

**Specialist Level Certification
on**

Power System Reliability

February 2015

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1.0 INTRODUCTION

The committee set up by the Ministry of Power under the Chairmanship of Shri. G.B. Pradhan, Addl. Secretary, MoP recommended setting up of a system of certification of System Operators by an independent Central body and National Power Training Institute has been entrusted with the responsibility of conducting the certification exams. Thereafter, the combined committee for training and certification under the Chairmanship of Shri S. M. Dhiman, Member, Central Electricity Authority, suggested three levels of certification viz. 'BASIC LEVEL', 'SPECIALIST LEVEL' and 'MANAGEMENT LEVEL'. It recommended that the certification authority may conduct the online examination for all the three levels of certification on periodic basis.

Ensuring reliable and secure power system is the primary responsibility of every system operator. The grid incidents of July 2012 have underlined the importance of grid security. As the grid grows in size and complexity, grid security has to be enhanced because the consequences of failure of a large grid are severe.

Therefore, Capacity Building in Reliability is essential for all personnel in Power Sector. This is recognized as the next step forward in the continued Capability Enhancement of System Operators and an area of specific specialization. Hence, a Specialist Learning and Development Programme and Certification Exam are being planned on Power System Reliability.

The Training Programme and the Certification Exam will be open to all System Operators from Load Despatch Centres who have cleared the basic level certification exam and have ten years of experience in power sector .

2.0 Framework for Power System Reliability Certification Exam

- **Certifying Agency-** The combined committee for training and certification of System Operators, has designated National Power Training Institute to be the Certification Agency and to award Certificates to successful candidates. In line with the recommendations of the committee, there would be a total of five grades from A to E and grade C shall be the minimum benchmark for award of certification.
- **Examination Committee-** An Examination Committee comprising of experts in the various fields representing a balanced mix of industry and academia to be constituted. The committee will be responsible for setting of Examination Paper, consolidating and moderating the same. The examination committee shall also fix the criteria for award of a particular grade on the basis of performance of the candidates in the examination.
- **Registering Agency-** National Power Training Institute will be the registering agency and will issue the admit cards to all Candidates.
- **Eligibility-** The eligibility criteria is as follows:-
 - The Specialist Level Certification will be open to those who are Certified System Operators of Basic Level and have put up **ten** years of service in power sector as on the first day of the month in which the exam is being conducted.
 - The candidate shall be a resident citizen of India
 - The candidate shall be a regular employee of any of the following- National Load Despatch Centre, Regional Load Despatch Centre, State Load Despatch Centre, Area Load Despatch Centre or Sub-Load Despatch Centre on the 1st day of the month in which the certification examination is scheduled to be conducted. An employer certification in this regard will be deemed necessary on behalf of all the appearing candidates
- **Fees-** A nominal fees of Rs. 6,000 + [ST@12.36%](#) per participant may be charged per participant towards administrative charges of conducting the exam by the Registering Agency.
- **Syllabus-** The syllabus of the exam is given as per Annexure-1.
- **Pattern of the Examination-** In line with the recommendation of the committee the examination will be conducted online. The certification exam question paper shall comprise of total one hundred and twenty (120) objective-type multiple-choice questions spread over three sections. The total time allowed for answering would be one hundred and twenty (120) Minutes. There shall be equal number of questions in all the three sections and all the questions shall carry equal marks without any negative marking.
- **Locations-** The certification exam shall be conducted at following centers:
 - Guwahati (North-eastern region)

- Kolkata (Eastern Region)
- New Delhi (Northern Region)
- Mumbai (Western Region)
- Bangalore (Southern Region)

Additional centres will be considered provided a minimum of 15 participants are available.

- **Timeline**

- Registration open : 03rd November 2014
- Last date for receipt of completed registration form at NPTI: 05th January 2015
- Certification Exam : 01st February 2015
- Declaration of result : 13th February 2015

The detailed time lines of the online exam are given in Annexure – 5.

- **Validity-** The Certificate will be valid for three years from the date of award of the certificate. The duration of validity of the certificate will be clearly mentioned on the certificate.
- **Other Terms and Conditions** – Remain the same as those applicable for Basic Level System Operator Certification Exam.

