A TECHNICAL REPORT ON
INDUSTRIAL VISIT
TO
220 KV S/S GWALIOR – II
SITHOULI, MP, INDIA
On 3rd February, 2024
WITH
50 Students, 2 Faculty and 2 Lab Staff
Organized by
DEPARTMENT OF ELECTRICAL ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
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A GOVT. AIDED UGC AUTONOMOUS & NAAC ACCREDITED INSTITUTE, AFFILIATED TO R.G.P.V. BHOPAL (M.P.), INDIA

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Introduction

In an era marked by unprecedented technological advancements, the power sector plays a pivotal role in shaping the world's future. Our visit offered a comprehensive exploration of electricity's journey. We gained insights into the crucial role of transformers in stepping down high voltage for safe and efficient utilization. Additionally, we witnessed the integration of cutting-edge technologies like microprocessors, revolutionizing relay and circuit control. The visit highlighted the crucial role of software like SCADA and MATLAB in substation simulation, providing valuable tools for analysis and optimization.

Beyond technical knowledge, the experience fostered a deeper understanding of the practical side of our chosen field. Witnessing the intricate systems operating in tandem within the substation solidified our theoretical understanding and ignited a passion for the practical applications of electrical engineering. This invaluable exposure served as a stepping stone, enhancing our academic learning and igniting a keen interest in pursuing further exploration within this vibrant field.

Table of Contents

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AboutSithouli Substation

Sithouli Substation, located in Gwalior, India, stands as a pivotal hub in the region's electrical infrastructure. As an essential component of the power distribution network, Sithouli Substation plays a crucial role in ensuring the reliable supply of electricity to both urban and rural areas in and around Gwalior.

Established to meet the growing energy demands of the region, Sithouli Substation serves as a vital link between the high-voltage transmission lines and the local distribution network. It acts as a distribution point where electricity is received at high voltages from the transmission system and then transformed into lower voltages suitable for consumption by homes, businesses, and industries.

The substation is equipped with advanced technologies and equipment to efficiently manage the flow of electricity, regulate voltage levels, and ensure uninterrupted power supply. Its strategic location and robust infrastructure make it capable of handling large volumes of electricity, thereby contributing to the stability and resilience of the local power grid.

Fig1:-Sithouli Substation

Furthermore, Sithouli Substation plays a significant role in supporting economic development and enhancing the quality of life in the region by powering essential services, industries, and residential areas. Its operations are carried out with a strong emphasis on safety, reliability, and environmental sustainability.

Overall, Sithouli Substation stands as a testament to modern engineering and technological advancement, playing a vital role in powering the growth and prosperity of Gwalior and its surrounding areas.

PowerTransmission Process at Sithouli Substation

The Sithouli substation plays a crucial role in transmitting power to various regions. Here's a breakdown of the process:

Power Source and Voltage Levels:

The substation receives power at **220kV** through two incoming power grids.

Voltage Transformation:

Transformers step down the high voltage from **220kV** to **132kV** for transmission over longer distances with minimized power loss.

At the designated locations, the voltage is further stepped down to **33kV** using transformers, catering to local distribution needs.

Distribution and Consumption:

The 33kV lines feed into distribution transformers located in different regions.

These transformers bring down the voltage to the utilization level of **11kV**.

Finally, step-down transformers convert the 11kV to **440V**, which is the standard voltage level for industrial and commercial use in India.

Reaching Different Regions:

The 11kV and 440V lines from the distribution transformers then deliver power to various regions within the coverage area of the Sithouli substation.

Fig2:- Specifications of transformer

Protection and safety measures

Electricity transmission and distribution substations handle immense power, making strict protection and safety measures **absolutely crucial**. Here's why:

- **Protecting lives:** High voltage electricity poses a constant threat of **serious injury or death** to anyone who comes into contact with it. Protection measures like fencing, access control, and PPE significantly reduce the risk of unauthorized entry, accidental contact, and arc flash incidents.
- **Ensuring reliable power:** Substation failures due to inadequate protection can lead to **widespread power outages**, disrupting critical services and causing economic losses. Equipment protection through fuses, relays, and proper grounding minimizes faults and ensures smooth power flow.
- **Preventing environmental damage:** Substations contain hazardous materials like oil and coolants. Leaks or spills can **contaminate soil and water**, harming ecosystems and human health. Spill containment and environmental management practices mitigate these risks.
- **Maintaining public trust:** The public relies on a **stable and safe electricity supply**. Stringent safety measures in substations demonstrate transparency and a commitment to protecting both people and the environment, fostering public trust in the power grid.
- **Minimizing economic losses:** Accidents and equipment failures in substations can incur **significant repair and replacement costs**. Robust protection measures reduce downtime, saving companies and ultimately consumers money.

