EAST WEST UNIVERSITY

INTERNSHIP REPORT

ON

DEMONSTRATION AND PRACTICAL VISIT OF POWER GENERATION, POWER TRANSMISSION AND POWER DISTRIBUTION SYSTEM OF BPDB RAJSHAHI

By

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Submitted to the

Department of Electrical and Electronic Engineering

Faculty of Sciences and Engineering

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Bachelor of Science in Electrical and Electronic Engineering

(B.Sc. in EEE)

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Approved by

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বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড

Bangladesh Power Development Board

Rajshahi Training Center, PDB, Baganpara, Rajshahi

Certificate

In accordance with the statutes of BPDB

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11.9.17

Course Co-Ordinator *Director*

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Acknowledgement

First, we would like to thank almighty Allah for giving us the opportunity to complete the internship and report.

We would also like to thank our supervisor Dr. Muhammed Mazharul Islam, Assistant Professor of Department of Electrical and Electronic Engineering of East West University for his guidance and suggestions from the very beginning till the end of this work. We owe him lots of gratitude for his guidance and encouragement.

We want to thank Dr. Mohammad Mojammel Al-Hakim, Chairperson and Professor of Department of Electrical and Electronic Engineering of East West University.

We further like to thank all the engineers and members of Rajshahi Training Center for their guidance and suggestions.

Finally we want to thank all of our honorable teachers, friends and family for supporting us all the way throughout our study.

Executive Summary

Power sector is the most important sector for a developing country like Bangladesh. We can't imagine a single day without electricity. Power sector includes generation, transmission and distribution of electricity. The government and the power sector are trying to increase the capability of generation. Bangladesh's total installed electricity generation capacity has reached nearly 15,000 Mega Watts (MW).

We got the opportunity to complete our internship under Rajshahi Training Center, Bangladesh Power Development Board (BPDB). During this internship, we visited three different types of power plants and two substations. In our internship, we have visited a diesel power plant in Katakhali, Rajshahi, which is a peaking power plant and operates on peak hours. It supplies 50 MW to the national grid. Then, we visited a gas turbine power plant in Baghabari, Sirajgonj, which uses natural gas as its fuel and supplies 171 MW to national grid. After that we visited a thermal power plant in Khalishpur, Khulna, which uses Heavy Fuel Oil (HFO) as its fuel to make steam and supplies 170 MW in the national grid. We achieved a clear idea of generation, transmission, distribution, control and maintenance of those power plants. Is this report, we briefly discussed about these processes that we learned during the internship. Also we discuss about protection systems and auxiliary systems of these power plants.

Training Schedule

Date	Topic	Time	Mentor
21-08-2017	HFO plants and impact of IPP in Power sector	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Shoayeeb Muhammad Shaikh
22-05-2017	Generator, HFO engine, cooling system of Katakhali 50MW peaking power plant	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Asique Rahman
23-08-2017	Fuel system, protection system and auxiliary system of Katakhali 50MW power plant	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Mahmudul Islam
24-08-2017	Amnura 132/33 KV grid substation	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. A.S.M. Mostafizur Rahman
25-08-2017	Auxiliary transformer, relays and circuit breaker of substation	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. A.S.M. Mostafizur Rahman
26-08-2017	Horogram 33/11KV substation	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr Md. Golam Kibria
27-08-2017	Gas turbine and its working Principle of Baghabari power plant	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. A.K.M. Tazedur Rahman
28-08-2017	Start up and shut down procedure of gas turbine	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Md. Bozlurur Rahman
29-08-2017	Fuel control, cooling and maintenance of gas turbine	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. A.K.M. Tazedur Rahman
06-09-2017	Energy distribution and metering test	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Abdullah-Al-Mamun
07-09-2017	Steam turbine and its working principle	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Rezaul Karim
08-09-2017	Boiler and turbine of Khulna power plant.	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Nahid Rahman
09-09-2017	Different stages of boiler panel and cooling system	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Arif Reza Khan
10-09-2017	Control system and fuel processing of steam turbine.	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Rezaul Karim
11-09-2017	Risk factor of Power sector and future of power sector	9:00 am - 1:00 pm and 2:00 pm - 6:00 pm	Engr. Hasina dilruba

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Chapter 1: Introduction

Power sector is one of the most important sectors of a nation. The economy of a nation is vastly depending on this sector. It is a great opportunity to accomplish internship in some power stations under BPDB Rajshahi training center. During our internship, we have visited three power stations and two substations. The power stations were Katakhali 50 MW peaking power plant, Baghabari 171 MW gas turbine power plant and Khulna 170 MW steam turbine power plant. The substations were 132/33 KV Amnura grid substation and 33/11 KV Horogram substation. We complete our internship from 21st August, 2017 to 29th August, 2017 and 6th September, 2017 to 11th September, 2017. During this time, we have learned about power generation, distribution and transmission processes of those power stations. We have also learned about the protection and control systems of those power stations and substations. This report is based on the experience gathered during our internship.

1.1 Objective

The primary objective of this internship is to complete the requirements for B.Sc. in Electrical and Electronic Engineering at East West University. Another objective is to get on-field exposure and acquire practical knowledge about power plants and related safety and protection systems.

1.2 Mission and Vision

BPDB is the owner of all the power plants in BPDB Rajshahi zone. So, mission and vision of the power plants is the same as BPDB. The main mission of those power plants is to deliver quality energy at reasonable and cheap charge and make some planning for future demand with professional attitude. Also increase the generation capacity of those power plants to make electricity available to all citizens. The main vision of those power plants is to generate electric power and dispatch same through transmission line of BPDB and to utilize available resources and capacity so that it can contribute towards the national economy through increasing generation of power.

1.3 Profile of Power Stations

We have visited three power plants and two substations during the internship. During our internship we visited two substations. One is Amnura 132/33KV grid project and other is

Horogram 33/11KV substation. The specifications of the power plants are given below in Table 1.1.

Table 1.1: Specifications of visited power plants [1]

Power plant name	Location	Type	Generation capacity	Generator terminated voltage	Transmitted voltage
Katakhali 50 MW power plant	Katakhali, Rajshahi	Diesel engine	50 MW	11 KV	132 KV
Baghabari 171 MW power plant	Sirajgong, Baghabari	Gas turbine	171 MW	11 KV	132 KV
Khulna power plant	Khalishpur, Khulna	Steam turbine	170 MW	11 KV	132 KV

1.4 Scope and Methodology

To prepare this report, we used notes, lectures, sketches, diagrams and templates provided by the mentors during the internship. We also used images and documents which were provided by the engineers of the power plants. Some of the pictures were also taken by us.

Chapter 2: Diesel Power Plant

2.1 Introduction

A power station with Heavy Fuel Oil (HFO) fired diesel engine generator has been set up by Bangladesh Power Development Board (BPDB) at Katakhali, Rajshahi. The year of establishment of this power plant was 2012. It is a peaking power plant and the capacity is 50 MW. It has six units and each unit generates 8.33 MW through the installed capacity is 8.73 MW.

2.2 Working Principle

Katakhali 50 MW diesel power plant uses two types of fuel, i.e. furnace oil as 'Heavy Fuel Oil' (HFO) and diesel as 'Light Fuel Oil' (LFO). First, the engine starts to rotate and sucks in air through the air intake system and then compress as the air. The HFO is supplied from the main storage tank to the day tank and then enters into engine. Inside the engine, the compressed air has high pressure and temperature. This air enters into the piston chamber and mixes with fuel. This creates a spontaneous combustion in the combustion chamber. Here the crankshaft is connected to the generator rotor. So as the rotor rotates, mechanical energy is converted to electrical energy through the generator of the engine. Basic flow diagram of the power plant is given below in Figure 2.1.