3.0 PATTERN OF EXAMINATION

The exam shall be conducted in a paperless mode. Candidates would not be allowed to take any material in soft or hard form along with them during the examination. Each candidate would be provided with one computer terminal at the designated test centre for examination and one computer terminal where reference material would be copied for reference. The candidate would appear in the exam through the interface provided on the respective computer screens. A fifteen-minute tutorial on operating instructions for the computer-based examination will be provided before the start of each examination. The tutorial would be self-explanatory, and no prior computer knowledge is needed.

The certification exam question paper shall comprise of total 120 objective-type multiple-choice questions spread over three sections. The total time allowed for answering would be Hundred and Twenty (120) Minutes . There shall be equal number of questions in all the three sections and all the questions shall carry equal marks without any negative marking. Computer-based testing would allow candidates to skip questions, mark, and return to them at a later time. During the examination, candidates may change their answer to any question. A clock would be displayed on the screen at all times indicating the time remaining. Before exiting the examination, the computer will indicate any question(s) that the candidate might have marked for review or those that remain unanswered.

3.1 PAYMENT OPTIONS:

- Through Demand draft/pay order payable to Power Systems Training Institute payable at Bangalore
- Direct Credit through Electronic Clearing System to
Bank Name: State Bank of India
A/C Number: 10031210203
IFSC: SBIN0006767
MICR: 560002008
Account Type: Current
Name of Beneficiary: Power Systems Training Institute
Pan No:AAALN0083C
Tan No: BLRP00338C
Service Tax Number: AAALN0083CSD005

3.2 REGISTRATION :

- Download blank registration form from the website of PSTI or take a photocopy of the blank registration attached with this document in Annexure-3.

- Fill the necessary details and paste your recent photograph.
- Get the completed registration form endorsed by the head of the respective Load Despatch Centre.
- Send the endorsed registration form along with the demand draft/pay order for registration fee. In case the fee has been paid through ECS, then the copy of the confirmation receipt obtained from the bank may be sent along with the registration form.
- Post the completed registration form along with the enclosures to The Principal Director, Power Systems Training Institute, Banashankari II Stage, Bangalore 560070.

3.3 EXAMINATION CENTRES:

The certification exam shall be conducted at the following centres subject to a minimum of 15 participants.

- Guwahati (North-eastern region)
- Kolkata (Eastern Region)
- New Delhi (Northern Region)
- Mumbai (Western Region)
- Bangalore (Southern Region)

Additional centres will be considered based on response.

3.4 ACCESS TO EXAMINATION CENTRE:

The access to the examination centre shall be through a valid photo admit-card (Annexure-4) for the certification exam issued by the Examination Coordinator (a designated officer of NPTI). The admit card should be duly endorsed by the stamp and signature of the Examination Coordinator. In case an applicant had received the admit card but is not carrying the admit card at the examination centre designated to the applicant due to some reason then he/she would be allowed to take the exam only if he/she shows the photocopy of the exam registration form along with the valid photo identity card issued to the candidate from the respective organization. A duplicate admit card shall be issued to such candidates at the examination centre by the examination centre in-charge.

Identification(s) that have been altered or damaged will not be accepted at the test centre. If there is any discrepancy between the name on the identification presented to the test centre staff and the examination registration form, the candidate will not be admitted to test and will be marked as a 'no-show'. A report of list of no-show candidates shall be forwarded to the concerned

organizations. No refunds shall be provided in case of no-show.

A photograph and finger printing of all the candidates reporting for the exam shall be taken at the test centre for the purpose of record. The candidates are therefore advised to reach the respective test centre at the scheduled reporting time.

After completion of the exam proceedings, an acknowledgement slip will be issued to all the candidates. The slip shall state that the candidate has appeared for the certification exam at the designated centre at the allotted date/time. The applicants are also advised to get their admit card's endorsed by the in charge of the respective examination centre.

