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प्रावीण्यं परोपवृत्तिश्च

Annual Training Calendar for Power System Operators; FY 2024-25

राष्ट्रीय विद्युत प्रशिक्षण प्रतिष्ठान

National Power Training Institute

विद्युत प्रणाली प्रशिक्षण संस्थान

Power Systems Training Institute

(Ministry of Power, Govt. of India)

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Sl. No	Course	Level	Mode of Delivery	Period	Venue
1	Power System Operation	Basic	1 st Week online, 2 nd & 3 rd Week Offline (Total 18 days)	11.11.2024 – 30.11.2024	NPTI (PSTI), Bangalore
				03.02.2025 – 22.02.2025	NPTI (PSTI), Bangalore
2	Power System Reliability	Specialist	1 st Week Online 2 nd Week Offline	24.02.2025 – 08.03.2025	NPTI (PSTI), Bangalore
3	Regulatory Framework in Power Sector	Specialist	-Do -	30.12.2024 – 11.01.2025	NPTI (PSTI), Bangalore
4	Power System Logistics	Specialist	-Do -	17.03.2025 - 29.03.2025	NPTI (PSTI), Bangalore
5	Basic Level Training and Certification Program on Cyber Security	Basic	05 days offline	21.10.2024 - 25.10.2024	NPTI (PSTI), Bangalore
				06.01.2025 - 10.01.2025	NPTI (PSTI), Bangalore

Basic course on Power System Operation - Day wise Program

Duration: 11.11.2024 – 30.11.2024 &

03.02.2025 – 22.02.2025

Day	Teaching hour (excluding Tea/Lunch Break)	Topics
Day 1	3 Hour Session	Power sector overview, Institutional Arrangement, Ring Fencing and Organizational set up in India.
	3 Hour Session	Electricity Act 2003 & Legal framework, Policies and Regulations.
Day 2	3 Hour Session	Indian Electricity Grid Code (IEGC) and Energy Conservation Act.
	3 Hour Session	CEA grid connectivity standards, Grid standards and Safety Regulations.
Day 3	3 Hour Session	Reactive power management, Frequency control - Primary, Secondary & Tertiary control and RGMO
	3 Hour Session	EHV AC Substations Layout, Equipment & Bus arrangements and HVDC Stations
Day 4	3 Hour Session	Protection of Generators, Transformers, Bus bars, Transmission lines and Distribution systems.
	3 Hour Session	Supercritical technology and Hydro station layout, Startup, Shutdown and Emergency response
Day 5	3 Hour Session	Metering and settlement principles (Incl. SAMAST Report)
	3 Hour Session	Black Start and System Restoration
Day 6	Full Day	Technical/Site visits 1: Any Power plant or AC Substation or HVDC
Day 7	3 Hour Session	TTC / ATC computations and Ancillary services in Indian electricity market.
	3 Hour Session	POC Tariff philosophy, Sharing of Transmission Charges and losses Regulation, Transmission Account
Day 8	3 Hour Session	First Time Charging (FTC) including RE
	3 Hour Session	Connectivity, Long term & Medium term access with states perspectives. GNA (General Network Access) and TGNA
Day 9	3 Hour Session	National Open Access Registry (NOAR) and Scheduling
	3 Hour Session	Power exchange operations (IEX, PXI, HPX) and products (DAM, GDAM, RTM and Term Ahead)
Day 10	3 Hour Session	Terms and Conditions of tariff regulations (TCT) along with RE
	3 Hour Session	RLDC and SLDC Fee and Charges Regulations (incl. CABIL Report)
Day 11	3 Hour Session	Energy Accounting & Settlement - DSM and Ancillary (RRAS & AGC) Regulation (including Santulan Report), SCED
	3 Hour Session	Energy Accounting - Reactive energy charge, Congestion charge, REA and PSDF Account
Day 12	3 Hour Session	MoP notified rules relevant to System Operation & Market Operation including Guidelines on PSM and Late Payment Surcharge (LPS) Rule etc.
	3 Hour Session	Group discussion and Assessment
Day 13	Full Day	Technical/Site visits 2: Any RE Generator Solar or Wind or Hybrid etc.
Day 14	3 Hour Session	SCADA Overview & Power System Communication
	3 Hour Session	Overview on PMU, Smart grid operations - Prevailing practices and Future roadmap