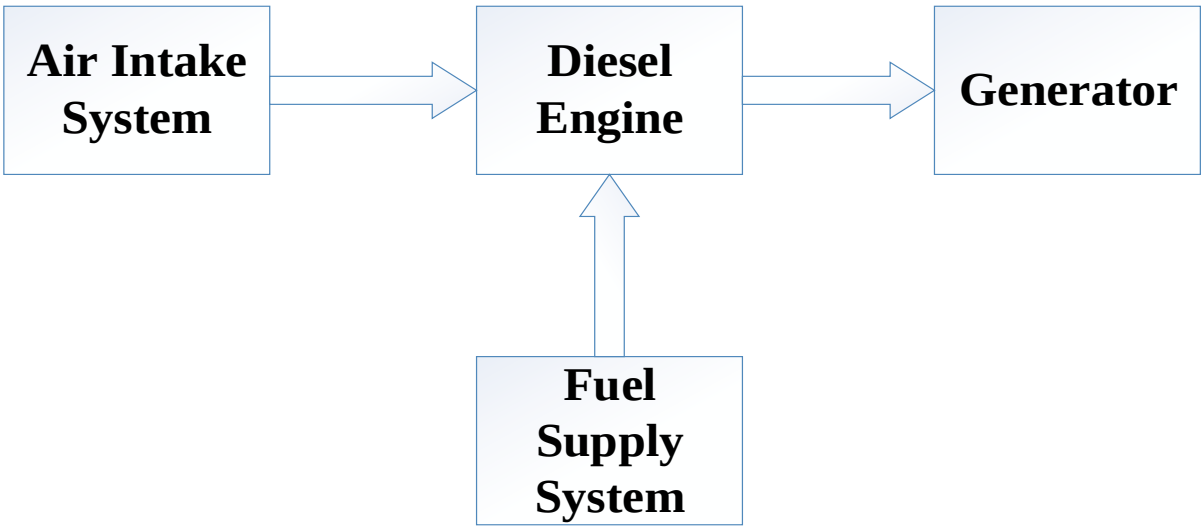

Figure 2.1: Basic flow diagram of Katakhali 50 MW power plant.

2.3 Fuel Processing

HFO (furnace oil) is used as the main fuel at Katakhali power plant. LFO (diesel) is also used only for starting the engine. After starting the engine, the supply of LFO is stopped and HFO is supplied through a valve for reducing the production cost. Furnace oil is slightly heavier than diesel fuel but shares similar heat-producing properties. But the cost of diesel is much higher than the furnace oil. So that, the use of furnace oil instead of diesel is cost effective.

There are two storage tanks (500 m^3) for diesel and two for HFO (5000 m^3). First, furnace oil comes to storage tank at a temperature of 40 - 45°C. Then, it goes to the buffer tank, where the temperature is 85°C. There is a HFO separator which is also used for purification, where the temperature is 90°C. After that, the pure oil goes to the day tank and the dust goes to slush tank. In the day tank, the temperature is maintained at a maximum of 100°C. Two pumps are used for controlling the process of supplying the fuel. Maintaining the temperature is very important for the stability of furnace oil. Because, furnace oil is turns into solid at low temperature. Figure 2.2 and Figure 2.3 is shows the HFO and LFO storage tank at Katakhali power plant respectively.

Figure 2.2: Storage tank for HFO at Katakhali power plant [2]

Figure 2.3: Storage tank for LFO at Katakhali power plant [2]

2.4 Diesel Engine

There are six diesel engines at Katakhali power plant. The engines are coupled with the generator. The engine rotates as the prime mover that drives the generator to produce electrical energy. The specifications of the engines are given below in Table 2.1, and Figure 2.4 shows one of the engines at Katakhali power plant.

Table 2.1: Specifications of engine at Katakhali Power Plant [3]

Manufacturer	MAN Diesel & Turbo SE
Cylinder Number	18
Rotating Speed	750 rpm
Fuel Acceptance	HFO, LFO

Figure 2.4: Front view of the diesel Engine at Katakhali power plant [2]

2.5 Generator

A Generator is a device which converts mechanical energy to electrical energy. There are six units of generator at Katakhali power plant. Each unit generates 8.33 MW, which is de rated capacity. So, the total generation is 6 x 8.33 MW = 49.98 MW although the installed capacity is 6 x 8.73 MW = 52.38 MW. The rated current of the generator is 550 A in totals. The generator is normally operated in a fully automatic mode and will start and take up load fully automatically.

2.6 Cooling System

There are two types of the cooling system at Katakhali power plant. One is the water cooling system, and another is the lube oil cooling system. Water cooling system also divided into two parts, i.e. external and internal. For the external cooling system, NaCl mixed into regular water. Here for NaCl, 1500 kg of salt needed in an hour. Two pipes are attached to each other where one contains heated water from the engine, and another contains the regular water. The regular water absorbs the heat from the heated water and goes to the storage which called as the underground pond. In the underground pond, the water ejects the heat into the air. Then, this water use again after mixing with NaCl for cooling, where use the same process which described above. For the internal cooling system, demi water is used because it has no extra particle. Demi water is the water in which the minerals and salts are removed. For that, it is safe for use internally in engines. Figure 2.5 is the picture of the demi water storage tank in Katakhali power plant.

Lube oil cooling system is used for internal cooling. Basically, lube oil is used to protect the internal parts. Lube oil spray is used to protect the bearing part from the friction.

Figure 2.5: Demi water storage tank at Katakhali power plant [2]

2.7 Auxiliary System

There is an auxiliary generator which is used to start the power plant in case of blackout. It's coupled with a diesel engine. It doesn't supply power to the grid. It is only used to run the auxiliary equipment which are needed to start the power plant. There is also installed CO_2 storage and a diesel water pump in case of fire protection. Also CT, PT and SF6 circuit breaker is installed in the power plant area.

2.8 Control Room

There is a control room of the power plant for controlling the processes and protection of the power plant. Basically, the manual tripping or automatic tripping of a relay or circuit breaker is maintained by the control room. When the temperature of exhaust gas reaches 550°C, a relay will automatically trip. Same situation will be happen when the temperature of HT (High Temperature) cooling water and LT (Low Temperature) cooling water reached at 95°C and 72°C respectively and for the nozzle, the maximum temperature is 90°C. Control room is also used to observe the whole systems and running conditions. Figure 2.6 shows the control room at Khatakhali power plant.

Figure 2.6: Monitoring section of control room (Katakhali power plant) [2]

Chapter 3: Gas Turbine Power Plant

3.1 Introduction

We visited a gas turbine power plant during internship at Baghabari, Sirajgonj which has a capacity of 171 MW. It has two units and their production capacities are given below in Table 3.1.

Table 3.1: Production capacity of visited gas turbine power plant at Baghabari [4]

Power plant name	Unit	Installed capacity (MW)	De rated capacity (MW)
Baghabari gas turbine power plant	Unit - 1	100	90
	Unit - 2	71	60

3.2 Working Principle

First, a starting motor is used to rotate the turbine and compressor shaft. The compressor shaft is used to draw the air from atmosphere and compress it as required. Then, the air is mixed with fuel and goes to the combustion chamber. Here, natural gas is used as fuel. In the combustion chamber, as the fuel ignites, the temperature and the pressure become high. Then, the flue gas goes to the turbine to rotate. Flue gas is a mixture of gases produced by burning of fuel in the power station. Here, a rotor of a three phase AC generator is connected with the turbine. So the rotor starts to rotate with the rotation of the turbine. For that, the mechanical energy is converted into the electrical energy. Here, Figure 3.1 is the basic flow diagram of Baghabari gas turbine power plant.

3.3 Fuel Processing

In Baghabari power plant, gas mixed with air is used as fuel. The ratio of air and gas mixture in the combustion chamber is 10:1. An air filtering process is used for collecting air from the nature. Through this process, the dust and other particle of air is reduced and the fresh air is collected. Then the fuel goes to burners by an injecting valve. Two valves are used to control the fuel system, i.e. SRV (Speed Ratio Valve) and GCV (Gas Control Valve).