3.5 EXAMINATION CENTRE REGULATIONS:

The candidates shall comply with the following examination centre regulations:

- Candidates who arrive late (Half an hour after the beginning of the exam) shall not be allowed access. Late arrivals that are not permitted to take the examination will be considered a no-show and must reapply. No refunds shall be allowed.
- No reference materials may be taken into the examination.
- No test materials, documents, notes, or scratch paper of any sort may be taken from the examination.
- Visitors are not permitted during the examination.
- Testing centre staff is instructed to answer questions about testing procedures only. They cannot respond to inquiries regarding the examination's content.
- During the examination, candidates may use the rest rooms for a biological break; however, the examination clock will continue running during such times.
- Candidates may not leave the testing centre until they have finished the examination.
- Smoking is not permitted in any testing centre.
- Any candidate giving or receiving assistance, or making a disturbance, will be required to turn in their examination materials, exit the examination room, and leave the testing centre. The test would be scored as is whether they have completed it or not. A report of such candidates shall be sent to their respective organizations and such candidates shall be barred from appearing in the certification exam for one year.
- Any instances of cheating, or attempts to impersonate another candidate, will be reported to the respective organization where the candidate is employed and such candidates shall be barred from appearing in the certification exam for one year.

3.6 WITHDRAWAL FROM THE EXAM:

A candidate may cancel and reschedule an examination appointment either by submitting a written

request to the Principal Director, Power Systems Training Institute at least five working days before the designated examination date. The candidate is allowed to re-appear in the next certification examination without paying an additional fee. If a candidate is late in withdrawing from the certification exam, does not appear for it, or arrive late, the candidate will be considered as no-show. All no-shows and candidates who have withdrawn will have to reapply to take the examination. No refunds shall be allowed.

3.7 EXAMINATION QUESTION PAPER:

As recommended in the combined committee for training and certification of system operators the examination paper will be set after taking input from experts in various fields and then consolidating and moderating the same. Experts of the exam committee shall be selected in such a manner that they represent a good mix of the industry and academia. The questions will be of multiple choice and the candidate would be expected to mark the most appropriate choice in his/her judgment. A set of sample questions are enclosed in Annexure-2.

3.8 AWARDING OF SPECIALIST LEVEL CERTIFICATE:

In line with the recommendations of the combined committee for training and certification of System Operators, there would be a total of five grades from A to E and grade C shall be the minimum benchmark for award of certification. The examination committee shall fix the criteria for award of a particular grade on the basis of performance of the candidates in the examination. Results of the certification examination shall be declared by the National Power Training Institute after grading and analysis. The results will be displayed in the website www.kar.nic.in/psti. All candidates acquiring grade A or grade B or grade C shall be awarded Specialist Level certificate for Power System Reliability signed by Director General, National Power Training Institute. The date on the certificate shall be considered as the reference date for the purpose of computing the validity period of the certificate.

Candidates awarded grades D and E in the examination may re-appear in the certification exams conducted subsequently. Such candidates would have to re-register for the exam by again paying registration fee applicable at the time of re-registration.

Disputes related to award of certificate, if any, shall be resolved through the dispute resolution process.

4.0 MAINTAINING 'ACTIVE' CERTIFICATION STATUS:

The Specialist level certificate will have to be renewed every three years. At the end of three years, the LDC executive will have to appear in the examination for re-certification.

4.1 CONFIRMATION OF CREDENTIAL TO THIRD PARTIES:

National Power Training Institute shall maintain a record of all the candidates who have appeared for the certification examination in a particular year along with their grades. It shall also maintain a record of the candidates possessing 'active' specialist level certificates for Power System Reliability. National Power Training Institute (NPTI) will confirm to the sponsoring organization that an individual holds a valid/'active' system operator certificate (including releasing the certificate number and the issuance date) in response to a written request, on the employer's letterhead (or official e-mail), providing the name of the individual and the grade acquired. No further information will be provided. NPTI will forward the certificate numbers and issuance dates for individuals holding a current system operator certificate to the respective State/Central Electricity Regulatory Commissions if requested. NPTI will confirm to an employment search firm, or a potential employer, whether an individual holds a valid Specialist certificate (including releasing the certificate number and the issuance date) if the search firm has a release from the individual. No further information will be provided.

