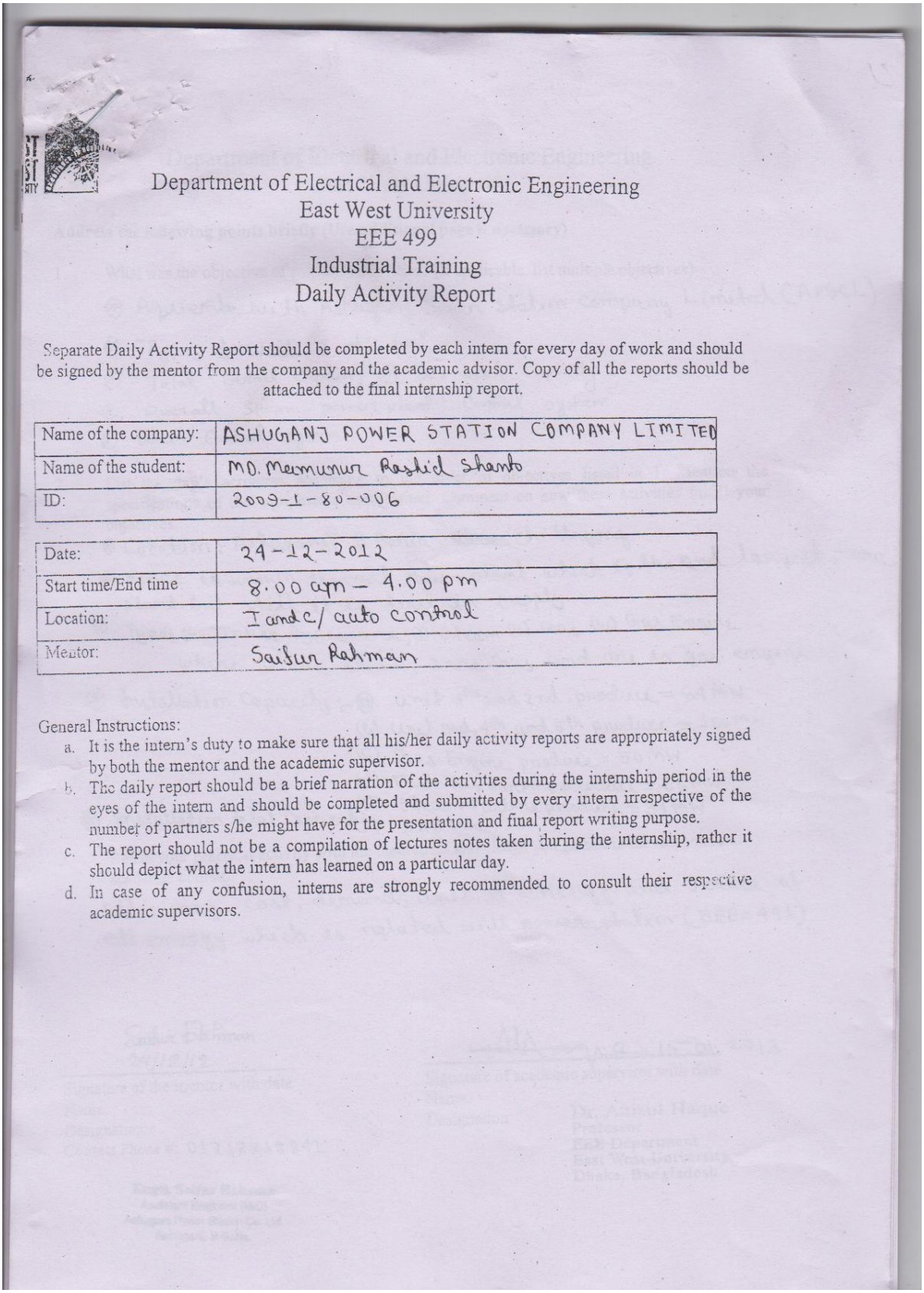
[5] Ramandeep Kaur Aujla, "Generator Stator Protection, under/over voltage, under /over frequency and unbalanced loading", Dept. Elect. And Comp. Eng., The Univ. of Western Ontario, London, May 1980.