Hence in order to protect and safeguard the above mention points, Sithouli substation has taken the following measures:-

- Protection from the lighting strike:- Lighting is a natural phenomenon, in order to protect the whole transmission system Lighting Arrestors(LA) are setup up which grounds the lighting charge. There are various LA setup in substation of various capacity to ground the charge like 220V, 11kv ,etc. which can be operated double their capacity. LA are the non linear resistors.
- Line Arrestors (LA): Guardians against surges in substations

  Line arrestors, also known as surge arrestors, play a crucial role in safeguarding substations from the dangers of lighting strikes and transient voltage spikes. These

unsung heroes are essentially voltage-controlled valves, allowing normal operating voltage to pass through but diverting and absorbing sudden surges. By channeling these harmful surges to ground, line arrestors protect vital equipment like transformers, circuit breakers and insulators from damage, ensuring reliable power transmission and minimizing the risk of outages. As lighting strikes are unpredictable and potentially catastrophic, these vigilant protectors stand guard, silently ensuring the smooth flow of electricity without a flicker.

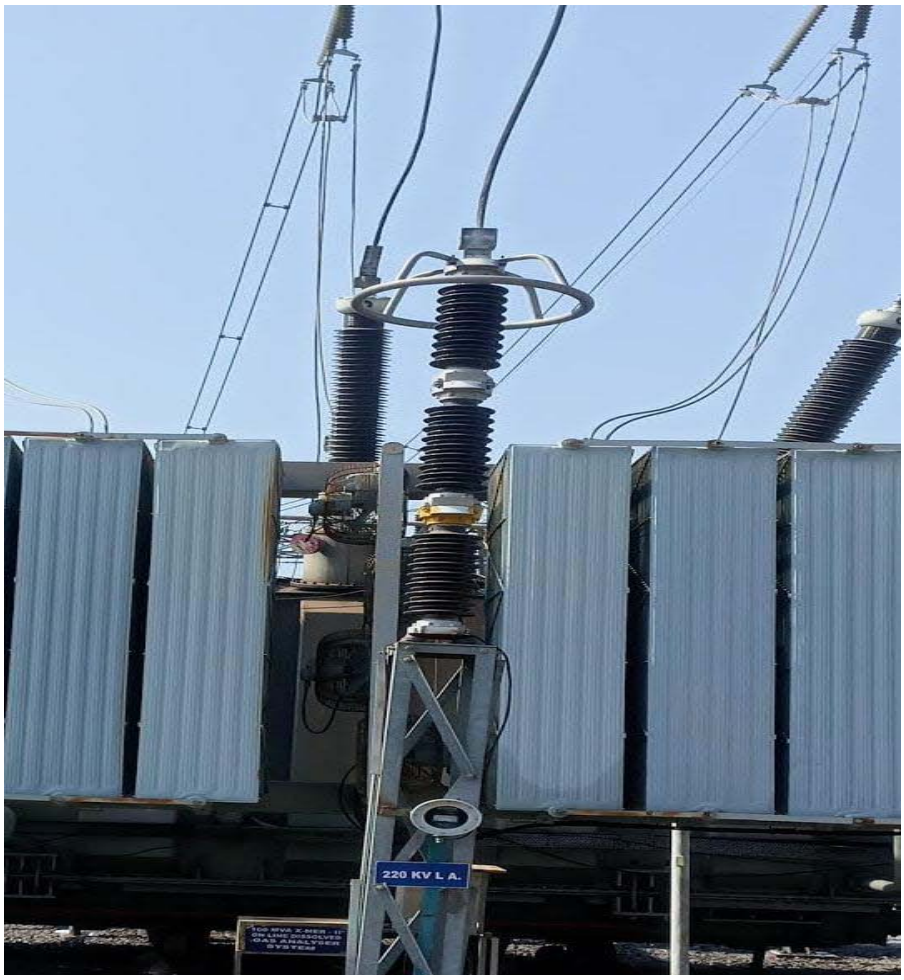

Fig3:-Lighting Arrestor

- Protection from fire :- A small sparking in the transformer can result up in a massive fire causing a huge economic as well a huge power and in some cases human live loss too. In order to reduce the chances of a massive fire various measures have been taken like the container which contains the cooling oil of the transformer is connected to a tank with the help of a pipe which is grounded and it is controlled by computer. So, in case fire takes place the oil is transferred to the underground tank to minimize its resulting in the shortage of fuel for the fire to burn.
- Protection from reptiles: - If in case any reptile like snake, lizard, etc. comes in contact with the lines creating a short circuit or a way for the supply to go from phase phase to another resulting in the short circuit. So, in order to protect the system from reptile stones are used in surrounding the area or the p]oles the setup on a heighted base so the reptiles cannot reach the lines or any appliance.
- Two safety relays are installed for every current transformer, voltage transformer, Transformer, main bus, etc. so in case if any of the relay goes disturbed or gets disrupted so we can use the another relay and the proper working of the system continues.

