

Syllabus
FOR 26 WEEKS COURSE
on

“OPERATION AND MAINTENANCE OF TRANSMISSION AND DISTRIBUTION SYSTEMS”

I. GENERAL INTRODUCTION

Generation, Transmission & Distribution Scenario of India

II. POWER GENERATION

Types of generation: Conventional and Non-conventional, Thermal Power Plant, Hydro Power Plant, Gas Power Plant, Nuclear Power Plant, Co-generation
Various sources Non-conventional Energy Sources.

III. POWER TRANSMISSION

(A) SWITCHYARD/SUBSTATION

- I. Types: Generation sub-station, Grid sub-station, Gas Insulated s/s etc.
Indoor/outdoor, general comparison
- II. General arrangement and layout of switchyard, switching schemes, single line diagram

(B) SUB-STATION/TRANSMISSION EQUIPMENTS (400 KV/220 KV/132KV)

- I. Power Transformers - Bushings, On-Load Tap Changer (OLTC) Buchholtz Relay, Conservator, Breather, Cooling arrangements- Methods of cooling, Transformer tests
- II. Switchgears - Circuit breaker: Types (MOCB, ABCB, VCB, SF6), constructional details, specifications, interlocks
 - (a) Isolator: Types earth switch, Bus bar
 - (b) CT/CVT. Lighting Arrestors/Lighting Mask
 - (c) Power Line Carrier Communication (PLCC):- Principle, purpose, types of coupling
 - (d) Relays: Types, functions, constructional details,
 - (e) Protection System: Philosophy, types, protection of transformer/reactor, motor, line/feeder generator, bus etc.
- III. Grounding:- Types of grounding, earth testing & treatment, earthmat design, step potential, Neutral grounding reactor
- IV. Auxiliary facilities: DG Set Station Battery System etc.
- V. Cables-Types, Control cables, power cables, cable termination & jointing.
- VI. Sub-station operation: Grid operation, communication with RLDC/SLDC etc.
- VII. Sub-Station Maintenance:
 - (a) Types-Routine, preventive, planned, predictive, break-down, emergency maintenance, online maintenance of different equipments,
 - (b) Transformer/ Reactor Maintenance-Factors affecting the life of transformer/Reactor. Inspection/preliminary testing of various components-oil sampling and testing, oil filtration, Dissolved Gas Analysis (DGA), maintenance schedule
 - (c) Switchgear & protection Maintenance:- Maintenance of CB, Isolator, Earthswitch, Support Insulators, CT/CVT,LA,LM, Protective relay maintenance testing
- VIII. Erection and commissioning pre-commissioning checks/Tests of sub-station;

(C) TRANSMISSION LINES

EHV Transmission system in India, Tower types, Conductors, Earth wire, Insulators, IE rules and Acts, Statutory clearances, Surveying, Route Alignment
Maintenance of transmission line, Thermo vision scanning, Hot line maintenance

(D) HVDC TRANSMISSION SYSTEM

- I. Development of HVDC technology, economics, comparison with HVAC systems, principles of HVDC conversion, HVDC lines, HVDC sub-stations-converters, AC & DC harmonics & filtering

VI. SAFETY & STATUTORY REGULATIONS

- (i) Safety Requirement, Hazards, Electrical Accidents and prevention, First Aid, Fire fighting-Types of fire, fire fighting/system, fire extinguishers

I. LOAD DISPATCH & COMMUNICATION

- i. Load Dispatch Centres-Functions, SLDC/RLDC, NLDC,
- ii. Supervisory Control & Data Acquisition (SCADA) System RTU, Front End Computers, Main Computers, Visual Display Units, mimic boards
- iii. Energy Management System-Functions
- iv. Load forecasting, Generation scheduling, Load Management, Load shedding, Hydro thermal scheduling, Voltage/Frequency Control
- v. Reactive Power Management
- vi. Grid Management, Grid disturbance/Case studies
- vii. Visit to SLDC/RLDC/NLDC

VI. POWER DISTRIBUTION

(A) DISTRIBUTION LINES/CABLES

- (i) Brief historical review of Distribution system
- (ii) Planning, design & selection aspects of tower/poles structure, conductors, insulators and other hardwares
- (iii) Conductor laying, stringing, sagging,
- (iv) Layout of earthwire/neutral wire, guarding repair and jointing of conductors, jumpering, binding
- (v) Design and selection of underground cables,
- (vi) Location, construction and erection of pole-mounted sub-stations
- (vii) Service lines – LV, MV, HV Consumers compliance of IE Rules
- (viii) Street Lighting-Design consideration and controlling methods
- (ix) O&M of Distribution & service lines
- (x) Maintenance schedules & Records

(B) DISTRIBUTION SUB-STATIONS

- (i) Types, Layouts, single line diagram/equipments
- (ii) Equipments-transformer, CB, fuse etc.
- (iii) Relays, Relaying schemes, installation
- (iv) Operation & Maintenance all equipment, protective relays and auxiliaries.

(C) DISTRIBUTION METERING & EFFICIENT ENERGY MANAGEMENT

- (i) Types & constructional details of various meters
- (ii) Indian Electricity rules regarding sealing of cut outs and meters penalty for seal breaking
- (iii) Detection of theft/tempering, unauthorized loads, investigation, legal aspects
- (iv) Testing consumer premises and dealing with disputed
- (v) IE rules regarding system voltage drops and improvements
- (vi) Distribution automation
- (vii) Improving the efficiency of pump sets, street lighting
- (viii) Anti-theft measures and case studies
- (ix) Demand side management

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