4.2 DISPUTE RESOLUTION PROCESS:

Any dispute arising under the System Operator Certification Program, or from the establishment of rules, policies, or procedures dealing with any segment of the certification process, or as a result of disciplinary action shall be subject to the System Operator Certification Dispute Resolution Process (hereafter called the "Process"). The Process is only for the use of persons who hold a system operator certification or persons wishing to be certified to dispute the validity of the examination, the content of the test, the content outlines, or the registration process. The dispute resolution process consists of two steps.

- Write to the examination coordinator (a designated officer of NPTI) explaining the nature of dispute. The candidate shall attach the photocopy of the valid admit card along with the letter. It is expected that most of the disputes shall be resolved at this first step. If the issue (s) is not resolved to the satisfaction of the parties involved in the first step the matter may be brought to the notice of Director General, NPTI.
- Director General, NPTI may constitute a committee to examine the dispute. The candidate shall be given an opportunity to present his/her case before the committee at a specified place, date and time. The committee shall give its recommendations to the DG, NPTI within fifteen days of the meeting with the candidate. DG, NPTI shall communicate the final decision to the concerned person within thirty days (30) of the meeting of the aggrieved person with the committee. The decision of the DG-NPTI shall be treated as final.

The committee set up for dispute resolution may use a simple majority vote of the committee members to decide all issues. The vote will be taken in a closed session.

4.3 DISCIPLINARY ACTION:

This disciplinary action procedure is necessary to protect the integrity of the system operator credential. Should an individual act in a manner that is inconsistent with expectations, this procedure describes the process to investigate and take action necessary to protect the credential.

The following shall serve as grounds for disciplinary action:

- Intentional misrepresentation of information provided on system operator certification exam registration form
- Intentional misrepresentation of identification in the exam process. This includes, but is not limited to, a person identifying himself or herself as another person to obtain certification for the other person.
- Violation of one or more examination centre regulations (as prescribed in this document) by a candidate.
- Any form of cheating during a certification exam. This includes, but is not limited to, bringing unauthorized reference material in the form of notes, study material, or other methods of cheating into the examination centre.

The in-charge of the examination centre shall report incidents fit for disciplinary action to the certification examination coordinator. The examination coordinator may discuss with the candidate involved and submit the preliminary findings and communicate the decision to the concerned candidate. The candidate may have the right to appeal through the dispute resolution process.

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Annexures

Detailed Syllabus- Specialist Level Certification on Power System Reliability 2015

- **Module 1: Basics of Power System**
 - **Basic Concepts**
 - Basic concepts; concepts of linear, nonlinear, active, passive, unilateral and bilateral elements; ideal and practical voltage & current sources.
 - Alternating Current vs Direct Current
 - Electrical Circuits and Magnetic Circuits
 - Basics of network laws and theorems
 - Single Phase and Three Phase Circuits
 - Representation of sinusoidal time varying quantities as phasors; concepts of reactance, impedance
 - Concept of Active Power, Reactive power & power factor
 - Concept of admittance, Susceptance in parallel circuits
 - Star & Delta connections; line & phase quantities
 - Per Unit System
 - Introduction to Electrical Machines and Measuring Instruments used in Power System
 - Introduction to power electronic devices
 - Basics of Engineering Mathematics
 - **EHV AC Transmission**
 - Evolution of HVAC and HVDC Transmission in India
 - Comparison of HVAC and HVDC systems.
 - Overhead transmission lines : Bundled conductors, Resistance, Inductance and capacitance calculations of EHV line configurations
 - Power loss due to corona
 - Electric Field under transmission lines
 - Overhead line insulators: Ceramic and non-ceramic types, Insulator performance in polluted environments, mitigation of pollution induced flashover.
 - HV cable transmission - Underground cables and Gas insulated transmission lines.
 - HV substations - AIS and GIS.
 - Over voltages in power systems, Temporary, lightning and Switching over voltages, over voltage computation.
 - Grounding of transmission towers and substations.
 - Common Problems associated with EHVAC Transmission
 - **HVDC Transmission**
 - Evolution of HVDC Transmission in India
 - Type of HVDC Transmission systems.
 - Components of HVDC transmission systems.