MONITORING SYSTEM AT SITHOULI ELECTRIC POWER SUBSTATION

Monitoring systems are crucial components of ensuring the safe, reliable, and efficient operation of 220kV electric substations. These systems collect and analyse data from various equipment and environmental factors within the substation, providing valuable insights to operators and enabling them to:

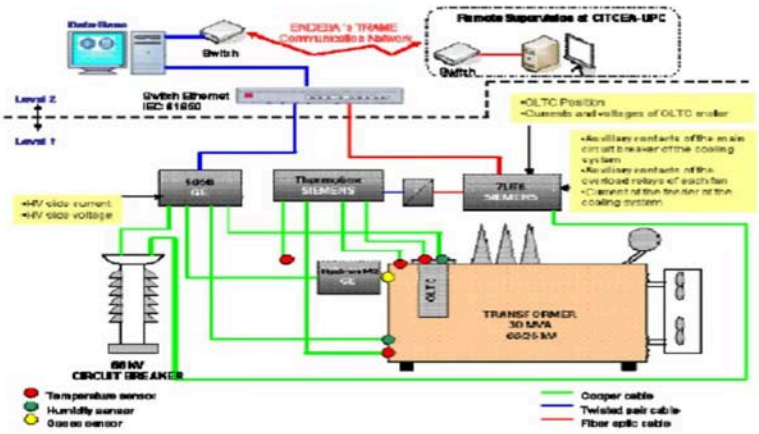

Fig4:- Scada

Prevent equipment failures: By continuously monitoring key parameters like temperature, vibration, and oil levels, potential issues can be identified and addressed before they lead to costly downtime or safety hazards.

Optimize operation: Real-time data on power flow, voltage, and current enables operators to make informed decisions about load balancing, transformer tap adjustments, and other actions to optimize energy efficiency and system stability.

Improve maintenance: Monitoring data helps identify equipment degradation trends, allowing for preventive maintenance to be scheduled effectively, minimizing downtime and extending equipment lifespan.

Enhance safety: Monitoring systems can detect fire hazards, environmental concerns, and security breaches, triggering alarms and enabling swift intervention to ensure personnel and public safety.

Here's a breakdown of the typical components of a 220kV substation monitoring system:

Sensors:

Current transformers (CTs) and voltage transformers (VTs): These measure electrical parameters like current, voltage, and power flow.

Temperature sensors: Monitor the temperature of transformers, circuit breakers, and other critical equipment.

Partial discharge (PD) sensors: Detect early signs of insulation degradation within transformers and other high-voltage equipment.

Vibration sensors: Monitor vibration levels in rotating equipment like transformers and cooling fans.

Oil level sensors: Monitor the oil level in transformers for potential leaks.

Environmental sensors: Monitor ambient temperature, humidity, and other environmental factors that can impact equipment performance.

Security cameras and intrusion detection systems: Enhance security and prevent unauthorized access.

Data acquisition and communication:

Data loggers: Collect data from sensors and store it locally.

Communication networks: Transmit data to a central control center or cloud platform for analysis and visualization.

Software and analytics:

Human-machine interface (HMI): Provides operators with a real-time overview of substation data and alarms.

Data analytics tools: Analyse trends, identify anomalies, and generate reports.

Fault location, isolation, and service restoration (FLISR) systems: Quickly pinpoint and isolate faults to minimize downtime.

