



**Steag Power Plant Learning Centre**  
**A-29-30, Sector 16, Noida, 201301**  
**Telephone No. +91 120 4625 – 000 / 301**

**Training Calendar 2018-19**

S.No.	Programme	Duration	Dates
1	Advances in Power Plant Chemistry	2 days	11-12 April 2018
2	Boiler Operation and Maintenance	3 days	18-20 April 2018
3	ESP O&M and Performance Enhancement	2 days	25-26 April 2018
4	Combustion Mechanism & Optimization	2 days	3-4 May 2018
5	Gas Turbine Operation, Maintenance & Performance Monitoring	3 days	9-11 May 2018 6-8 June 2018
6	Advance Level Heat Rate awareness	3 days	16-18 May 2018
7	Implementation of PAT Scheme in Thermal Power Stations	2 days	7-8 June 2018
8	Power Plant Chemistry	5 days	11-15 June 2018
9	Industrial Safety and Environment Management	5 days	18-22 June 2018
10	*Training on Subcritical Plant based Simulators - <ul style="list-style-type: none"> <li>• PF Fired Generic 600 MW Subcritical Thermal Power Station</li> </ul> Or <ul style="list-style-type: none"> <li>• PF Fired Generic 195 MW Subcritical Thermal Power Station</li> </ul>	2 weeks	07-18 May 2018 02-13 July 2018 10-21 Sept 2018 07-18 Jan 2019
11	*Training on Simulator - <ul style="list-style-type: none"> <li>• 750 MW GE Frame 9FA based Gas Turbine Combined Cycle Power Station</li> </ul>	2 weeks	09-20 April 2018 18-29 June 2018 20-31 Aug 2018
12	*Training on Simulator - 430 MW Generic Gas Turbine Combined Cycle Power Station	2 weeks	16-27 July 2018 10-21 Dec 2018 04-15 Feb 2019
13	*Training on Supercritical Plant based Simulators - <ul style="list-style-type: none"> <li>• PF Fired Generic 660 MW Super - critical Thermal Power Station</li> </ul> Or <ul style="list-style-type: none"> <li>• PF Fired Generic 800 MW Super - critical Thermal Power Station</li> </ul>	2 weeks	28 May-08 June 2018 23 July-03 Aug 2018 26 Nov-07 Dec-2018 25 Feb-08 Mar 2019
14	Steam Turbine- <b>Operation</b>	2 days	5-6 July 2018
15	Generator- <b>Operation</b>	2 days	12-13 July 2018
16	Electrical System- <b>Operation</b>	2 days	26-27 July 2018

S.No.	Programme	Duration	Dates
17	Rotor Vibrations	2 days	2-3 Aug 2018
18	Energy Auditing in Thermal Power Stations	5 days	6-10 Aug. 2018
19	Gas Turbine Controls and Instrumentation	2 days	23-24 Aug. 2018
20	Installation, Repair & Maintenance Battery and chargers	2 days	6-7 Sept. 2018
21	Performance measurement, monitoring and analysis based diagnostics in CAPP.	3 days	13-14Sept. 2018
22	Condition Monitoring based Maintenance of Power Plant Equipments	2 days	17-18Sept. 2018
23	Performance optimization of Steam Turbine and its Auxiliary Systems	2 days	20-21 Sept.2018
24	Turbine Governing System	2 days	4-5 Oct.2018
25	Condition Monitoring of Electrical Equipment in Power Plant	2 days	11-12 Oct.2018
26	Variable Frequency Drives: Design and Maintenance	2 days	25-26 Oct.2018
27	Gas Turbine and Centrifugal Compressor Course	3 days	12-14 Nov.2018
28	Steam Turbine-Generator Control for Operators	5 days	19-23 Nov.2018
29	Statistical Process Control (SPC) & Measurement System Analysis (MSA)	3 days	21-23 Nov.2018
30	Controls and Instrumentation	3 days	28 -30 Nov.2018
31	Balance of Plant for Thermal Power Plant.	3 days	5-7 Dec.2018
32	Best Practice in Coal & Ash Handling Plants in Thermal Power Plants	3 days	12-14 Dec.2018
33	Best Practices O & M of Coal Mills	2 days	20-21 Dec.2018
34	Boiler Performance & Life Extension	3 days	26-28 Dec.2018
35	Tube Failure in Boilers- Causes & Remedial Measures	2 days	3-4 Jan.2019
36	Pumps Operations & Maintenance.	2 days	10-11 Jan.2019
37	Bearing Maintenance & Shaft Alignment	2 days	17-18 Jan.2019
38	Valve maintenance	2 days	24-25 Jan.2019
39	Renovation and Modernization of Thermal Power Stations	2 days	7-8 Feb.2019
40	Project management in power Sector	2 days	14-15 Feb.2019
41	Environmental Issues, Challenges & Solutions for Power Plants	2 days	7-8 March 2019
42	Earthing & Grounding	1 day	14-15 March 2019
43	High Voltage Testing of Power System Equipments	1 day	21 March 2019
44	Operation, Maintenance & Repairs of LT & HT motors	2 days	28-29 March 2019