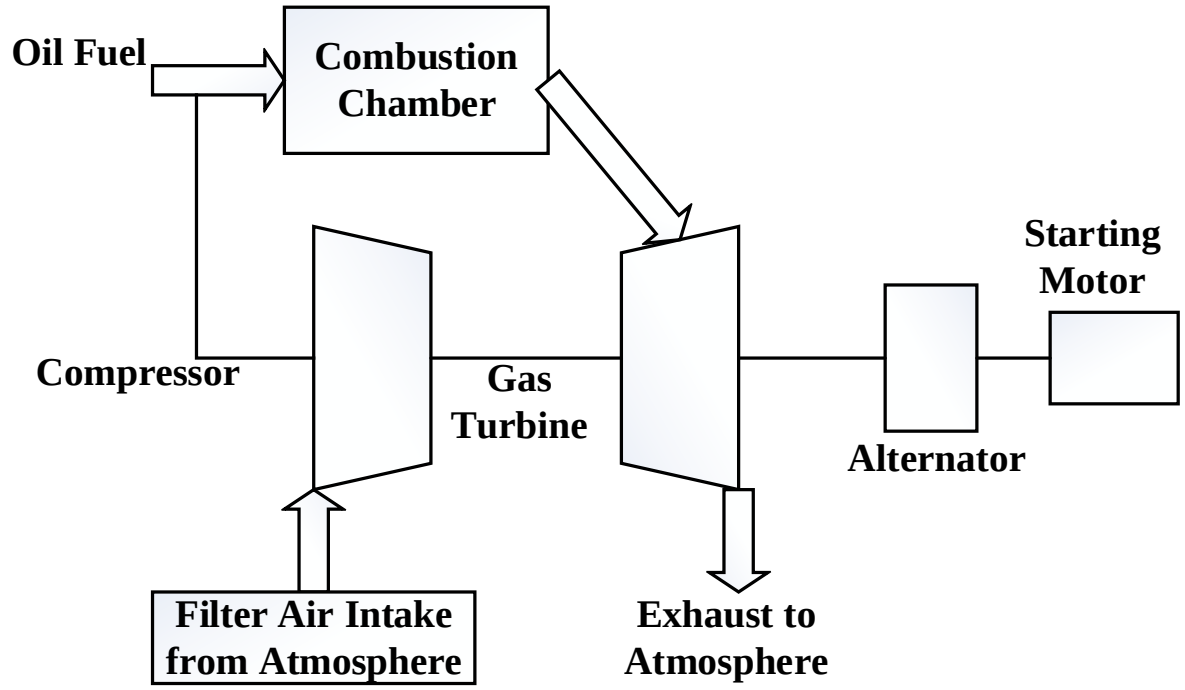

Figure 3.1: Basic flow diagram of Baghabari Gas turbine power plant.

3.4 Generator

Baghabari gas turbine power plant has two generating units. The specifications of the generators are given below in Tables 3.2 and 3.3. Here, Figure 3.2 shows the generator at Baghabari gas turbine power plant.

Table 3.2: The specification of 100 MW generator in Baghabari power plant [4]

Type	TARI 1080-36P
Model	PG 9171E
Apparent power	134.25 MVA
Real Power (Rated)	107.4 MW
Stator Voltage	11 kV
Stator Current	7046 A
Rotor Voltage	350 V
Rotor Current	811 A
Speed	3000 rpm
Pole	2
Frequency	50 Hz
Phase	Y

Table 3.3: The specification of 71 MW generator in Baghabari power plant [4]

Model	PG 9111B
Real Power (Rated)	75 MW
Stator Voltage	11 kV
Speed	3000 rpm
Pole	2
Frequency	50 Hz
Phase	Y

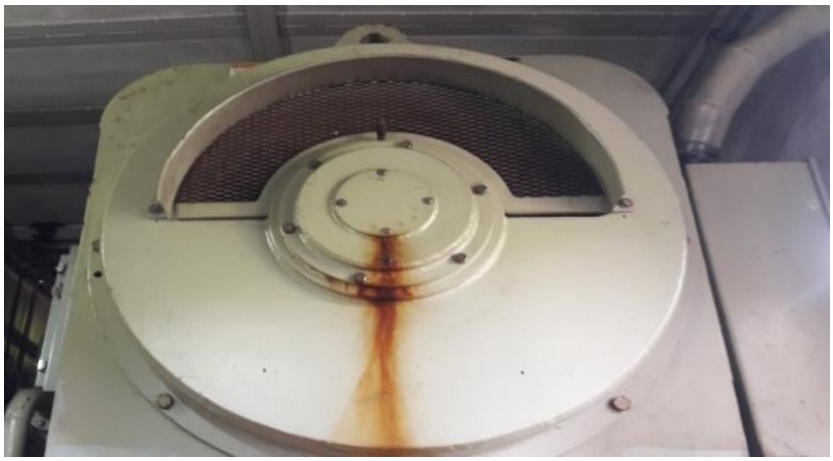

Figure 3.2: Front view of 100 MW generator at Baghabari power plant [2]

3.5 Turbine

A turbine is a rotary mechanical device that extracts energy from a fast moving fluid flow and converts it into mechanical work. A gas turbine is a combustion engine that can convert natural gas into mechanical energy. Here, the fuel is turned into flue gas by burning. First, the air is compressed by a compressor and mixed with the gas or fuel and goes to the combustion chamber. In the combustion chamber, this fuel is named as flue gas and this flue gas passes through a connector to the turbine to rotating the turbine. There is a valve which controlled the amount of flue gas. When it starts to rotate, the speed of turbine continuously rises and meets some conditions. Those are given below in Table 3.4.

There are three stage of moving blades in a gas turbine. The flue gas passes through the blades and goes to chimney. This gas is known as exhaust gas and the temperature is 540°C.

A gas turbine has two main components. One is turbine rotor and another is turbine stator. Turbine rotor consists with two wheel shaft and turbine stator consists with turbine shell and

exhaust frame. Figure 3.3 shows the coupling part of gas turbine with generator at Baghabari power plant.

Table 3.4: Speed (turbine) and conditions of Baghabari gas turbine power plant [4]

Speed (rpm)	Condition
0	Starting motor on
750	Ignition on the combustion chamber
1600	Starting motor off
2300	Excitation on stator
3000	No load Condition

Figure 3.3: The coupling part of gas turbine with generator at Baghabari power plant [2]

3.6 Auxiliary Systems

A 1.3MW generator is used for initial starting of the plant. A gas booster is also installed at Baghabari Gas turbine power plant. Normally, the pressure in combustion chamber has to be maintained at 18 to 22 bar. When the pressure falls, the gas booster is used for boost the pressure. The gas booster has the ability to boost the pressure from 10 bar to 22 bar.

In Baghabari gas turbine power plant, lube oil is used for cooling. Lube oil is used to protect the internal parts such as the bearing from wearing out too quickly due to friction. The front view of lube oil system at Baghabari power plant is shown in figure 3.4. Here, we can see the storage tank of lube oil and the supply pipes of lube oil in the picture.

Figure 3.4: The front view of lube oil system at Baghabari power plant [2]

Chapter 4: Steam Turbine Power Plant

4.1 Introduction

We visited a steam turbine power plant during internship at Khalishpur, Khulna which has a capacity of 170 MW. It has two units and their production capacity is 110 MW and 60 MW respectively. This plant is run by furnace oil as Heavy Fuel Oil (HFO) and now it is shut down for lack of fuel.

4.2 Working principle

First, water is collected from the nearby river and purified. Then it goes to the water tube boiler through the feed pump. From condenser to boiler, the water passes Seal steam Condenser (SSC), five Low Pressure Heaters (LPH), Gland Steam Condenser (GSC), feed water tank through deaerator, two High Pressure Heater (HPH) and two economizers. The pressure of the feed water pump is 200kg/cm^2 and the required pressure of boiler drum is 161kg/cm^2. This water is turned into steam through heating and HFO is used as fuel to the boiler. There are two tanks for HFO, one is the storage tank and another is the service tank. HFO is injected from the storage to the service tank through an injection valve. This injection valve is also used to maintain the fuel level. Then, the HFO goes to the boiler from the service tank. There is a heater in the storage tank to maintain the temperature (160°C - 250°C) of HFO. The steam generated in the boiler drum does not yet rotate the turbine. In the boiler drum, the average viscosity of the fuel is 12 – 18 cSt (centistokes) where 1 cSt = 10^{-6} m^2 s^{-1}. Now, the steam is heated by four super heaters and gains more temperature and pressure. The temperature is raised upto 90°C to 120°C and the pressure is around 40kg/cm^2. This heated steam rotates the turbine. As the steam rotates the turbine, it loses pressure and temperature and a reheater is used to raise the temperature and pressure. The turbine is coupled with the generator which produces electricity. Figure 4.1 shows the basic flow diagram of Khalispur steam turbine power plant.