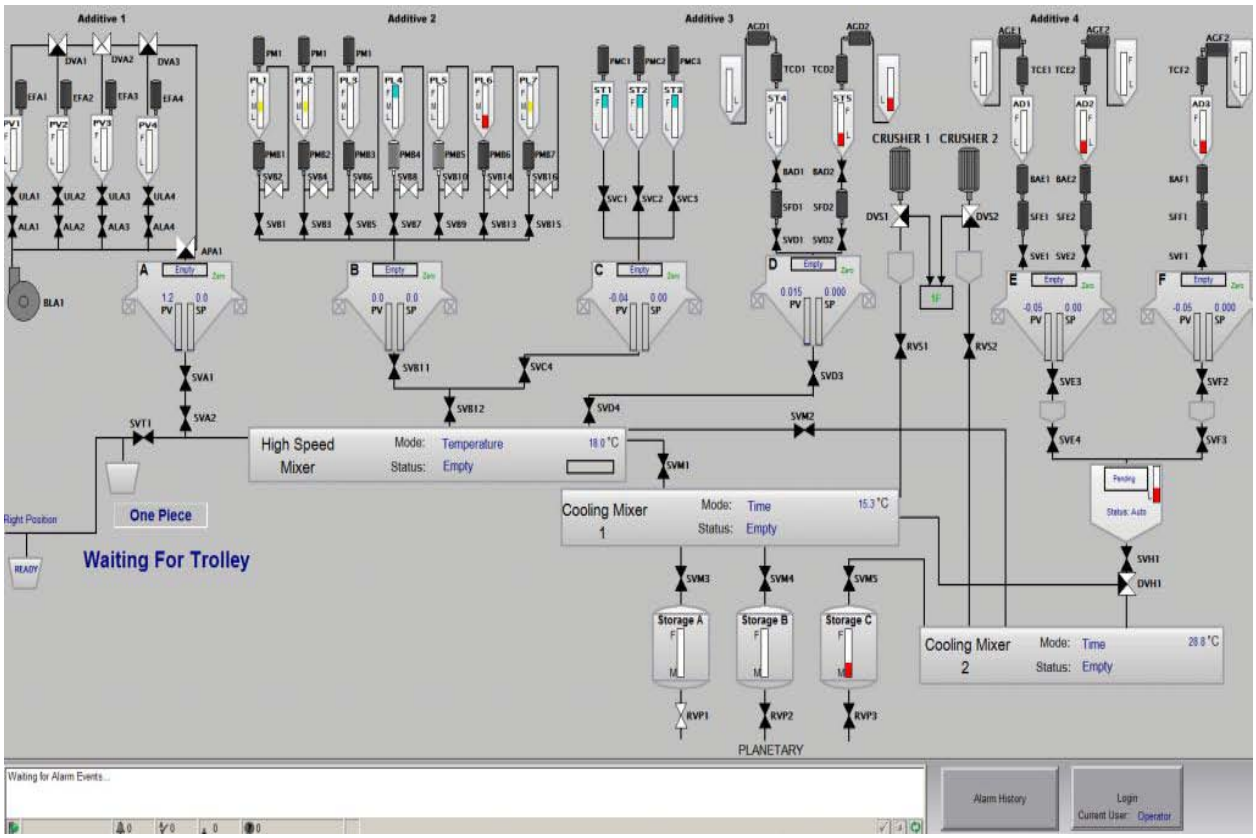

Fig6:-Simulation

SCADA

A Supervisory Control and Data Acquisition (SCADA) system is an enterprise-level software whose main task is to monitor and control an electrical grid system based on the information it collects from the substations within that system. A SCADA system is normally installed in a control room where operators can consistently monitor the overall health and function of the electric system. To provide enough information for an operator, a SCADA system supports a range of features and functions such as a single-line diagram and a historian.

Single-line diagram

A single-line diagram is an interactive graphical representation of the grid system via which an operator can monitor different parameters of the system and issue commands as necessary. A SCADA single-line diagram generally consists of an overview of the system plus multiple detailed pages for different components of the system to which an operator can navigate.

Real-time trending

Unlike single-line diagrams that show the components and connection of the system, the real-time trending function provides the operator with a real-time chart that monitors the values it receives from devices in the substation. An operator can add one or several points to the chart and follow the real-time value changes for better analysis of the system.

Event and alarm management

Event and alarm management is also part of the standard functions offered by a SCADA system. An alarm can be raised by the SCADA system in an alarm window based on predefined criteria. The operator can then acknowledge the alarm and clear it when the value of the point the alarm was created on goes back to its normal status.

Like alarms, events can also be generated based on the status of the data points collected from the field. Contrary to an alarm management system, an event management system doesn't require an operator's intervention – as generally events are not considered critical.

User notification

One of the main tasks of a SCADA system is to provide the necessary information to the right people in a timely manner. In a new SCADA system, the software administrator can assign notifications for different alarms and events to specific users or a group of users and send them email or text message notifications based on that list.