Day 15	3 Hour Session	State Estimation Techniques, EMS and IT
	3 Hour Session	DTS (Dispatcher Training Simulator)
Day 16	3 Hour Session	Introduction of RE in India, Grid Integration of RE, Challenges faced in Grid operation, Operations of REMCs.
	3 Hour Session	RE Forecasting tools & technique, Scheduling and RPO. Overview of Electric Vehicles and Energy Storage System (ESS)
Day 17	3 Hour Session	Overview of PV Technology, PV Solar Energy Systems, Wind turbine technology, Types of wind turbines and their characteristics. Overview of other RE resources: Small Hydro, Biomass, Green Hydrogen and Hybrid RE technology.
	3 Hour Session	Ethics, Diversity, Equity and Inclusion for System Operators, Communication and Soft Skills (Emotional Intelligence, Growth Mindset, Active Listening, Work Ethic and etc.)
Day 18	3 Hour Session	Cyber Security: General awareness, CEA Guidelines, Role of CERT-In, NCIIPC, CERT-GO, MEITY, CISO etc
	3 Hour Session	Crisis Management: Precautionary or pre-crisis phase, Crisis management or response phase and Post-crisis phase
Day 19	2 Hour Session	Aptitude and logical reasoning
	1 Hour Session	Assessment
	2 Hour Session	Feedback & Valedictory

Specialist Level Course on - Power System Reliability; Day-wise Program Duration: 24.02.2025 – 08.03.2025			
Day	Teaching hour (excluding Tea/Lunch Break)	Topics	Description
Day 1	6 Hours session	Basics of Power Systems - I	Circuit Fundamentals, Types of Circuit Elements, Sources, KVL, KCL, Theorem, Types of Circuits, Star and Wye Connection, PU Systems, Operating States
		Basics of Power Systems - II	
		Basics of Power System - III	
		QnA Practice Session	QnA Practise on the topics covered during the previous Sessions
Day 2	3 Hour Session	Steady State Power System Analysis - I	Per Unit System, Introduction to Power Flow Solution, Y- Bus Matrix formation, Types of Load Flow Analysis, PV QV Analysis
		Steady State Power System Analysis - II & QnA Practise Session	
	3 Hour Session	EHV AC Transmission & QnA Practice Session	EHV Transmission, Concepts, Planning & Design, Power Loss, Voltage Drop, Resistance, Regulation, Efficiency, Limits, Grid Code, Advantage and Disadvantage, Types of Towers, Substation Layout, Impulse, Network Models, Conductors, Insulators, Earthwire, Survey and Design of Transmission Lines,

			National and International Statistics
Day 3	3 Hour Session	HVDC Transmission & QnA Practice Session	Advantages and Disadvantages, HVAC Vs HVDC Comparison, Types of HVDCs, Survey and Design, HVDC S/s Details, Modes of Operation, National and International Statistics
	3 Hour Session	Fault Analysis - I	Transmission Fault Types, Equipment Modelling for Faults, Types of Faults, Z-Bus Formation, IEEE and Other Standards, National and International Standards on Fault Analysis
Fault Analysis - II & QnA Practice Session			
Day 4	3 Hour Session	FACTS and Power Transmission Control & QnA Practice Session	Types of Facts Devices, STATCOM, VSC, Types of Compensation, Characteristics, Power Transfer Graphs, FACTS in RE Sources, National and International Statistics
	3 Hour Session	Power System Study Lab - I	In-depth Analysis on Power System Solution Methods for Steady State Power Flow, Construction of Base Cases for conducting Studies regarding Planning, Real-Time and Post Event Studies in Appropriate Software.
Power System Study Lab - II			
Day 5	3 Hour Session	Power System Planning - I	Principles of Planning, Types of Planning, Planning Process & Procedure, Types of Studies Conducted, Designing of Base Cases, Planning Committees, Transmission Planning Criteria, Relevant Regulations
		Power System Planning - II & QnA Practice Session	
	1.5 Hour Session	Power System Protection I	Philosophy of Protection, National and International Standards of Protection, Bus Bar Protection, Transmission Line Protection, Zones, Relay Characteristics
	1.5 Hour Session	Power System Protection II & QnA Practice Session	Generator Protection, HVDC, FACTS Devices, Renewables etc, Post Despatch Analysis using Disturbance Recorder, Fault Signature Analysis
Day 6	3 Hour Session	Power System Stability - I	Stability Definition, Types of Power System Stability, Operating States, Power-Angle Relationship, Stable vs Unstable Systems, SPS, Islanding Schemes, National and International Practises
		Power System Stability - II & QnA Practice Session	
	1.5 Hour Session	Utilization of PMUs I	Fundamentals of PMUs, Phasor Estimation Techniques, Signature of Fault and other grid events, Basics of data analytics and Mathematics based on PMU signals, Oscillations
	1.5 Hour Session	Utilization of PMUs II & QnA Practice Session	Application of PMU data for System Analysis, Case - Studies, Oscillation Source Location identification with Modal Analysis, National and International Statistics
Day 7	3 Hour Session	Power System Operation - I	Power Flow Concepts, System Frequency Concepts, Steady State Power Flow Concepts, Steady State Voltage Control, Economic Despatch-I, Hydro Scheduling, Hazards & Safety
		Power System Operation - II & QnA Practice Session	