Seal Steam Condenser (SSC) is used to prevent steam leakage from steam turbine and air infiltration into the steam turbine. Gland Steam Condenser (GSC) collects condensate and steam calories as well as creation of vacuum state inside of Seal Steam System (SSS). Low Pressure Heaters (LPH) are heat exchangers. The work of LPH is to extract steam from the low pressure turbine end and heat the feed water. The pressure rating range of LPH is

30kg/cm^2 - 100kg/cm^2. HPH is installed after the boiler feed pump and heats the feed water by exchanging heat with the steam that is extracted from the high pressure turbine end. The pressure rating range of LPH is 100kg/cm^2 - 300kg/cm^2.

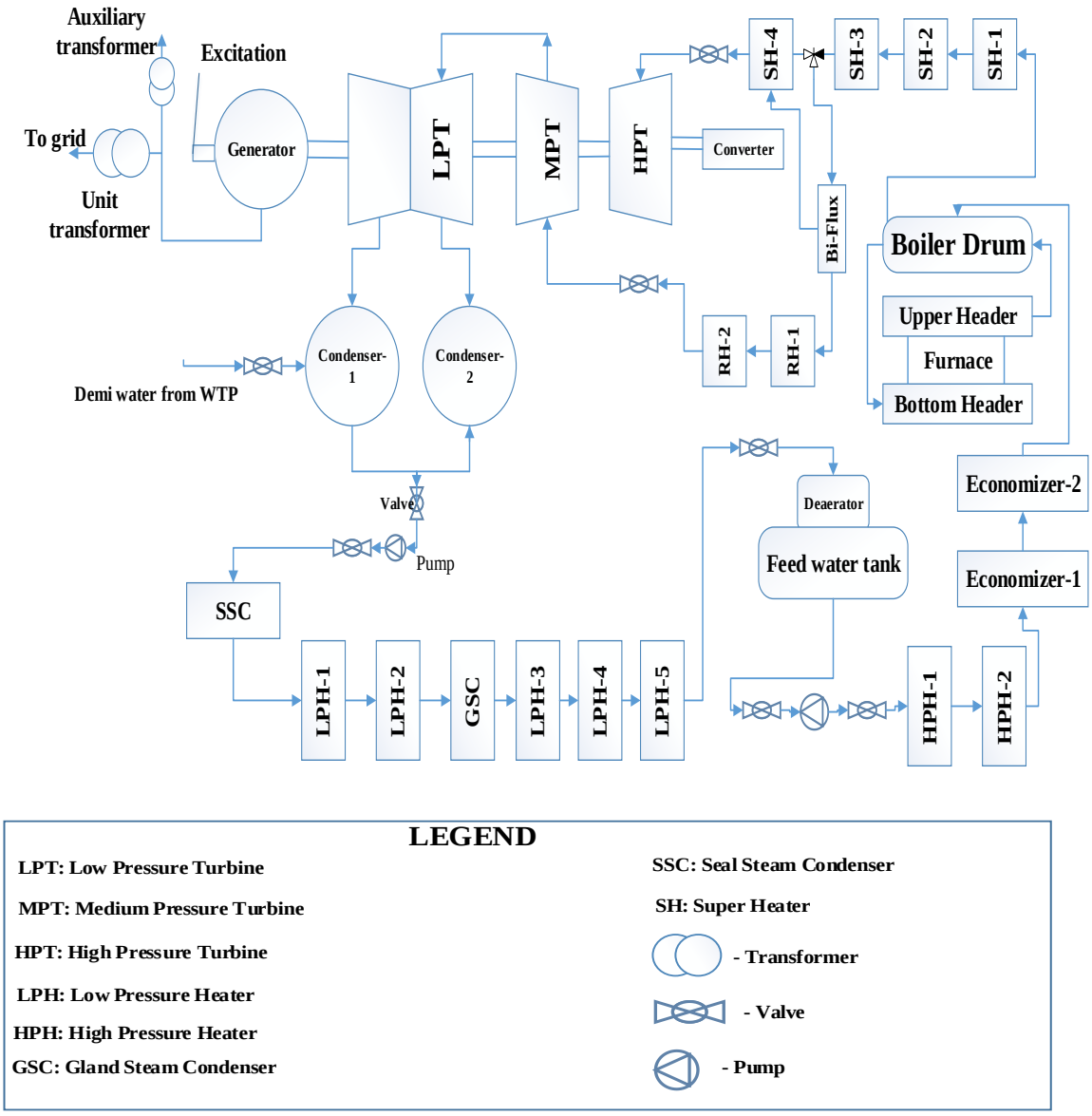

Figure 4.1: Basic flow diagram of Khulna steam turbine power plant

4.3 Generator

Khulna steam turbine power plant has two generating units. The specifications are given below in Tables 4.1 and 4.2.and Figure 4.2 shows the 60 MW generator at Khulna power plant.

Table 4.1: The specification of 110 MW generator in Khulna power plant [5]

Type	HY. 644840/2HH
Apparent power	137 MVA
Real Power	110 MW
Stator Voltage	10.5 ± 5% kV
Stator Current	7560 A
Rotor Voltage	20-100-346 V
Rotor Current	80-468-1325 A
Speed	3000 rpm
Frequency	50 Hz
Phase	Y
Power Factor	0.8

Table 4.2: The specification of 60 MW generator in Khulna power plant [5]

Type	H 632810 / 2 HH
Apparent power	75 MVA
Real Power	60 MW
Stator Voltage	11 ± 7.5% kV
Stator Current	3940 A
Rotor Voltage	75-240 V
Rotor Current	370-1000 A
Speed	3000 rpm
Frequency	50 Hz
Phase	Y
Power Factor	0.8

4.4 Turbine

A steam turbine extracts thermal energy from pressurized steam and uses it to produce mechanical energy on a rotating output shaft. Here, also the turbines are coupled with generators. First, steam goes through a mechanical system and loses some pressure and thermal energy. The low pressure steam and high pressure steam are produced in the boiler. In Khulna steam power plant, the turbine is combined of both impulse and reaction type. The

impulse arrangement is made up of a ring of nozzles followed by a ring of blades. The high-pressure, high-energy steam is expanded in the nozzle to a lower-pressure, high-velocity jet of steam. This jet of steam is directed into the impulse blades and leaves in a different direction. The changing direction (and therefore velocity) produces an impulsive force which mainly acts in the direction of rotation of the turbine blades. The reaction arrangement is made up of a ring of fixed blades attached to the casing, and a row of similar blades mounted on the rotor, i.e. moving blades. The blades are mounted and shaped to produce a narrowing passage which, like a nozzle, increases the steam velocity. This increase in velocity over the blade produces a reaction force which has components in the direction of blade rotation and also along the turbine axis. There is also a change in velocity of the steam as a result of a change in direction. The efficiency is maximum 30%. During the internship, we collect an 110MW steam turbine specification which is given in Table 4.3 though this power plant has also a 60 MW steam turbine.

Table 4.3: Specifications of 110 MW steam turbines [5]

Type No	Steam turbine K 110-130
Type	Condensing turbine/TPP
Rated Capacity	110 MW
Speed	3000 rpm
Manufacturer	Škoda Turbines
Efficiency	30%
Inlet steam temperature	525℃
Inlet steam pressure	13 MPa
Reheat steam temp.	525℃

There are three stages of turbine for 60 MW units and 110 MW units and they are

1. High Pressure Turbine (HPT)
2. Intermediate Pressure Turbine (IPT)
3. Low Pressure Turbine (LPT)

First, the superheated steam directly enters into HPT, and it takes a vast amount of vapor to displace the blades to rotate the shaft. To hit the blades, steam needs high pressure and temperature. So at this stage, the pressure and the temperature falls down. Turbine blades are small, so it requires high pressure and temperature with a high volume. In HPT, the expansion of volume takes place, and the pressure falls. So there is a need to use a turbine

which is designed for the lower pressure of steam. After hitting the HPT, steam comes to the reheater, then it enters into IPT which has a low pressure than HPT, but the blades of IPT are larger than the blades of HPT. In IPT, the reheated steam expands with less energy. After IPT, the steam enters the LPT, then it starts to expand with less energy continuously. The blades of LPT are larger than the blades of IPT. It expands steam and enters into the condenser. Figure 4.3 shows the turbine blades for 60 MW unit at Khulna power plant.