- HVDC system control features, Control Modes, Control Schemes, Control comparisons.
- Smoothing reactor and DC Lines.
- Reactive power requirements in HVDC Transmission.
- Common Problems associated with HVDC Transmission
- Multi-terminal HVDC system.
- Advances in HVDC transmission.

- **Power System Planning**
 - Transmission Planning Process
 - Transmission Planning Criteria

- **Module 2 : Power System Operation and Control**
 - **Power System Operation**
 - Load Dispatch Centre Functions
 - Understanding trends in power system operation (Load Curves, Load Duration Curves etc.)
 - Demand Estimation, Monitoring & Control Procedure
 - Actions to be taken during load crash and load changeover
 - Measures to ensure Network Security and Reliability
 - Measures during high frequency conditions
 - Measures during low frequency conditions
 - Governor Operation, Automatic Voltage Regulators and Power System Stabilisers
 - Control of Voltage at grid substations/generating stations
 - Transformer Tap Optimisation
 - Synchronous Condenser Mode of Operation
 - Contingency Evaluation
 - Requirements for Solar & Wind generator
 - Operational Planning in different time horizons
 - Scheduling and Despatch
 - Hydro-Thermal Coordination
 - Economic Operation of Power System ; concept of unit commitment & economic despatch
 - Facilitating Generating Units / Transmission Elements Outage Requests
 - Re-configuration of transmission system, changing HVDC settings to implement proposed transmission system/equipment outages.
 - Monitoring Frequency, Voltages and Line Loading
 - Line Charging Guidelines
 - Introduction to Power Flow Control Devices
 - Event Information & Reporting Procedure
 - Managing Congestion in real time operation
 - Different reasons for taking generation or transmission outages
 - Estimated time for generation or transmission outage for each reason
 - Forced vs Planned Outages
 - Practices to be followed for outage planning
 - Procedure to be followed while approving planned or forced outages
 - Outage Planning Framework in Indian Power Sector
 - Load Frequency Control

- **Voltage Control**
 - Reactive power & voltage control - basic concepts
 - Transmission lines and reactive power compensation
 - Series and shunt capacitors—their effect on reactive power
 - Transformer tap changer effect on reactive power
 - HVDC operation effect on reactive power
 - FACTS & reactive power control
 - Generator reactive power capability
 - Reactive power management and renewable energy

- **Power System Restoration**
 - Analysis of System Disturbances
 - Understanding consequences of a large scale system disturbance
 - Classification of System Disturbances / Incidences as per CEA Grid Standards
 - System Restoration Approaches and Instructions
 - Important Loads to be met during restoration
 - Black start Facilities
 - Overview of Traction Supply System
 - Restoration Procedure for Indian Power System
 - Islanding Schemes and System Protection Schemes
 - Case studies of power system restoration

- **Module 3 : Power System Analysis**
 - **Steady State Power Flow Analysis**
 - Parameters of different power system elements and their modelling
 - Introduction to Power Flow Problem and Bus Admittance Matrix Formulation
 - Iterative techniques for power flow solution
 - Computation of transfer capability
 - Contingency Analysis
 - Contingency Ranking
 - PV,QV Analysis
 - Using PSS/E for power flow analysis (Lab Sessions)

 - **Fault Analysis**
 - Introduction to Short Circuit Analysis
 - Types of Faults
 - Symmetrical Components
 - Sequence Networks
 - Short Circuit Calculations (L-G, L-L, L-L-G and 3-phase Faults)
 - Short Circuit Calculation Using Bus Impedance Matrix
 - Fault level at important buses in Indian Power System

 - **Power System Stability**
 - Classification of Stability
 - Modeling of Synchronous Generators, Transmission Lines, Loads, Excitation System, Prime movers, HVDC for stability studies

- Voltage Stability, Frequency Stability, Angular Stability
- Sub Synchronous Oscillations
- Methods of Improving Stability
- Stability Issues in Indian Power System
- Case studies of Voltage Collapse in Indian Power System