[6] *Synchronous Generator*, Electric Machinery, [Online]. Available: http://processmodeling.org/theory/electronics/emf/electric_machinery3.html.

APPENDIX



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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	24-12-2012
Start time/End time	8.00 am – 4.00 pm
Location:	I and C/ auto control
Mentor:	Saifur Rahman

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)

- Aquiente with Ashuganj Power Station company Limited (APSCL)
- Types of unit. & it's fuel.
- Total install Capacity & De-rated Capacity.
- Overall Steam power plant Control system
- ~~Boiler Control system~~.

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.

- Location :- Ashuganj, B.Baria, ~~Dhaka~~ Chittagong
- APSCL is known thermal Power plant which is the 2nd largest power plant. but still it is first in supply.
- Types :- Three types are; (i) Steam (ii) Gas (iii) Gas Engine where 6 are steam, 2 are Gas and one is gas engine
- Installation Capacity :- (a) unit 1th and 2nd produce = 64 mw
  (b) Unit 3rd, 4th, and 5th produce = 150 mw
  (c) Gas Engine produce = 50 mw
  (d) Each Gas turbine produce = 56 mw
  (e) Steam turbine produce = 34 mw
- Installatim total Capacity : 278 mw.

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

Efficieney, cost, demand, unit of energy and source of ~~eff~~ energy which is related with power station (EEE=441)

Saifur Rahman
24/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717718841

Engr. Saifur Rahman
Assistant Engineer (I&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh.

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD Mesmunur Rashid Shanto
ID:	2009-1-80-006

Date:	26-12-2012
Start time/End time	8.00 am – 4.00 pm
Location:	I and C / Auto control
Mentor:	Saifur Rahman

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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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)

Aquainte with water treatment plant and how to collect demi water from meghna river.

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.

- River water
- Raw water pump
- Primary filter :- (a) Heavy duty bar screen (b) Rotating bar screen (c) Travelling bar screen
- Two pumps are used :- (1) Raw water pump and circulating cooling water pump, where throw two raw water pump then the water is send to intermediate basin.
- Final filter :- (a) Gravel (b) Scavenger (c) Catern (d) anion (e) Mixed Bleade some water is send to feed overhead tank and the rest is send to water treatment plant (450MW) where through chemical dosing we get demi water.

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

I have observed with water treatment plant which new ~~and~~ I learn to me and I learn and see it. (Measuring Device)

Saifur Rahman
26/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717718841

Engn. Saifur Rahman
Assistant Engineer (M&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh.

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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	27-12-2012
Start time/End time	8.00 am – 4.00pm
Location:	I and C / Auto control
Mentor:	Saifur Rahman

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)

(i) Aquiente with air flow gas and it's equipment
(ii) Boiler control system

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.

Boiler control system:- (I) Air (II) Gas (III) Temp control (IV) Drum level (V) Controlling equipement (VI) measuring equipement.

Equipement:- (I) FDF (Force draft fan)
(II) CI Fan
(III) Inlet vane
(IV) Actuator
(V) Burner
(VII) Gas control valve
(VIII) Damper

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

I have observed air flow gas and burner process which is related with power station course (EEE-491)

Saifur Rahman
27/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717718841

Engr. Saifur Rahman
Assistant Engineer (I&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: **Dr. Anisul Haque**
Designation: **Professor**
EEE Department
East West University
Dhaka, Bangladesh.

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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	28-12-2012
Start time/End time	8.00 am – 4.00 pm
Location:	control room of unit 3, 4 and 5
Mentor:	Saifur Rahman

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.

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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)

* Acquainte with control room for unit 3, 4 and 5 of the steam power station
* Controlling of relay, circuit breaker

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.

