

**Mode of Programme: ITEC (Classroom)**

**TESTING, OPERATION, MAINTENANCE AND PROTECTION OF EHV  
SUBSTATIONS AND LINES**

**Duration: 3 Weeks Classroom Programme**

**Dates: 20<sup>th</sup> Nov to 08<sup>th</sup> Dec, 2023**

**AIM:**

With phenomenal growth in the power to be transferred, it has become essential to transmit power with least interruptions and minimum losses. This is requiring to revise the transmission voltage higher and higher from 220KV, 400 KV and 765 KV and above. EHV substations and lines act as nervous system for the power sector. With the leading role of regulators, transmission sector organisations are witnessing higher performance expectation in business.

Reliability above 98% in their operation has become a minimum standard for modern transmission organisations. These high expectation leads to adoption of best practices in operation and maintenance of transmission systems. These expectations can be met only if a holistic approach is adopted in development of transmission systems well from the planning stage to day to day operation stage. Efficient and economical design, careful erection and systematic operation and maintenance without any compromise become paramount in providing reliable and prolong life of systems.

For meeting above expectations, monitoring of transmission assets over the clock is required, which is highly impossible for human being without help of sophisticated technology. Luckily, sophisticated and accurate protections systems are commercially available in market to take care of this round the clock monitoring of abnormal conditions in a system. Working in such state-of-the-art technology requires special skills on the part of the engineers working in transmission sector. This programme addresses required need of transmission engineers with detail and advance knowledge on the different aspects of testing, operation and protection of transmission system. **Indian Power Transmission sector is most complex, robust and reliable system incorporating different voltage levels and advance technologies and practices. Government of India, in its planning and policies framework has taken care of all these requirements systematically so as to make the sector efficient and competitive for stake holders. These practices and experiences are certainly going to help participating countries.**

**OBJECTIVE/OUTCOME:**

- Orientation towards the state-of-the-art technologies in the design of EHV substations
- Equip with necessary skills in the Operation and Maintenance of EHT substations including protection aspects
- Provide exposure to advance practices such as condition monitoring and enhancing the life of the EHV assets by adopting new technologies.
- Provide details knowledge of commercial and management of EHV assets

## **TOPICS TO BE COVERED:**

### **Introduction to Power Sector**

Power sector scenario in India and Organizational setup  
Electricity Act 2003 and National Electricity Policy and growth of Indian power sector  
Present Regulatory mechanism issues and challenges in operation and maintenance of EHV substations- India's & International experience

### **Design Concepts of EHV substations**

Salient aspects of Sub-Station Design: EHT substations layouts and Bus bar arrangement to be adopted, lightning impulse and switching impulse withstand levels, insulation coordination and selection of Lightning Arrestors, Measuring soil resistivity and design of earth mat and lightning protection, Soil analysis and specific considerations in foundation design, Design aspects of substation main and auxiliary structures , Design of station lighting system, Civil aspects covering yard levelling, controlling room, station drains, internal and approach roads, fencing, etc. Gas insulated substations.

Design of communication system for data transmission and protection covering PLCC and OPGW

### **Commissioning and testing of sub stations**

Salient features, Selection and economical procurement of EHV class Power Transformers; and substation equipments and erection practices & Substation construction practices

### **Sub Station Protection Issues:**

Salient features of substation protection systems  
AC and DC systems including battery capacity calculations  
Transformer, Bus Bar and Equipment Protections and Schemes, Digital Techniques in protection

### **Condition monitoring of EHV Substations and Best Practices in O&M**

O&M of Power Transformers and substation equipments, operational problems; maintenance practices and troubleshooting

Condition Monitoring and Hotline maintenance practices

### **Advanced topics**

Gas Insulated Substations  
Substation Automation & SCADA, SAS, Outage management

### **General Management:**

Change Management, Time Management & Business Communication, Work Life Balance

### **Field visits:**

Field Visit to a 400/220 KV SS and a Gas Insulation Substation & Protection Systems

### **Project and case studies:**

Based on the topic a case studies and projects will be offered to participants to give more practical exposure.