Annexure – 2

Sample questions

Sl. No.	Question	Option A	Option B	Option C	Option C
1	The inrush current in a transformer contains predominantly	7th harmonic	2nd harmonic	5th Harmonic	3rd harmonic
2	Adjustment of generation by ramping up / down the units simultaneously falls under _____ frequency control.	Primary	Secondary	Tertiary	Over
3	Which is the most suitable condition for operating OLTC of a 400kV/220kV auto transformer?	390kV/220 kV	410kV/201kV	420kV/225kV	380kV/180kV
4	Earth Potential rise can be controlled by	Reducing the system voltage	Increasing the earth resistance	Increasing the area	Reducing the fault current and the earth resistance
5	Consider a transmission line transmitting a fixed amount of power. The efficiency of transmission increases, when	voltage decreases, power factor remains constant.	voltage increases and power factor also increases.	voltage decreases, power factor decreases.	voltage is constant, power factor decreases.

Specialist Level Certification Exam on Power System Reliability 2015

REGISTRATION FORM

- NAME OF THE CANDIDATE :
- FATHER'S NAME :
- DATE OF BIRTH(dd/mm/yyyy):
- GENDER (Male / Female) :
- HIGHEST QUALIFICATION :

Sr. No.	Diploma / Graduate / Postgraduate	Year	Name of Institute

- CONTACT NUMBER :
- EMAIL ADDRESS :
- POSTAL ADDRESS :
- EXAMINATION CENTRE :Please select from the five centers listed in the brochure
Preference 1..... Preference 2.....
Would you prefer to appear for the certification in a city other than the five locations indicated in the brochure? If yes, please mention name of the city
.....

- Details of the Basic level System Operator Certification Exam Passed:

- Roll No. _____
- LDC _____
- Date of Examination _____
- Exam Centre _____

- Number of years of service in power sector :
- DETAILS OF THE REGISTRATION FEE :
 - a) PAYMENT THROUGH DEMAND DRAFT/PAY ORDER
 - Demand draft/pay order number :
 - Issuing bank :
 - Issued on date :
 - Amount :
 - b) PAYMENT THROUGH ECS :
 - Issuing bank :
 - Transaction ID and date :

I agree to abide by the rules and regulations of the Specialist certification Exam.

(SIGNATURE of the Candidate)

Certified that the candidate is employed in ----- Load despatch
and has put up a minimum of ten years service in power sector.

PLACE:

DATE:

Signature of the LDC In-charge

Specialist Level Certification Exam on Power System Reliability 2015

ADMIT CARD

NAME:

FATHER'S NAME:

DATE OF BIRTH:

GENDER:

ADDRESS OF THE EXAMINATION CENTRE:

DATE OF EXAMINATION : 01st February 2015

REPORTING TIME : 09:30 am

(EXAMINATION COORDINATOR)

NAME:

ADDRESS:

It is certified that the above candidate appeared in the examination for Specialist level certification conducted on 1st February 2015.

(EXAMINATION CENTRE-INCHARGE)

Timelines For Specialist Level Certification Exam on Power System Reliability 2015

Sr. No.	Target Date	Activity	Action by
1	30.10.2014	Circulation of Brochure to all System Operators by PSTI, with request for participation	PSTI
6	31.10.2014	Display of “Specialist Level Power System Reliability Certification” details in www.kar.nic.in/psti	PSTI
7	03.11.2014	Registration for the Specialist Level System Operator Certification Examination Commences	PSTI
8	05.01.2015	Last date for Registration for the Specialist Level System Operator Certification Examination	PSTI
9	12.01.2015	Last date for withdrawal from the Certification Examination	PSTI / Registered Participants
10	19.01.2015	Completion of Processing of Registrations, dispatch (by email/post) of Examination Admit Cards to the Registered participants	PSTI
11	01.02.2015	Specialist Level System Operator Certification Examination held across the Country	PSTI, TCS, POSO,CO, Participants
12	13.02.2015	Declaration of Results by PSTI	PSTI