***\*For Simulator training would be conducted in batches of 6 participants. In the event of nomination of less than 6 trainees by any organisation, the fee would be charged for full batch of 6 participants.***

**Venue - All training programs will be conducted at the above address**

**Training Fee (Indian Nationals): Rs 5,000 plus applicable service tax per day per trainee**

**Training Fee (Foreign Nationals): US Dollar 300 per day plus applicable service tax per day per trainee**

**For details of program: Please Refer attached Annexure.**

1. All nominations for training program along with the cheque /Bank draft for training fee, in the name of "Steag Energy Services (India) Pvt. Ltd." Payable at New Delhi/Noida should be sent atleast four weeks in advance of date of commencement of the particular program to Mr. Saurabh Kumar Mehta, AGM, Training (email id: sk.mehta@steag.in) or Ms. Monika Patra, Manager, Training, (email id: m.patra@steag.in) **Steag Power Plant Learning Centre, Steag Energy Services (India) Pvt. Ltd., A-29-30, Sector 16, Noida (UP) - 201301. Training Fee is inclusive of charges for working lunch & tea/ coffee and reading materials.**
2. Indian Participants can make their own arrangements for Boarding, Lodging and local transport during the training. If requested, Steag Power Plant Learning Centre can also make arrangements in suitable hotel and in that case the actual charges need to be reimbursed to the hotel directly.
3. For Foreign Nationals Steag will take full responsibility of making logistic arrangements involved in travel, boarding, lodging etc on actual chargeable basis.