Figure 4.2: Side view of 60 MW generator at Khulna power plant [2]

Figure 4.3: Turbine blades for 60 MW unit at Khulna power plant [2]

4.5 Boiler

Boiler is a device which generates steam at fixed temperature and pressure. The steam which comes from the boiler is used to rotate the turbine. In Khulna power plant, there is one water tube boiler which requires demi water, flue gas transmission at fixed temperature and pressure and maximum utilization of heat and fuel. First, demi water passes through the tubes and flue gas transmits the heat to water tubes. So, steam is produced, and HFO is used as fuel to operate the boiler. Table 4.4 shows the configuration of the boiler at Khulna steam turbine power plant.

Table 4.4: Configuration of the boiler at Khulna steam turbine power plant [5]

Boiler type	Water tube
Feed water temperature	246°C
Normal working temperature	530°C
Maximum evaporation capacity	500 ton/hour
Maximum allowable steam pressure	161 kg/cm^2
Efficiency	38%

There are two parts in this boiler, i.e. furnace and boiler drums. Figure 4.3 shows the opening gate of furnace at Khulna power plant. There is a chamber where the fuel burnt is called furnace. The furnace walls are made of refractory materials such as fire clay, silica, kaolin etc. The mixture of fuel and air on the furnace is burnt by combustion process. When the steam gains the temperature of 1800°C to 2200°C, it provides heat to the water tube to make more steam. Then, the boiler drum is used to reserve the steam and water. The steam goes to the turbine for rotating the shaft. In the boiler drum, there is a water management level. When the level is minimum, the plant will trip.

4.6 Super Heater and Reheater

Super heater is a type of device which heats the steam to raise its temperature above the boiling point. There are four super heaters to heat the steam in Khulna power plant. Super heater is basically a group of tubes carrying hot flue gas. The saturation temperature is 538°C. First, the wet steam is dried at same temperature and pressure. Then the temperature increases at a constant pressure. This principle increases the overall efficiency.

Reheater is basically a device which provides the heat to holding the saturated temperature. The main purpose of reheater is to avoid excess moisture in steam. There are two reheaters in Khulna power plant.

Figure 4.4: The opening gate of furnace at Khulna power plant [2]

4.7 Auxiliary Components and Systems

There are some auxiliary components such as economizer, induced draft (ID) fan, forced draft (FD) fan, chimney and systems such as cooling system in Khulna power plant whose play vital role in the system.

An economizer consists of large number parallel steel tubes. The economizer is connected on the headers of boiler drums. The feed water flows through these tubes and the flue gases flows outside. So that, the heat of flue gases is transferred to the feed water. For that, the temperature of feed water increases. So, the main purpose of the economizer is to absorb some amount of heat.

Induced draft fan (ID fan) is located between dust collector and chimney. It handles the flue gas and induced low the pressure. And forced draft fan (FD fan) sucks air from atmosphere.

Chimney is a structure which emits the flue gas. The flue gas is going through some sucking process and then emit to the nature without harmful objects. Figure 4.5 shows the structure of chimney at Khulna power plant

Figure 4.5: The structure of chimney at Khulna power plant [2]

Water, hydrogen and lube oil are used for cooling. In water cooling process, there are installed some water tubes besides the stator winding which are carrying demi water. A pump is used to supply the water. Hydrogen is used to cooling the rotating parts and internal parts of generator. Hydrogen gas absorbs the heat from the internal parts and transfer heats to the water tube. Lube oil is used to cool the internal bearing parts.

Chapter 5: Substation

5.1 Introduction

Substation is a part of power sector which transmit and distribute the electricity. It receives electric power from generating stations via transmission lines and delivers the power via the outgoing transmission lines. It is an integral part of a power system and it forms important links between electrical generation, transmission, distribution system, and load points, where voltage is transformed form high to low or low to high. During our internship, we visited two substations, one is Amnura 132/33 KV grid project and the other is Horogram 33/11 KV substation.

Amnura 132/33 KV grid project is a double bus bar project under PGCB. It is basically a transformer substation as only the voltage level is changed. A 132 kV single circuit pole line from Rajshahi to Chapainawabganj enters into Amnura substation on single circuit pole line, which is 15 km long known as 132/33 kV AIS (Air Insulated switchgear). The incoming line is 132 KV and it transformed by a step down transformer to 33 KV which is used to distribute. So, the power is transferred to the system of the grid and after fulfilling the requirements it distributes to the customer. [6]

Horogram 33/11 KV substation is a single bus bar project under PGCB which has three incoming line of 33 KV from three different places. Then a step transformer is used to transformed the 33 KV into 11 KV and then distribute through public demand. Who have demand more than 50 KW are generally supplied power at 11 kV for further handling with their own substations. Transformer is the main equipment of this substation.

5.2 Bus Bars

Bus bars are conductor or a group of conductors, which collect electric power from the incoming feeder and distribute them to the outgoing feeder. During our internship, we saw double bus bar at Amnura grid project and single line bus bar at Horogram substation. Double bas bars are connected in parallel. There is an advantage of double bus bars. The system is connected to two separate circuit breaker compartments, each fitted with a circuit breaker. This system is achieved using single bus bar switchgear connected in a back-to-back or front-to-front arrangement, with a common cable connection for the incoming or just to the feeder cable. If any fault occurs for load interruption in one line, the other lines are working and the

fault can be solved or repair without any hazard [6]. Figure 5.1 is shows the double bus bar at Amnura grid project and Figure 5.2 shows the single bus bar at Horogram substation.

Figure 5.1: Double bus bar at Amnura grid project [2]

5.3 Insulator

Insulator is a type of material which does not allow the free movement of electric charges. An insulator resists electricity due to their high resistivity. But, in practical cases, insulators contain small numbers of free charges that can carry current. So, at a high voltage, the insulation will be break down. This is called the break down point of an insulator. There are different sizes of insulator for different breakdown voltages. Insulators can be different types, such as, disk type insulator, pin type insulator, gie type insulator, shackle type insulator etc. Disc type insulators are used in 33 KV distribution lines where each insulation voltage is 11 KV. Pin type insulators are devices that isolate a wire from a physical support such as a pin on a pole. Shackle type insulators are usually used in low voltage distribution network both in horizontal and vertical positions and the conductor in the groove of shackle insulator is fixed with the help of soft binding wires. Gie type insulators are attached with the polewhich detaches the line pole from the ground. Figure 5.2 shows the disc type insulator at Amnura grid project. [6]

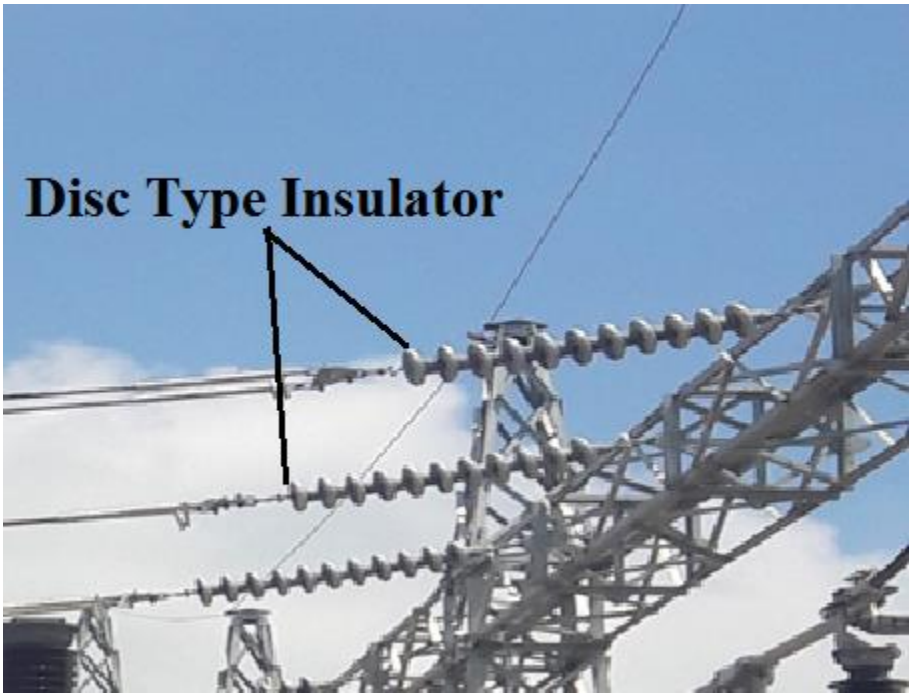

Figure 5.2: Disc type insulator at Amnura Grid Project [2]