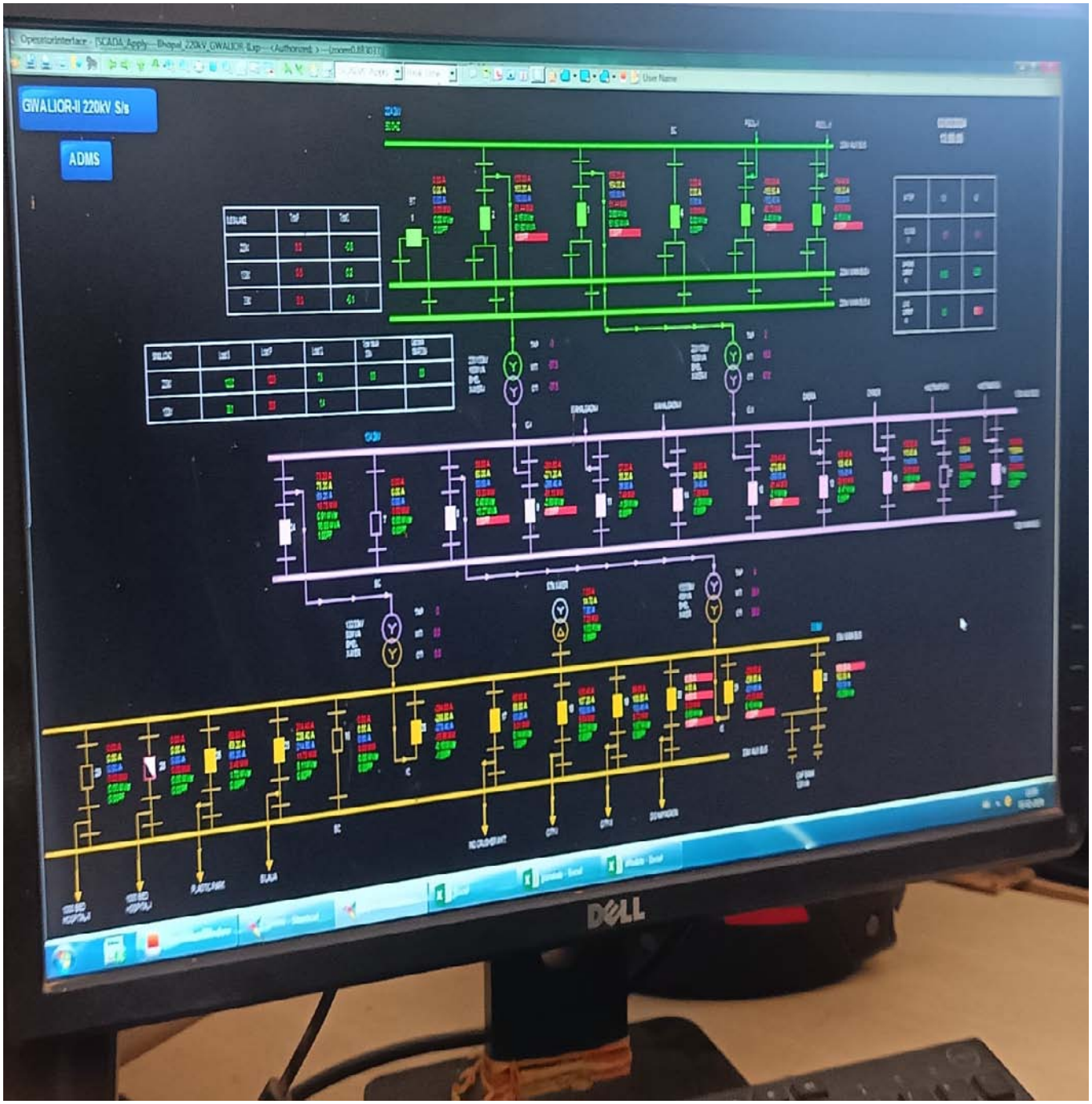

Fig7:- Monitoring system

Evaluation Feedback

The February 3rd, 2024, substation visit served as a crucial experiential learning opportunity, bridging the gap between theoretical knowledge from coursework and practical applications in the field of electrical engineering. Its primary objective was to facilitate a deeper understanding of key concepts through direct observation and interaction with substation equipment and operations. Additionally, the visit aimed to expose students to cutting-edge technologies and advancements shaping the industry landscape.

The visit proved immensely successful, garnering high satisfaction from students. Engaging directly with real-world infrastructure, such as high-voltage transformers, circuit breakers, and protection relays, solidified their comprehension of complex concepts encountered in courses like power systems analysis and power electronics. Witnessing these systems in operation provided invaluable insights into system dynamics, control strategies, and safety protocols, often overshadowed in traditional classroom settings.