## Annexure

Steag Power Plant Learning Centre

A-29-30, Sector 16, Noida, 201301

### Details of Programs included in Training Calendar 2018-19

Sl. No.	Programme	Duration	Broad Contents
1.	Advances in Power Plant Chemistry	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Introduction to advances in Power Plant Chemistry</li> <li>• Modern water treatment practices</li> <li>• Management of cooling water system</li> <li>• Pre &amp; post operation chemical cleaning management</li> <li>• Effluent treatment practices</li> <li>• Water Chemistry for supercritical plants</li> </ul>
2.	Boiler Operation and Maintenance	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Carnot and Rankine cycles, Thermodynamic principles and laws.</li> <li>• Boiler construction, pressure parts, boiler drum internals.</li> <li>• ID, FD and PA fans, their characteristics, stalling and surging,</li> <li>• Fuels, combustion and combustion equipments, oxygen controls and Stoichiometry.</li> <li>• Pre-checks for boiler start ups, boiler filling, boiler purge and start up, pressure raising.</li> <li>• Coal mills, warming and start up of coal mills, removal of oil support and mill controls.</li> <li>• Boiler shutdown and emergencies, boiler protections, boiler losses and efficiency.</li> <li>• Causes of tube failures, tube replacement and hydraulic test of boiler</li> </ul>
3	ESP O&M and Performance Enhancement:	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Electrostatic precipitator theory and practice including back filter</li> <li>• Resistivity effects</li> <li>• Power supply and 5automatic voltage control description and operation</li> <li>• Rapper control description and operation</li> <li>• On-line assessment techniques</li> <li>• Electrical diagnostics</li> <li>• Troubleshooting</li> <li>• Factors affecting precipitator performance</li> <li>• Alternative cleaning techniques (acoustics)</li> <li>• Acid gas and mercury mitigation</li> <li>• Proper inspection of electrostatic precipitators</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
4	Combustion Mechanism & Optimization	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Combustion process</li> <li>• Coal properties effecting boiler performance</li> <li>• Effect of moisture, volatile matter</li> <li>• Ash, fixed carbon, calorific value, grindability of coal on boiler performance</li> <li>• Combustion optimization tools and techniques</li> <li>• O&amp; M practices relating to combustion optimization</li> </ul>
5	Gas Turbine Operation, Maintenance & Performance Monitoring	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Theory and Principles of Gas Turbine working, Construction details of Gas Turbine, Air compressors, Combustors.</li> <li>• Variables affecting the performance parameters of GT</li> <li>• Electrical system for GT Power Plant, Excitation and Black start up.</li> <li>• Lubrication system and Fuel supply arrangements, Water injection and Fuel treatment</li> <li>• Start up including different types of starting arrangements, Speed raising and synchronization and load raising, Diffusion and pre-mix firing</li> <li>• Surging and stalling of compressors, Compressor washing, cleaning of air filters and routine maintenance practices in GT plants.</li> <li>• Operation of HRSG</li> </ul>
6	Advance Level Heat Rate Awareness	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Impact of design on Performance.</li> <li>• Operational efficiency Vs design.</li> <li>• Performance degradation</li> <li>• Restoration of performance based on conditioning monitoring</li> <li>• Performance testing – Guarantee Vs Routine.</li> <li>• Factors affecting Heat Rate</li> <li>• Deviations and its impacts on performance,</li> <li>• Improvement in the process monitoring, calibration.</li> <li>• Auxiliary power, factors affecting auxiliary power.</li> <li>• Sustaining performance.</li> <li>• Usage of offline instruments for performance testing</li> <li>• Usage of DCS based performance trending for operation and maintenance Engineers</li> <li>• Boiler performance testing techniques</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Turbine performance testing and performance analysis</li> <li>• Usage of PADO for Performance Tracking</li> <li>• Diagnostic Analysis</li> </ul>
7	Implementation of PAT Scheme in Thermal Power Stations	2 days	<ul style="list-style-type: none"> <li>• EC Act,2001</li> <li>• Background and introduction of PAT Scheme</li> <li>• Energy Conservation (PAT) Rules, 2012-salient provisions</li> <li>• Compliance of PAT by TPS</li> <li>• Energy Savings Certificates</li> </ul>
8	Power Plant Chemistry	5 days	<ul style="list-style-type: none"> <li>• Coal analysis, HGI calculations, determination of Stoichiometric air, excess air.</li> <li>• Hydrogen purity tests and production of Hydrogen in Thermal Power Stations.</li> <li>• Water clarification, treating the raw water, uses of clarified water, drinking water.</li> <li>• Pollution control and standards and limit for NOx control, pollution limits in thermal power stations.</li> <li>• Production of Demineralized water, DM plant description and operation.</li> <li>• Air pollution, limits and control of air pollution.</li> <li>• Chemical requirement of Boiler water, chemical dosing of feed water including boiler drum.</li> <li>• Chlorination of circulating water and cathodic protection of screens, pumps and piping.</li> <li>• Lubricants and their physical and chemical properties, chemical treatment of lubricants.</li> <li>• Synthetic oils, uses of synthetic oils in Power Plants.</li> <li>• Reverse Osmosis water purification system.</li> <li>• Orsat analysis, ash analysis, industrial utilization of ash.</li> </ul>