5.4 Isolator

Isolator is a manually operated mechanical switch to isolate the faulty part from the system for repairing. It is designed to open a circuit under no load. When the isolator opens, there is a chance to create arc and it could be harmful for the systems. For overcome this problem, the isolator keeps close. Figure 5.3 shows the isolator at Amnura grid project. [6]

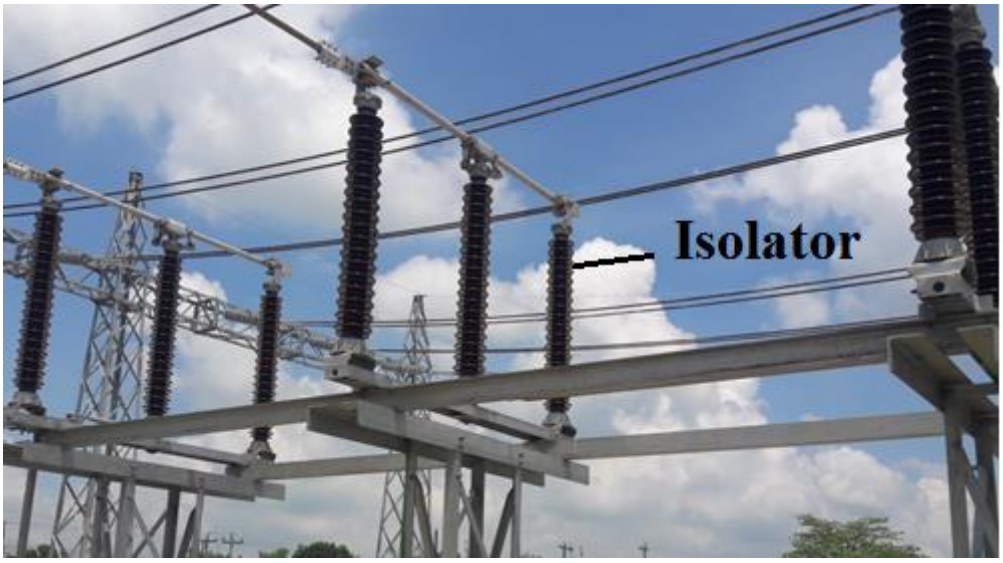

Figure 5.3: Isolator at Amnura grid project [2]

5.5 Power Transformer

Special type of transformers which are actually used to step up or step down the voltage are called power transformer. Basically, for transmission purposes, some substations of power station uses step up transformers and, some uses step down transformers for distribution. There are two power transformers in Amnura grid project with the same ratings. Figure 5.4 shows the power transformer at Amnura grid project

Figure 5.4: 132/33KV power transformer at Amnura grid project [2]

Also, there are two power transformers in Horogram substation of different ratings. Figure 5.5 shows the 33/11 KV power transformer at Horogram substation.

Figure 5.5: 33/11KV power transformer at Horogram substation [2]

5.6 Current Transformer and Potential Transformer

Current transformer is a type of transformer which is used to step down the current, so, it steps up the voltage. For that, it can be called step up transformer. Current transformer is used for measuring the current. Figure 5.6 shows the picture of current transformer at Amnura grid project. [6]

Potential transformer is a type of transformer which is used to step down the voltage to a desired value for used in low ratings meters and relays. [7]

Figure 5.6: Current transformer at Amnura grid project [2]

5.7 Circuit Breaker

Circuit breaker is a protective device which protects the systems, equipment and line from over current and over voltages. Circuit breakers operate automatically, when a fault occurs, and sends a signal for tripping the circuit. There are three type of circuit breaker in those substations. They are

1. Minimum oil circuit breaker
2. Vacuum circuit breaker
3. SF_6 circuit breaker

5.7.1 Minimum Oil Circuit Breaker

In oil circuit breakers, a fixed contact and a moving contact are immerged inside the insulating oil. The oil has better insulating properties than air. When the arc is created, the contacts get separated the oil is vaporized. We saw this type of circuit breakers in Horogram substations connected with the incoming lines. [7]

5.7.2 Vacuum Circuit Breaker

In vacuum circuit breaker, the arc is extinguished in vacuum. This technology is suitable for medium voltage applications. The operations of opening and closing of current carrying contacts and the arc interruption is called vacuum interruption. The pressure is 10^{-6} bar inside the vacuum. When the contacts start separating, there is a hot spot due to the high current flow. The metal of the contact vaporize due to hot spot and creates a conducting media. The current is increased but the contacts are separated and no metal vapor for conducting media. Figure 5.7 shows the vacuum circuit breaker at Horogram substation. [7]

Figure 5.7: Vacuum circuit breaker at Horogram Substation [2]

5.7.3 SF_6 Circuit Breaker

A circuit breaker in which the current carrying contacts operate in sulphur hexafluoride or SF_6 gas is known as SF_6 circuit breaker. A SF_6 circuit breaker consists of fixed and moving contacts enclosed in a chamber. The chamber is called arc interruption chamber which is fully contains with SF_6 gas. A valve mechanism is there to control the gas to the arc interruption chamber. When the contacts of breaker are opened, the valve mechanism permits a high pressure SF_6 gas from the reservoir to flow towards the arc interruption chamber. In the closed position of the breaker, the contacts remain surrounded by SF_6 gas. When the breaker operates, the moving contact is pulled apart and an arc is struck between the contacts. Figure 5.8 shows the SF_6 circuit breaker at Amnura grid project. [6]

Figure 5.8: SF_6 circuit breaker at Amnura grid project [2]

5.8 Lightning Arrester

Lightning arrester is a protective device which conducts the high voltage surges on the power system to the ground. It is useful in case of lightning. When the lighting falls on the bus bars a conduction path is connected to the ground for passes the high voltages to the ground through the connector. Figure 5.9 shows the lightning arrester at Amnura grid project. [6]

Figure 5.9: Lightning arrester at Amnura grid project [2]

5.9 Relays

An automatic device which senses the abnormal condition of any electrical circuit and closed its contact is known as relay. It is a small low voltages control device. It consists of a coil which get excited and send a trip signal. Figure 5.10 shows the front view of relays in control room at Amnura grid project. [6]

Figure 5.10: The front view of relays in control room at Amnura grid project. [2]

5.10 Metering System

There are many types of meters connected with generation, transmission and distribution sectors. In our internship, we learnt about the distribution side metering system where they use energy meter. Energy meter is used to measure the amount of power consumed by a load. We learn about two type of meter. They are

1. Single phase meter
2. Three phase meter

5.10.1 Single Phage Meter

In our country, single phase meters are widely used in households. Typically single phase lines carry 230V voltage. The configuration of a single phase meter is very easy. It can be mounted on the 230V single phase line, where one of two connections is for incoming 230V live line and other one is for neutral line. The range of current is 10A - 40A for analog and 10A - 60A for digital meter. The meter constant is 1600 imp/kWh (that means, 1600 impulses per kilowatt hour) for digital single phase meter. There are two types of classes for these meters. Class 1.0 and Class 2.0 where accuracy of Class 1.0 is better than Class 2.0. A digital meter has the ability to measure electricity passes through two different points and record the highest one. Figure 5.11 shows the picture of single phase analog meter and Figure 5.12 shows single phase digital meter. [1]

Figure 5.11: Single phase meter (analog) [2]