Furthermore, the visit served as a springboard for exploring emerging trends and innovations in the field. Students gained exposure to advancements in smart grids, distributed generation integration, and advanced automation techniques, igniting intellectual curiosity and fostering informed career aspirations. Witnessing the practical implementation of these technologies fostered a deeper appreciation for their potential impact on the future of electrical engineering.

र.एन.आई. नं. एम.पी.एव.आई.एन./2008/27836 वर्ष-16 | अंक-162 | ग्वालियर | सोमवार 05 फरवरी 2024 | पृष्ठ 8 | मूल्य 2 रूपया

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य नहीं है क्योंकि मैंने
ता हुआ कल देखा है
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दैनिक
हर पल आपके लिए
नगर चिंगारी

पेज-7 ईशिता रघु भाबरी और साक्षात की जोड़ी जीती खेल

ग्राउंड वायरिंग के लिए किया जाता है ऑप्टिकल फाइबर का उपयोग : डॉ. दीक्षित

नगर चिंगारी | ग्वालियर

माधव इंस्टीट्यूट ऑफ टेक्नोलॉजी एंड साइंस के विद्युत अभियांत्रिकी के विद्यार्थियों ने सिथौली स्थित 220केवी के सब स्टेशन, पॉवर ट्रांसमिशन कॉर्पोरेशन लिमिटेड में इंडस्ट्रियल विजिट की। डॉ. शिशिर दीक्षित और डॉ. निखिल पालीवाल के संयोजन सब स्टेशन अधिकारी संजय निगड़िकर और राजेश अरोरा ने भी छात्रों को गाइड किया। इस दौरान डॉ. शिशिर दीक्षित ने कहा कि स्काडा बहुत ही महत्वपूर्ण सॉफ्टवेयर है। इसके द्वारा सिग्नल और कम्युनिकेशन सिस्टम के माध्यम से सिथौली सब स्टेशन का संचालन जबलपुर से किया जा सकता है। उन्होंने बताया कि कम्युनिकेशन सिस्टम को बेहतर बनाने में उपयोग होने वाले ऑप्टिकल फाइबर का प्रयोग ग्राउंड वायरिंग के लिए किया जाता है। डॉ. दीक्षित ने छात्र छात्राओं को एनआईएफटी और वैक्यून सर्किट ब्रेकर के प्रयोग और संचालन के रखरखाव सहित फॉल्ट ठीक करने और

सही तरह से सब स्टेशन को मॉनिटर करने के बारे में भी विस्तार से बताया। इस अवसर पर संस्थान के निदेशक डॉ. आरके पंडित, विभागाध्यक्ष डॉ. सुलोचना वाधवानी ने भी छात्रों को नवीनतम ज्ञान वृद्धि के लिए प्रोत्साहित किया। भ्रमण में संस्थान की ओर से विद्यार्थियों का मार्गदर्शन के लिए प्रोफेसर रिचा शर्मा, आशीष पात्रा, इंजीनियर आरपी गुप्ता, पवन शाक्य, विक्रम और एके राजे भी मौजूद रहे।

दैनिक भास्कर ग्वालियर सिटी भास्कर 06-02-2024

स्काडा और ऑप्टिकल का उपयोग तेजी से हो रहा है

सिटी रिपोर्टर • ग्वालियर |एमआईटीएस के विद्युत अभियांत्रिकी विभाग के विद्यार्थियों ने सिथौली स्थित पॉवर ट्रांसमिशन कॉरपोरेशन लिमिटेड की विजिट की। यहां डॉ. शिशिर दीक्षित और डॉ. निखिल पालीवाल के संयोजन में सबस्टेशन अधिकारी संजय निगड़ीकर और राजेश अरोरा ने छात्रों को गाइड किया। डॉ. शिशिर दीक्षित ने कहा कि स्काडा बहुत ही महत्वपूर्ण सॉफ्टवेयर है। इससे सिग्नल और कम्युनिकेशन सिस्टम के माध्यम से सिथौली सबस्टेशन का संचालन जबलपुर से होता है।