	3 Hour Session	Power System Operation - III	Frequency Control, National and International Best Practices, Resource Optimization, Unit Commitment, Economic Despatch, Area Control Error
		Power System Operation - IV & QnA Practice Session	
Day 8	Full Day		Field Visit to any RE Generation, 765/400 kV HVAC, HVDC etc.
Day 9	1.5 Hour Session	Dynamic Studies - I	Dynamic Simulation Overview and Tools, High Level Overview of Dynamic Systems
	1.5 Hour Session	Dynamic Studies - II	Modelling of Power Plant Components, HVDCs, FACTs etc.
	1.5 Hour Session	Dynamic Studies - III	Modelling of Renewable Resources
	1.5 Hour Session	QnA Practice Session & Lab Session	Practice Questions and Hands-on Practise of Dynamic Simulation of appropriate Software
Day 10	1.5 Hour Session	Dynamic Studies - IV	Power System Model Validation Concepts, Tuning of Various Equipment Parameters viz. Governor, Exciters, PSS etc.
	1.5 Hour Session	QnA Practice Session & Lab Session	Practice Questions and Hands-on Practise on Appropriate Software
	1.5 Hour Session	Transient Studies I	Importance of Transient Studies, Preparation of Base Cases, Discussion on Modelling of Equipment, Electromagnetic Transient Studies, Transformers, Faults and Protection, Induction Machines, Power Electronic & FACTS Devices, Generators, Power Quality etc.
	1.5 Hour Session	Transient Studies II & QnA Practice Session	Case Studies, Hands-on Training on Appropriate Software, National and International Standard on Transient Studies
Day 11	3 Hour Session	Power System Resiliency I	Difference between Reliability and Resiliency, Enhancing Resiliency, Cost Benefit Analysis for Resiliency, Disaster Management, Emergency Restoration Systems, National and International Standards for Resiliency, Case Studies
		Power System Resiliency II & QnA Practice Session	
	3 Hour Session	Power System Restoration - I	Philosophy of Power System Restoration, Restoration Approaches, Assessment, Islanding and SPS Design, Automatic Load Restoration, Hunting, Limitations, Black Start, Grid Disturbance Case Studies, Do's and Don'ts in Power System Restoration, National and International Standards
		Power System Restoration - II & QnA Practice Session	
Day 12	1.5 Hour Session	Resource Adequacy Framework & International Practices	Resource Adequacy Planning and Reserve Estimation, Best National and International Practises, Methodology, Technology and Human Resource Requirement

	1.5 Hour Session	Optimization Techniques & Tools	Optimization Techniques, Different Types of Mathematical Methods, Tools such as PLEXOS, GAMS, MATLAB, Python etc, Case Studies
	1.5 Hour Session	Evaluation Test	Tests for all the modules delivered
	1 Hour Session	Feedback & Award of Certificates	