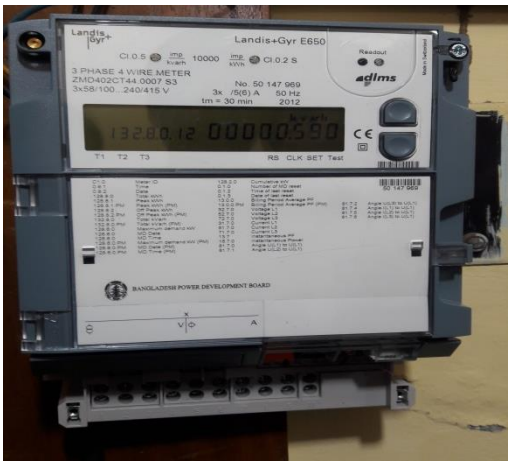

Figure 5.12: Single phase meter (digital) [2]

5.10.2 Three Phase Meter

Three phase connection is usually used in industrial purposes or any place where three phase connection is needed. Typically in a three phase connection, each phase carries 230V respect to neutral. The line to line voltage is 400V. The configuration of a three phase meter is quite different from single phase meter. There are total 4 points for input where 3 points are for three phases and another one is for neutral. The rated current is 10-60A. The meter constants are 1000 imp/kWh and 1000 imp/kVARh (that means, 1000 impulse per kilovolt amperes reactive hour.). There are also two types of classes for these meters, Class 1.0 and Class 2.0. These classes indicate the accuracy level, where accuracy of Class 1.0 is better than Class 2.0. Figure 5.13 shows three phase digital meter. [1]

Figure 5.13: Three phase meter (digital) [2]

Chapter 6: Conclusion

From the internship, we gathered practical knowledge about power sector. We learned about the generation, transmission and distribution of the power. Throughout our internship, we visited diesel power plant, gas turbine power plant and steam turbine power plant. We got an overall idea about the working principle and equipment in these power stations. From the substations, we learned about different types of protection systems. The practical experience will be helpful for our future career and profession in the power sectors.

Throughout the internship, we confronted some issue. We faced problems regarding taking pictures. Also, we did not get any safety equipment.

References

[1] Documents and information provided by BPDB Rajshahi training center.

[2] Picture was captured by us during internship.

[3] Documents and information provided by Katakhali power plant.

[4] Documents and information provided by Baghabari power plant.

[5] Documents and information provided by Khulna power plant.

[6] Documents and information provided by Amnura grid project.

[7] Documents and information provided by Horogram substation.

Appendix A: Daily Activity Report

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:	BPDB
Name of the student:	Shabnam Sultana
):	2013-2-83-015

Date:	21-08-2017
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Rajshahi training, BPDB Rajshahi
Mentor:	Engr. Shoayeed Muhammad Shaikh

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of the day's activities are to discuss about BPDB and know about power sector of Bangladesh. know about the Basic principles of HFO plants.

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.

There are three Parts of Power sector in Bangladesh — generation, transmission and distribution, know about HFO Plant as Peaking Power Plant and the working Principle of HFO Plant when it comes in action.

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

Our today's Practical activities is much related with the course EEE 441 (Power Station)

Signature of the mentor with date
Name:
Designation: সহকারী প্রকৌশলী
Contact Phone #: কাটাখালী ৫০ মেঃ ওঃ পিকিং বিদ্যুৎ কেন্দ্র
বিউরো, রাজশাহী

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Shobnom Sultan
):	2013-2-83-015

Date:	22-08-2017
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Katakhali Power plant
Mentor:	Engr. Asique 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)

The objective of the day's activities are to visit a Peaking power station and discuss about generator, HFO engine, cooling system of katakhali Peaking power plant.

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.

There are 6 units of generator in katakhali 50MW Peaking power plant and each Unit has a capacity of 8.33MW. So the total generation is 49.8MW and output is 11kV.
There are Six diesel engine ASD 18V 32/40 32/40 MAN which works as a Prime mover. Turbine rotate at 3000 rpm.

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

Our today's practical activity is relate with the course EEE 301 (Electrical machine Fundamen and EEE 304 (Synchronous machines and Power system Fundamental)

Signature of the mentor with date
Name: আসিক রহমান
Designation: আই.ডি.নং-১-১২৯৫ নির্বাহী প্রকৌশলী (পরিচালন)
Contact Phone # কাটাখালী ৫০ মেঃ ওঃ পিকিং বিদ্যুৎ কেন্দ্র বিউরো, রাজশাহী

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Shabnam Sultana
	2013-2-83-015

Date:	23-08-2017
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Katakhali power plant
Mentor:	Engr. Mahmudul Islam

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of the day's activities are to know about the Protection and Auxilians system, fuel system. Discuss about the control system, startup and shutdown Procedure of katakhali 50MW Peaking Power Plant, katakhali Rajshahi.

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.

If blackout occur then Auxiliary generator is used to start the power station. Diesel water pump is used for any kind of firing. To protect the output CT, PT, SF_6 are used. There are two type of fuel → HFO and LFO. which are store in storage tank, buffer tank and day tank.

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

Our today's Practical activity is relate with the course EEE 441 (Power station)

23.08.17

Signature of the mentor with date
Name: উপ-বিভাগীয় প্রকৌশলী (সংরক্ষণ)
Designation: কাটাখালী ৫০ মেঃ ওঃ পিকিং বিদ্যুৎ কেন্দ্র
Contact Phone #: বিউবো, রাজশাহী।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Shobnom Sultana
):	2013-2-83-015

Date:	24-08-2017
Start time/End time	9:00-11:00 and 14:00-18:00
Location:	Amnura Coal Project
Mentor:	Md Engr. Md Mastafizur 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)

The objective of the day's activities are to know about Power Grid system of Bangladesh at 132/33 kV Amnura Grid. Function of grid system and working principle.

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 Amnura grid. Chapainawabgonj, we know about 132/33 kV single line diagram. Discuss about distribution transformer 132/33 kV, current transformer, potential transformer and lighting arrester, isolator, SF_6 circuit breaker.

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

our today's practical activity is relate with the course EEE 441 (Power station)

24.08.17

Signature of the mentor with date
Name: A.S.M. Mostafizur Rahman
Designation: Executive Engineer, ID # 00313
Contact Phone #: Amnura 132 kV SS and Associated Transmission Line Project, PGCB, Dhaka.

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Shobnom Sultana
):	2013-3-80-002

Date:	25-08-2017
Start time/End time	9:00 – 13:00 and 14:00 – 18:00
Location:	Bonnona grid project
Mentor:	Engr. Md Mostafizur 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)

the objective of the day's activities are to know about protecting relaying at 132/33kV grid project of Amnura and visit the control room.

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.

know about over voltage, over current, under voltage, under current protection, Auxiliary transformer direct 33+6.6 kV DC.

In the grid there are a control room with CB and Protective relay.

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

our today's practical activity is ~~rele~~ ~~of~~ much relate with the course 442 (EEE) (Power station)

25-08-17

Signature of the mentor with date
Name: A.S.M. Mostafizur Rahman
Designation: Executive Engineer, ID # 00313
Contact Phone #: Amnura 132 kV SS and Associated Transmission Line Project, PGCB, Dhaka.

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Md. Shahnukh Hassan
):	2013-3-80-009

Date:	26-08-2017
Start time/End time	09:00 - 13:00 and 14:00 - 18:00
Location:	Honognam sub-station, Rajshahi
Mentor:	Md. Golam Kibria

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of todays activities were distribution system, operation and function of 33/11 kV Hanogram sub station.

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.

1) 33/11 kV Honogram Substation:
   i) Step down transformer - 2 unit
   ii) 33/0.4 kV Auxilialy transformer
   iii) CT, PT
   iv) Lighting arrester
   v) Circuit breaker)

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

Related to EEE 442 (Switch gear and protective relaying)

Signature of the mentor with date
Name: সহকারী প্রকৌশলী
Designation: রাজশাহী প্রশিক্ষণ কেন্দ্র
বিউবো, রাজশাহী।
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation: Dr. Muhammed Mazharul Islam
Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Md. Shahrukh Hasan
ID	2013-3-80-002

Date:	27-08-2017
Start time/End time	9:00 - 13:00 and 14:00 - 18:00
Location:	Baghabari Power plant
Mentor:	Engr. A.K.M Tazedur 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)

The objective of today's activities were to know working principle, maintanance of turbine of Baghabari Power plant.