पत्रिका

•220 केवी के सब स्टेशन विजिट बहुत महत्वपूर्ण है स्काडा और ऑप्टिकल फाइबर का उपयोग

पत्रिका प्लस @ ग्वालियर. माधव इंस्टीट्यूट ऑफ टेक्नोलॉजी एंड साइंस के विद्युत अभियांत्रिकी के विद्यार्थियों ने सिथौली स्थित 220 केवी के सब स्टेशन, पॉवर ट्रांसमिशन कॉर्पोरेशन लिमिटेड में इंडस्ट्रियल विजिट की। डॉ.शिशिर दीक्षित और डॉ.निखिल पालीवाल के संयोजन में सब स्टेशन अधिकारी संजय निगड़िकर और राजेश अरोरा ने भी छात्रों को गाइड किया। इस दौरान डॉ.शिशिर दीक्षित ने कहा कि स्काडा बहुत ही महत्वपूर्ण सॉफ्टवेयर हैं। इसके द्वारा सिग्नल और कम्युनिकेशन सिस्टम के जरिए सिथौली सब-स्टेशन का संचालन जबलपुर से किया जा सकता है। इस अवसर पर संस्थान के निदेशक डॉ.आरके पंडित, विभागाध्यक्ष डॉ.सुलोचना वाधवानी, प्रो.रिचा शर्मा, आशीष पात्रा, आरपी गुप्ता आदि मौजूद रहे।

05/02/2024 | Gwalior City | Page : 13
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दैनिक
सत्ता सुधार
जनता के साथ जनता की आवाज
ग्वालियर ■ सोमवार 5 फरवरी 2024 ■ वर्ष-25 ■ अंक-197 ■ पृष्ठ-16 ■ मूल्य-₹03

- परीक्षा की गोपनियता बना रखने के लिए विशेष कदम उठाए गए
- संवेदनशील और अति संवेदनशील केंद्रों की होगी वीडियोग्राफी

भोपाल आज का तापमान MIN 15 MAX 28

ग्राउंड वायरिंग के लिए किया जाता है ऑप्टिकल फाइबर का उपयोग: डॉ. दीक्षित

सत्ता सुधार ■ ग्वालियर

माधव इंस्टीट्यूट ऑफ टेक्नोलॉजी एंड साइंस के विद्युत अभियांत्रिकी के विद्यार्थियों ने सिथौली स्थित 220केवी के सब स्टेशन, पॉवर ट्रांसमिशन कॉर्पोरेशन लिमिटेड में इंडस्ट्रियल विजिट की। डॉ. शिशिर दीक्षित और डॉ. निखिल पालीवाल के संयोजन सब स्टेशन अधिकारी संजय निगड़िकर और राजेश अरोरा ने भी छात्रों को गाइड किया। इस दौरान डॉ. शिशिर दीक्षित ने कहा कि स्काडा बहुत ही महत्वपूर्ण सॉफ्टवेयर है। इसके द्वारा सिग्नल और कम्युनिकेशन सिस्टम के माध्यम से सिथौली सब स्टेशन का संचालन जबलपुर से किया जा सकता है। उन्होंने बताया कि कम्युनिकेशन सिस्टम को बेहतर बनाने में उपयोग होने वाले ऑप्टिकल फाइबर का प्रयोग ग्राउंड वायरिंग के लिए किया जाता है। डॉ. दीक्षित ने छात्र छात्राओं को एनआईएफटी और वैक्यून सर्किट ब्रेकर के प्रयोग और संचालन के रखरखाव सहित फॉल्ट ठीक करने और सही तरह से सब स्टेशन को मॉनिटर करने के बारे में भी विस्तार से बताया। इस अवसर पर संस्थान के निदेशक डॉ. आरके पंडित, विभागाध्यक्ष डॉ. सुलोचना वाधवानी ने भी छात्रों को नवीनतम ज्ञान वृद्धि के लिए प्रोत्साहित किया। भ्रमण में संस्थान की ओर स विद्यार्थियों का मार्गदर्शन के लिए प्रोफेसर रिचा शर्मा, आशीष पात्रा, इंजीनियर आरपी गुप्ता, पवन शाक्य, विक्रम और एके राजे भी मौजूद रहे।