Specialist Level Course on - Regulatory Framework in Power Sector; Daywise Program		
Duration: 30.12.2024 – 11.01.2025		
Day	Teaching hour (excluding Tea/Lunch Break)	Topics
Day1	Day-1 (Act and Policies)	
	3 Hour Session	Electricity Act
		Legal & Regulatory Framework in India with focus on Power Sector
		Role of CERC, SERC, JERC, APTEL etc.
	3 Hour Session	National Electricity Policy and Tariff Policy,
		Green Hydrogen & Hydrogen Policy, ESS Policy
National Electricity Plan		
Day 2	Day-2 (Mop Rules and Guidelines)	
	3 Hour Session	Electricity (Rights of Consumers) Rules, 2020
		Rules/Regulations under Energy Conservation Act, 2001
	3 Hour Session	Electricity (Late Payment Surcharge and Related Matters) Rules, 2022.
		Grant of Regulatory Approval to CTU
		Guidelines and Standard Bidding Documents (SBDs) for procurement of Inter-State Transmission Services (ISTS) through Tariff Based Competitive Bidding (TBGB) process
		The Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022.
		Guidelines & Standards for Charging Infrastructure for Electric Vehicles
		Guidelines for Short-Term Procurement of Power
		Promotion of Generation of Electricity from Must-Run Power Plant Rules, 2021
Day 3	Day-3 (CEA Regulations)	
	3 Hour Session	Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines)
		Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations
	3 Hour Session	Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources)
		Central Electricity Authority (Technical Standards for Connectivity to the Grid) and (Amendment)

		Central Electricity Authority (Grid Standards) Regulations
Day 4	Day-4 (CEA Regulations)	
	4.5 Hour Session	Overview of CEA Transmission Planning criteria
		Central Electricity Authority (Technical Standards for Communication System in Power System Operation) Regulations, 2020.
		Central Electricity Regulatory Commission (Planning, Coordination and Development of Economic and Efficient Inter-State Transmission System by Central Transmission Utility and other related matters) Regulations, 2018
1.5 Hour Session	Central Electricity Authority (Installation and Operation of Meters) and (Amendments)	
	Technical details by generating company regulations 2009	
Day 5	Day-5 (IEGC & DSM)	
	3 Hour Session	Indian Electricity Grid Code
	3 Hour Session	Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST) Report
		Methodology of settlement of accounts for bilateral short term and collective transactions, for the period of Grid Disturbance
Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters)		
Day 6	Day-6 (Term and Condition of Tariff and Fee and Charges)	
	3 Hour Session	Central Electricity Regulatory Commission (Terms and Conditions of Tariff) 19-24
	3 Hour Session	Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations
	1.5 Hour Session	Central Electricity Regulatory Commission (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations
		The Central Electricity Regulatory Commission (Terms and Conditions for Dealing in Energy Savings Certificates) Regulations
	1.5 Hour Session	Central Electricity Regulatory Commission (Fees and Charges of Regional Load Despatch Centre and other related matters) Regulations
FOLD Report on CABIL		
Day 7	Day-7 (Connectivity/Transmission Pricing/ Revenue Sharing)	
	3 Hour Session	Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations / GNA regulation
		Grant of connectivity to projects based on renewable sources to inter-state transmission system/ GNA regulation
	3 Hour Session	Transmission System Planning, Development and Recovery of Inter-State Transmission Charges Rules, 2021
Central Electricity Regulatory Commission (Sharing of inter-State Transmission Charges and Losses) Regulations		
Central Electricity Regulatory Commission (Sharing of Revenue Derived from Utilization of Transmission Assets for Other Business) Regulations.		
Day8	Day-8 (Power Market, Cross Broder)	

	4.5 Hour Session	Central Electricity Regulatory Commission (Power Market) Regulations Framework for Real-Time Market	
	1.5 Hour Session	Central Electricity Regulatory Commission (Procedure, Terms and Conditions for grant of trading licence and other related matters)	
		Guidelines on Cross Border Trade of Electricity- 2016	
		Central Electricity Regulatory Commission (Cross Border Trade of Electricity) Regulations, 2019	
Day 9	Day-9 (PSDF/Ancillary/Trading License/RSD)		
	3 Hour Session	Central Electricity Regulatory Commission (Ancillary Services) Regulations FOR Report on Intra-State Reserves and Ancillary Services For Balancing - (SANTULAN) (2020)	
		3 Hour Session	Congestion Management Procedure in Real-Time System Operation CERC (Standards of Performance) Regulations 2012 Central Electricity Regulatory Commission (Power System Development Fund) Regulations DOP on Reserve Shutdown and Compensation Mechanism
	Day-10 (RSD, Congestion Management, PAT)		
	3 Hour Session		Discussion on Landmark CERC/APTEL Judgements
	3 Hour Session		Drafting Petitions, Case Studies (Workshop, Assignments)
Day 11	Day-11 (Case Study and Assignment)		
	3 Hour Session	Drafting Petitions, Case Studies (Workshop, Assignments)	
	3 Hour Session	Adjudication, Life cycle of petition	
Day 12	Day-12 (Review and Validation)		
	3 Hour Session	Assessment & Feedback	
	3 Hour Session	Valedictory	