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.

- Baghabari Powe plant : i) Gas turbine
  ii) 171 mw (100 MW & 71 MW)
- Turbine : i) 3000 rmp
  ii) 2 pole
- Used gas booster.

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

Related to EEE 441

27.08.2017

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

নির্বাহী প্রকৌশলী (পরিচালন)
বাঘাবাড়ী বিদ্যুৎ কেন্দ্র
বিউরো, বাঘাবাড়ী, সিরাজগঞ্জ।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Md. Shahrukh Hassan
ID:	2013-3-80-002

Date:	28-08-2017
Start time/End time	9:00 to 13:00 and 14:00 to 18:00
Location:	Baghabari Power Plant.
Mentor:	Md. Bozlurur 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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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 todays activities wea the start up and shut down procedure of Baghabari gas turbine power plant.

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) Used shartup motor for initial starting. Then the turbine reach at 1600 rpm. Then the motor removed.

ii) For shutting down first whole auxiliary system will be shut down. Shut down is preferred for only maintainance.

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

Related to EEE 442 (Switch gear and Protective relaying)

28/08/2017

Signature of the mentor with date
Name: সহকারী প্রকৌশলী
Designation: বৈদ্যুতিক সংরক্ষণ ও আইএন্ডসি বিভাগ
Contact Phone #: বাঘাবাড়ী বিদ্যুৎ কেন্দ্র, বিউপো
বাঘাবাড়ী, সিরাজগঞ্জ।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Md. Shahrukh Hasan
ID:	2013-3-80-002

Date:	29-08-2017
Start time/End time	9:00 - 13:00 and 14:00 - 18:00
Location:	Baghabari Power plant
Mentor:	Engr. A.K.M Tazedur 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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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 todays, activities were known about fuel control system, cooling system, turbine cooling system maintananee.

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.

- Fuel control system: I) SRV (Speed ratio valve)
  II) GCV (Gas control valve)
- Cooling system: I) Used Lube oil
- Control room: There is a control room to control the whole system.

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

Related to EEE442 (switch gear & protecting relaying)

29.08.2017

Signature of the mentor with date
Name:
Designation: নির্বাহী প্রকৌশলী (পরিচালন) বাঘাবাড়ী বিদ্যুৎ কেন্দ্র বিউবো, বাঘাবাড়ী, সিরাজগঞ্জ।
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation: Dr. Muhammed Mazharul Islam
Assistant Professor
Department of Electrical and Electronic Engineering

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:	BPDB
Name of the student:	Md. Shahrukh Hasan
ID	2013-3-80-002

Date:	06-09-2017
Start time/End time	9:00 - 13:00 and 14:00 - 18:00
Location:	Rajshahi Power house
Mentor:	Engr. Abdullah-Al-Mamun

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of today's activities were to know about metering system in Power system at energy auditing unit division, Rajshahi.

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.

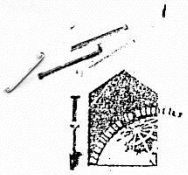
I) Single phase meter (Both analog and digital)
II) Three phase meter (Both HT & LT)
III) Meter testing
IV) CT, PT (used in metering system)

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

Related to EEE 442 (Switchgear and Protecting relaying)

Signature of the supervisor with date
Name:
Designation: নির্বাহী প্রকৌশলী এনার্জি অডিটিং ইউনিট বিভাগ বিউবো, রাজশাহী।
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation: Dr. Muhammed Mazharul Islam
Assistant Professor
Department of Electrical and Electronic Engineering



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:	BPDB, Rajshahi
Name of the student:	Tanvir Chowdhury
):	2013-2-80-109

Date:	07.09.17
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Khulna power plant.
Mentor:	Engr. Rezaul 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.
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)

Today we learn How to operate and working prineiple of Khulna power Plant.

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.

Khulna 170MW power plant have two unit. one is is 110MW and anotler is 60MW. There is three main stapes. compressure, combustion, and generation. power generation & scale is exactly 10.5KV.

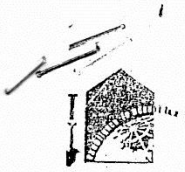
3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

This is related to my academic course.

9/2/17

Signature of the mentor with date
Name:
Designation:
Contact Phone #(মোঃ রেজাউল করিম)
পরিচিতি নং-০১-০৯৮০
ব্যবস্থাপক (উঃ প্রঃ) পরিচালন (ডিভিশন)
খুলনা বিদ্যুৎ কেন্দ্র, বিউবো, খুলনা।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Professor
Department of Electrical and Electronic Engineering



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:	BPDB, Rajshahi
Name of the student:	Tanvir Chowdhury
):	2013-2-80-109

Date:	08.09.17
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Khulna power plant
Mentor:	Engr. Nahid 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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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)

Today we learn about boilar and turbine system. And we also learn other auxiliary system of this plant.

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.

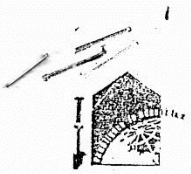
Today we firstly see boiler and its parts. Boiler drum, furnace and Burner, other auxiliary knobs for control the fuel level.
Then we see Turbine. Here we see three step blades of turbine in 60 MW unit.

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

Today activety is related ~~with~~ to EEE442

Signature of the mentor with date
Name:
Designation:
Contact Phone #:
(Nahid Rahman)
ID No. 1-01115
Assistant Chief Engr. (Xen)
Khulna Power Station
BPDB Khulna

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering



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

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Name of the company:	BPDB, Rajshahi
Name of the student:	Tanvir Chowdhury
):	2013-2-80-109

Date:	09.09.17
Start time/End time	9:00-13:00 and 14:00-18:00
Location:	Khulna power plant
Mentor:	Engr. Arit Reza Khan

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)

Today we learn about boiler SH and RH panel and also know about cooling procedure.

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.

There are connected four superheater(SH), and two econoniser and two Reheater(RH) with Boiler.

Here used demiwater and air for cooling the system.

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

Today activity is related to EEE 442

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

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering

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

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Name of the company:	BPDB, Rajshahi
Name of the student:	Tanvir Chowdhury
):	2013-2-80-109

Date:	10.09.17
Start time/End time	9:00 - 13:00 and 14:00 - 18:00
Location:	Khulna B Power Plant
Mentor:	Engr. Rezaul Karim

General Instructions:

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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)

Today we learn about power plant control system and fuel control system of the plant.

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.

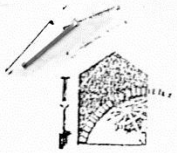
They use PLC software for control the power plant.
Here they use HFO Fuel and they used 2 tank. One tank they storage and another one is service tank. They also use heater for melting HFO.

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

Today activity is related to EEE442

Signature of the mentor with date
Name: (মোঃ রেজাউল করিম)
Designation: পরিচিতি নং-০১-০৯৪০
Contact Phone # ব্যবস্থাপক (তঃ প্রঃ) পরিচালন (ভারপ্রাপ্ত)
খুলনা বিদ্যুৎ কেন্দ্র, বিউবো, খুলনা।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professo
Department of Electrical and E... tmg



Department of Electrical and Electronic Engineering
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Daily Activity Report

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Name of the company:	BPDB, Rajshahi
Name of the student:	Tanvir Chowdhury
	2013-2-80-109

Date:	11.09.17
Start time/End time	9:00 - 13:00 and 14:00 - 18:00
Location:	Rajshahi training center.
Mentor:	Engr. Hasina Dilruba.

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)

The objective of the day is to discussion about management and risk factor in power seetor in Bangladesh and working ceremony.

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.

→ Disester management and its function.
→ The awareness
→ Risk factor
→ Blackout in Bangladesh
→ Start up process after blackout.

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

The activity is new to me.

11.9.17

Signature of the mentor with date
Name: ডঃ হাসিনা দিলরুবা
Designation: পরিচালক
Contact Phone: পল্লী প্রশিক্ষণ কেন্দ্র পল্লীবা রাজশাহী।

Signature of academic supervisor with date
Name: Dr. Muhammed Mazharul Islam
Designation: Assistant Professor
Department of Electrical and Electronic Engineering