उपयोगी है स्काडा और आप्टिकल फाइबर

माधव इंस्टीट्यूट आफ टेक्नोलाजी एंड साइंस के विद्युत अभियांत्रिकी के विद्यार्थियों ने सिथौली स्थित 220 केवी के सब स्टेशन, पावर ट्रांसमिशन कार्पोरेशन लिमिटेड में इंडस्ट्रियल विजिट की। डा. शिशिर दीक्षित और डा. निखिल पालीवाल के संयोजन में सब स्टेशन अधिकारी संजय निगड़िकर और राजेश अरोरा ने छात्रों को गाइड किया। इस दौरान डा. दीक्षित ने कहा कि स्काडा बहुत ही महत्वपूर्ण साफ्टवेयर है, इसके द्वारा सिग्नल और कम्युनिकेशन सिस्टम के माध्यम से सिथौली सब स्टेशन का संचालन जबलपुर से किया जा सकता है। उन्होंने बताया कि कम्युनिकेशन सिस्टम को बेहतर बनाने में उपयोग होने वाले आप्टिकल फाइबर का प्रयोग ग्राउंड वायरिंग के लिए किया जाता है। उन्होंने छात्र-छात्राओं को एनआइएफटी और वैक्यून सर्किट ब्रेकर के प्रयोग व संचालन के रखरखाव सहित फाल्ट ठीक करने और सही तरह से सब स्टेशन को मानिटर करने के बारे में बताया। इस दौरान उन्होंने छात्र-छात्राओं के सवालों के जवाब भी दिए। इस अवसर पर संस्थान के निदेशक डा. आरके पंडित, विभागाध्यक्ष डा. सुलोचना वाधवानी ने भी छात्रों को नवीनतम ज्ञान वृद्धि के लिए प्रोत्साहित किया। भ्रमण में संस्थान की ओर से प्रोफेसर रिचा शर्मा, आशीष पात्रा, इंजीनियर आरपी गुप्ता, पवन शाक्य, विक्रम व एके राजे भी मौजूद रहे।

एमआइटीएस के विद्यार्थियों ने सब स्टेशन का शैक्षणिक भ्रमण किया।

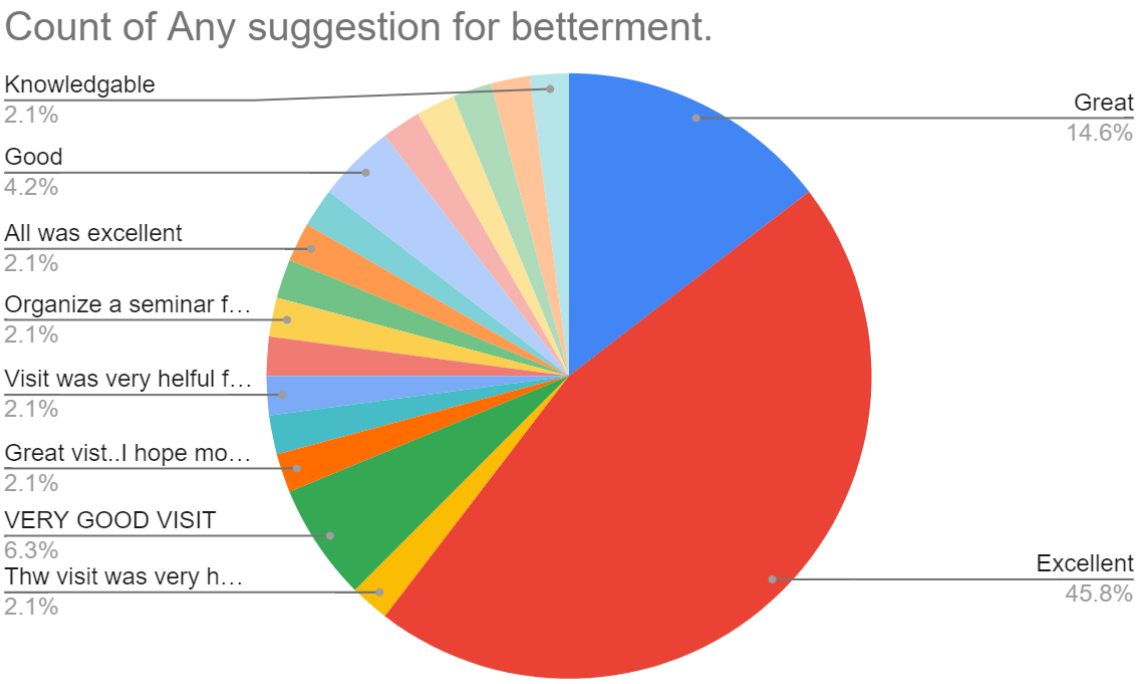

FIG.8:- FEEDBACK

SUGGESTIONS FOR BETTERMENT

S.NO	SUGGESTION BY	SUGGESTIONS
1.	0901EE221082	More Visits must be organized.
2.	0901EE221001	Higher rating of substations must also be arranged to visit.
3.	0901EE221104	Time management could be better
4.	0901EE233D03	Organize a seminar among students visited and also include students who have not gone.


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03/02/2024 13:56