In unit 3 and 4 for steam power plant equipment are operate from operating desk. In the operating desk there are some test button: limit switch button, leak test button pressure switch button. Other equipement are: Fuel gas, FD fan CI fan, Boiler feed pump, supper heater spray etc. In unit 5 we have seen digital control system, where semi- DCS (Distribution control system) software is used to control over all system.

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

In our academic course EEE-205, EEE-311 and EEE-402 we learned about digital logic design and control system.

Saifur Rahman.
28/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717218841

Engr. Saifur Rahman
Assistant Engineer (I&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh.

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Industrial Training
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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	29-12-2012
Start time/End time	8.00Am — 4.00 pm
Location:	I and C / Auto control
Mentor:	Saifur Rahman

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.
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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)

(*) Aquiente with Boiler and it's equipment.
(*) Boiler operation
(*) Boiler types

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.

(*) Types :- (I) Water tube boiler (II) Fire tube boiler
(*) Operation :- (a) Mechanical (b) Control
(*) Equipment :- (I) Condenser (II) Hot ~~water~~ well tank (III) L.P heater
(IV) Feed water tank (V) Deacration (VI) Boiler feed pump (VII) H.P heater
(VIII) Economiser (IX) Boiler Furnace (X) Boiler drum (XI) Super heater (1,2,3)
(b) Equipment :- (I) Solonied valve (XII) Re-heater (II) Register Temparature detector (III) Limit Switch
(IV) High pressen bypass unit (V) Safety value (VI) Boiler master (VII) Purging
(VIII) Pressure switch

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

I have observed water tube boiler and it's equipment which is related with power station course (EEE-441)

Saifur Rahman
29/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717218841

Engr. Saifur Rahman
Assistant Engineer (I&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: **Dr. Anisul Haque**
Designation: Professor
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East West University
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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid shanto
ID:	2009-1-80-006

Date:	30-12-2012
Start time/End time	8.00 am — 4.00 pm
Location:	I and C / Auto Control
Mentor:	Saifur Rahman

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.
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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)

Aquiente with ~~tat~~ turbine and it's classification equipment
Turbine control system

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.

Turbine :- Fixed and rotating blade where steam flow is connected to generator and converted mechanical into electrical energy

classification :- (I) Steam (II) water (III) Gas

Steam :- (a) ~~main valve~~ Live steam value (a) I.P.T and L.P.T
(b) main Stop value
(c) Regulating value
(d) Governor controle flow of steam
(e) Jarnal Bearing
(f) Lubroil
(g) Lube filter
(h) H.P.T

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

The turbine and it's function is related with power station (EEE-441) academic course.

Saifur Rahman
30/12/12
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01717218841

Engn. Saifur Rahman
Assistant Engineer (I&C)
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria.

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamoun Rashed Shanto
ID:	2009-1-80-006

Date:	31-12-2012
Start time/End time	8.00 am — 4.00 pm
Location:	Generation Division
Mentor:	Kazi Abdul Karim

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)

Aquainte with motor winding shop and types of motor.

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.

Types of motor: (I) DC motor (II) single phase AC motor
(III) Tree phase inductors motor

parts of motor:- (I) Slot of motor
(II) Pole
(III) Stator winding
(IV) Rotor
(V) Bearing
(VI) Lamp test of motor

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

I have observed with motor winding shop which is related with our academic course EEE-301 (Electrical Machine-I) and EEE-304 (Electrical machine-II)

31/12/12

Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01740593133

Assistant Engineer
Generator Division
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402

15.01.2013

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	01-01-2013
Start time/End time	8.00 am — 4.00 pm
Location:	Generator Division
Mentor:	Kazi Abdul Kaium

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.
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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)

Aquainte with the construction of generator and it's workking principles

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.