Specialist Level Course on - Power System Logistics Duration: 17.03.2025 -29.03.2025		
Day	Teaching hour (excluding Tea/Lunch Break)	Topics
Day 1	Day-1 (Fundamentals of SCADA)	
	3 Hour Session	SCADA Systems in LDCs - Historical background, basic fundamentals, design architecture and Visualization
	3 Hour Session	Data acquisition principles and case studies - Site to Control Centre on IEC-101/104 protocols/ Modbus C37.118

Day 2	Day-2 (Basic Operation and Maintenance)	
	3 Hour Session	Database Modelling and associated O&M - SCADA applications
	3 Hour Session	Data acquisition principles and integration challenges - Control Centre to Control Centre on ICCP protocol
Day 3	Day-3 (Communication)	
	3 Hour Session	Substation Automation - IEC 61850 based
	3 Hour Session	Communication Systems in Power Sector - Media and Protocols
Day 4	Day-4 (REMCs)	
	3 Hour Session	Renewable Energy Management Centres - Systems and associated functioning
	1.5 Hour Session	Scheduling and Forecasting tools at REMCs
	1.5 Hour Session	Auxiliary Power System (APS)
Day 5	Day-5 (WAMS)	
	3 Hour Session	Wide Area Monitoring Systems - PMU based
	3 Hour Session	Analytical Applications used in WAMS systems
Day 6	Day-6 (Technical Visit)	
	3 Hour Session	Technical Visit to one control centre
	3 Hour Session	Technical Visit to any Data Centre
Day 7	Day-7 (Hardware and Networking / CIM)	
	3 Hour Session	Control Centre Hardware and Networking Devices
	3 Hour Session	CIM Overview - Compatibility across different versions
Day 8	Day-8 (EMS Applications)	
	3 Hour Session	EMS applications - State Estimation (Topology Processing, Observability, Weighted Least Square Method and Bad Data Detection) , Tuning of EMS applications - Examples and Case Studies
	3 Hour Session	EMS applications - Contingency Analysis, Transfer Corridor Monitoring and Security Enhancement
Day 9	Day-9 (EMS Applications)	
	3 Hour Session	EMS Applications - Dynamic Security Assessment
	3 Hour Session	Dispatcher Training Simulator - Functioning and Use Cases
Day 10	Day-10 (Cyber Security)	
	3 Hour Session	Cyber Security of SCADA Systems - Design Architecture and Best Practices
	3 Hour Session	Introduction to SIEM & various Cyber Security tool use in OT System

	Day-11 (Regulations and Processes)	
Day 11	3 Hour Session	Data historian applications and Advance visualisation techniques – Implementation
	1.5 Hour Session	Regulations related to SCADA and Communication - By CERC and CEA
	1.5 Hour Session	AMR Architecture
	Day-12	
Day 12	3 Hour Session	Introduction to AGC and Implementation In India
	3 Hour Session	Assessment, Feedback & Valdictory

Basic Level Training and Certification Program on Cyber Security	
Duration: 23.09.2024 – 27.09.2024	
06.01.2025 – 10.01.2025	
<p>Creating Cyber Security Awareness, Creating a secure cyber ecosystem, Creating a cyber-assurance framework, Strengthening a regulatory framework, Creating mechanisms for security threat early warning, vulnerability management and response to security threat, Securing remote operations and services, Protection and resilience of critical information infrastructure, Reducing cyber supply chain risks, Encouraging use of open standards, Promotion of research and development in cyber security, Human resource development in the domain of cyber security, Developing effective public private partnerships, Information sharing and cooperation, Operationalization of the National Cyber Security Policy.</p>	