(I) prime mover
(II) Rotor
(III) Stator
(IV) Carbon brush
(V) Slip ring
(VI) Pailot exciter
(VII) main exciter
(VIII) cooling system of the generator

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

I have observed with generator which is related with our academic course EEE-301 (Electrical machine-I) and EEE-304 (Electrical machine-II)

01/01/13

Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01740593133

Assistant Engineer
Generator Division
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402

15.01.2013

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	02-01-2013
Start time/End time	8.00 am — 4.00 pm
Location:	Generation Division
Mentor:	Kazi Abdul Kaium

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.
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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 was DC supply and DC to AC converter and DC storage system

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.

I have visited diode room, voltage regulator room of unit 1 and 2. and learnt about principle of convertion AC to DC where excitation of rotor winding is created by DC supply. We have also visited battery room. Emergency luke oil pump and emergency energy supply is control by DC.

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

In our academic course EEE-102 and EEE-111 have learnt about diode, rectifierd circuit and energy storage system.

02/01/13

Signature of the mentor with date
Name: Kazi Abdul Kaium
Designation:
Contact Phone #: 01740593133

Assistant Engineer
Generator Division
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402

15.01.2013

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	03-01-2013
Start time/End time	8.00am — 4.00 pm
Location:	Generation Division
Mentor:	Kazi Abdul Kaium

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.

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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)

Aquainte with generator protection and it's equipment.

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.

Equipment :- used different kind of relay and breaker and transformer

Types of Relay :- (I) Generator over voltage relay (II) Generator over current relay (III) Generator under excitation relay (IV) Generator station earth fault relay (V) Generator rotor earth fault relay (VI) over speed protection (VII) Generator reverse power relay.

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

I have observed with generator protection which is related with our academic course EEE-301 (Electrical machine - I) and EEE - 304 (Electrical machine - II)

03/01/13
Signature of the mentor with date
Name:
Designation:
Contact Phone #: 01240593133

Assistant Engineer
Generator Division
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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Name of the company:	ASHUGANJ POWERSTATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	04-01-2013
Start time/End time	8.00 am – 4.00 pm
Location:	Control room of CCPP
Mentor:	MD. Mizanur Rahman

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.
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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)

To learn about controll room of combine cycle power plant like GT$_1$, GT$_2$ and ST

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.

Different types of meters and recorders.
Controlling pump:- main condenser extraction, vacuum pump, lube oil pump, jacking oil, ~~supp~~ make up water H.P Dosing pump, L.H Dosing pump. Grland water pump. Feed pump, cooling pump.
Different types of Valve:- Superheater drain value, main steam stop, main steam Bypass, condenser returen isolation value vacuum break value actuator
Fan:- Grland vent condensate extraction fan, Oil tank vapour fan, Buildeng vent Fan.
Interpretation of relay and circuit breake

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

I have learnt about ~~a~~ logic gates, pump, motor, relay and circuit breaker which ~~d~~ is related in my academic course EEE-200, EEE-205, EEE-311, EEE-301, EEE-304

15.1.2013

15.01.2013

Signature of the mentor with date
Name: MD. Mizanur Rahman
Designation: Shift charge Engineer
Contact Phone #: 08 528 -74604

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

Department of Electrical and Electronic Engineering
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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-06

Date:	05-1-2013
Start time/End time	8.00 am – 4.00 pm
Location:	Combined Cycle power plant
Mentor:	MD. Kamruzzaman Bhuiyan

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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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)

- Overview of Gas turbine, GT_1 or GT_2
- Different equipment of Gas turbine
- Air flow and Gas control

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.

Gas turbine use diesel engine as prime mover, torque converter, Reduction gear where turbine and generator in one shaft. Generator is 2 pole and 3000 rpm

Equipment:- (I) Air filter
(II) Governor
(III) Dumper
(IV) Mechanical pump
(V) AC pump
(VI) DC pump
(VII) Burners
(VIII) Air flow compressor
(IX) Combustion chamber
(X) Nock out

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

I have learnt about gas turbine which is related with my academic course EEE-441 (Power station)

05.01.13
Signature of the mentor with date
Name:
Designation: Manager (E&IC),CCPP
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402
Contact Phone #: 01712160690

15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh.

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Name of the company:	ASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	06-01-2012
Start time/End time	8.00 am – 4.00 pm
Location:	Combined cycle power plant
Mentor:	MD. Kamruzzaman Bhuiyan

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.
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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)

(*) ~~Controlling~~ The combined cycle power plant ~~like~~ system like GT_1, GT_2 and ST, I have observed.

(*) Controlling of Lube oil and equipments.

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.

Controlling station of GT and ST are consist of different type of meter like varmeter, synchronoscope, frequency meter. Relay are used to protection of generator from over voltage low voltage, over current, low current. Two pump used to controlling of ~~load~~ lube oil.

Equipment:-

(I) Frequency meter
(II) Power factor meter
(III) Gas turbine
(IV) Steam turbine
(V) Torque converter
(VI) Spark plug
(VII) Low pressure heater
(VIII) High pressure heater
(IX) Supper heater
(X) Boiler dreump
(XI) Damper
(XII) Fuel pump

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

I have learnt about gas turbine and steam turbine which is related with my academic course EEE-441 (Power station)

06.01.13

Signature of the mentor with date
Name:
Designation: Manager (E&IC),CCPP
Ashuganj Power Station Co. Ltd.
Ashuganj, B-Baria-3402
Contact Phone #: 01712160640

15.01.2013

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

Department of Electrical and Electronic Engineering
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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 LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006
Date:	07-01-2012
Start time/End time	8.00 am – 4.00 pm
Location:	Combined cycle power plant
Mentor:	MD. Kamruzzaman Bhuiyan

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.
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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)

- Different types of pressure meter and Bearing
- Vibration speed, ~~cir~~ critical speed, Level, Temperature

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.

Pressure meter:- pressure Gague, pressure transmitter, Thermocouple battery room, air filtering, 3 phase divde, Lub oil pressure.

Types of Bearing:-(i) Ball bearing (ii) Roller (iii) Journal (iv) Thaust bearing

Level :- Lube oil tank, magnetic level switch

Speed :- magnetic speed sensor and magnetic speed pickup

Vibrocation :- (i) Ribat moving shafe (ii) Axial moving shafe

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

I have learnt about different meter which is related with my academic course EEE-311 and EEE-441

07.01.13
Signature of the mentor with date
Name:
Designation: Manager (E&IC),CCPP
Ashuganj Power Station Co. Ltd.
Contact Phone #: Ashuganj, B-Baria-3402
01712160640

Haque 15.01.2013
Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh

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Name of the company:	AASHUGANJ POWER STATION COMPANY LIMITED
Name of the student:	MD. Mamunur Rashid Shanto
ID:	2009-1-80-006

Date:	08-01-2013
Start time/End time	8.00am – 4.00pm
Location:	Combined Cycle power plant
Mentor:	MD. Kamruzzaman Bhuyan

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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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 visit and learn Gas engine power plant and know about it's working function

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.

In the gas engine power plant, There has 16 gas engine are used to produce 50mw and Each engine produce 3.35 mw

Equipment:- (I) 4- Strock IC engine (20 cylinder)
(II) Compressor
(III) Turbine
(IV) Generator
(V) Silencer
(VI) Heat exchanger
(VII) Radiator fan
(VIII) Ventilation fan
(IX) Oil tank
(X) Transformer
(XI) Scan

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

In our accademic course EEE-441 (power station), I have learn about Gas engine power plant

08.01.13

Signature of the mentor with date
Name: Manager (E&IC), CCPP
Designation: Ashuganj Power Station Co. Ltd.
Contact Phone #: Ashuganj, B-Baria-3402
01732160690

15.01.2013

Signature of academic supervisor with date
Name: Dr. Anisul Haque
Designation: Professor
EEE Department
East West University
Dhaka, Bangladesh