9	Industrial Safety and Environment Management		<ul style="list-style-type: none"> <li>• Accidents-causes cost of accidents, reporting of accidents, accidents inquiries. Prevention of accidents</li> <li>• How the injuries occur, labor rules and acts for lifting and loading, handling of heavy and over dimension</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
		<p><b>5 days</b></p>	<p>consignments.</p> <ul style="list-style-type: none"> <li>• First aid, Providing and arranging ambulance and first aid.</li> <li>• Industrial safety and hazards, work permits,</li> <li>• Protective clothing and equipments, safety aspects in electrical works and tools. Indian Electricity Rules on safety.</li> <li>• Fire fighting arrangements and statutory requirements in buildings, classification of fires and fire extinguishers used.</li> <li>• Fire fighting pumps, pumps house and water storage for firefighting, handling of electrical and chemical fires, pressurized water piping arrangements in power stations.</li> <li>• Factory acts and labor laws on labor safety. Providing safe drinking water and pollution free environment, availability of fresh water showers and air in chlorination and DM plant.</li> <li>• Global Warming and Greenhouse effect. Ecology and energy needs. Legislation and standards for noise and water pollution. Environment protection act 1986 etc.</li> <li>• Disaster Management</li> </ul>
10	<p>Training on Subcritical Plant based Simulators -</p> <ul style="list-style-type: none"> <li>• PF Fired Generic 600 MW Subcritical Thermal Power Station</li> </ul> <p>Or</p> <ul style="list-style-type: none"> <li>• PF Fired Generic 195 MW Subcritical Thermal Power Station</li> </ul>	<p><b>2 weeks</b></p>	<ul style="list-style-type: none"> <li>• Introduction to simulator, DCS system of Unit, starting of CW, ACW and DMCW system</li> <li>• Cooling tower performance, practice on simulator for CW emergency</li> <li>• Condenser hot well filling, line up of condensate system. Starting of CEP pumps. Deaerator filling, Starting of Vacuum pumps.</li> <li>• Importance of condenser performance, Practice on Simulator</li> <li>• Unit starts up from cold condition. Pressure rising in Boiler, checking interlock and protection.</li> <li>• Practice on Simulator</li> <li>• Charging steam lines, operation of HP/LP by pass, Operation of turbine side drains and vents, rolling and synchronization.</li> <li>• Practice on Simulator</li> <li>• Milling plant operations. Raising of boiler pressure and increasing the load. Starting of second set of auxiliaries. Milling plant and burner arrangements, optimization of secondary air, drum level control.</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Practice on Simulator</li> <li>• Attemperators line up, tilting burners operation and discussion. Raising load on Turbine, changing controls from manual to auto. Rising to full load.</li> <li>• Practice on Simulator</li> <li>• Load reduction and shutting down procedures.</li> <li>• Practice on Simulator</li> <li>• Hot and warm start ups. Unit operation in emergency conditions. Changing of power factor, AVR operations in auto/manual. Electrical emergencies.</li> <li>• Practice on Simulator</li> <li>• Emergencies in Boiler.</li> <li>• Emergencies in Turbine/ Generator</li> <li>• Unit emergency shutdown safe practices.</li> </ul>
11	Training on Simulator - <ul style="list-style-type: none"> <li>• 750 MW GE Frame 9FA based Gas Turbine Combined Cycle Power Station</li> </ul>	<b>2 weeks</b>	<ul style="list-style-type: none"> <li>• Introduction of GE-9FA/Siemens V 94.2 Gas Turbine/Combined Cycle Power Plant and Simulator</li> <li>• Cold unit start up, charging of electrical system, control and station air system HPU, lub-oil, Hydrogen seal oil start-up</li> <li>• Charging and normalizing of condensate and feed water system, cooling water and CCW pumps start up. Starting of BFPs, boiler drum filling, opening of drains</li> <li>• Line up of gas and fuel system for GT, Start up of GT</li> <li>• Steam Turbine preparation, pressure raising, rolling and synchronization</li> <li>• Load raising, ramp loading and taking unit to full load</li> <li>• Mark V and VI Controls</li> <li>• Unit shut down in Simple Cycle mode</li> <li>• Emergencies</li> <li>• Discussion and hands on practice</li> </ul>
12	Training on Simulator – <ul style="list-style-type: none"> <li>• 430 MW Generic Gas Turbine Combined Cycle Power Station</li> </ul>	<b>2 weeks</b>	<ul style="list-style-type: none"> <li>• Introduction of GE-9FA/Siemens V 94.2 Gas Turbine/Combined Cycle Power Plant and Simulator</li> <li>• Cold unit start up, charging of electrical system, control and station air system HPU, lub-oil, Hydrogen seal oil start-up</li> <li>• Charging and normalizing of condensate and feed water system, cooling water and CCW pumps start up. Starting of BFPs, boiler drum filling, opening of drains</li> <li>• Line up of gas and fuel system for GT, Start up of GT</li> <li>• Steam Turbine preparation, pressure raising, rolling and synchronization</li> <li>• Load raising, ramp loading and taking unit to full load</li> </ul>



Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Mark V and VI Controls</li> <li>• Unit shut down in Simple Cycle mode</li> <li>• Emergencies</li> <li>• Discussion and hands on practice</li> </ul>
13	Training on Supercritical Plant based Simulators - <ul style="list-style-type: none"> <li>• PF Fired Generic 660 MW Super - critical Thermal Power Station</li> </ul> Or <ul style="list-style-type: none"> <li>• PF Fired Generic 800 MW Super - critical Thermal Power Station</li> </ul>	<b>2 weeks</b>	<ul style="list-style-type: none"> <li>• Introduction to Simulator</li> <li>• Overview of Plant systems/equipments and DCS in Generic Simulator</li> <li>• Familiarization of Operator screens and Face plate functions, colour coding</li> <li>• Unit Cold Start-up activities – Cooling water system line up and Start-up.</li> <li>• Line up and starting of Fuel Oil system</li> <li>• Condensate water system lineup, Condenser Hotwell filling</li> <li>• De-aerator filling/pegging.</li> <li>• Main Turbine lubricating oil system startup</li> <li>• Generator seal oil startup, Main turbine turning gear system startup. Hydrogen filling</li> <li>• Motor driven boiler feed pumps startup.</li> <li>• Boiler cold flushing and Seperator filling</li> <li>• Turbine gland steam sealing system start-up. Condenser vacuum pulling system startup</li> <li>• Draft plant (air) system startup and Boiler Purging,</li> <li>• Boiler lit up and pressurization</li> <li>• Boiler Hot flushing</li> <li>• Charging of bypass &amp; pressure raising to achieve rolling parameters</li> <li>• Steam Turbine rolling, soaking, excitation and synchronization.</li> <li>• Primary air fan startup. Mill B warming, startup and load raising.</li> <li>• Charging of LP heaters, IP extraction line to De-aerator.</li> <li>• Load raising upto 30%</li> <li>• TDBDFP-A line up, rolling &amp; loading and MDBFP unloading/cut off</li> <li>• Wet to Dry changeover</li> <li>• Mill A Start-up &amp; Load raising</li> <li>• Charging of HP heaters.</li> <li>• TDBFP-B line up, rolling &amp; loading at 50%load</li> <li>• Mills C, D Start-up, Load raising and achieving full load conditions.</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Load reduction, Plant planned shutdown.</li> <li>• Hot Start-up</li> <li>• Emergency operations and Runbacks handling</li> </ul>
14	Steam Turbine- <b>Operation</b>	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Turbine specifications &amp; parameter monitoring</li> <li>• Turbine Rolling</li> <li>• Turbine Protection</li> <li>• Emergencies in Turbine</li> <li>• Turbine Aux. –               <ul style="list-style-type: none"> <li>➢ CEP,</li> <li>➢ Heaters,</li> <li>➢ Gland Steam system, etc.</li> </ul> </li> <li>• Turbine Monitoring &amp; Controls</li> <li>• Vacuum system</li> <li>• Turbine Shutdown</li> </ul>
15	Generator- <b>Operation</b>	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Seal oil system</li> <li>• Gas system</li> <li>• Stator Water system</li> <li>• Generator Rotor &amp; Excitation System</li> <li>• Generator Protection</li> <li>• Generator Parameter Monitoring</li> <li>• Generator Shut Down</li> </ul>
16	Electrical System - <b>Operation</b>	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Switchyard SLD</li> <li>• Charging a line</li> <li>• Shut Down of a line</li> <li>• Aux. Power SLD</li> <li>• Charging a feeder – Medium voltage, Low voltage</li> <li>• Shut Down of a Feeder - Medium voltage, Low voltage</li> <li>• Emergencies in Electrical system – Power &amp; Control</li> <li>• Emergencies in DC system</li> <li>• Diesel Generator – Startup &amp; Shut Down</li> <li>• Feeding Emergency Bus.</li> </ul>
17	Rotor Vibrations	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Simple harmonic motions, natural frequencies, damped and un-damped vibrations, critical speeds etc.</li> <li>• Hydrodynamic lubrication, oil whipping and half frequency whirls, oil properties and its effect on lub oil system.</li> <li>• Alignment of shafts and bearings, dynamic balancing of rotors, misalignment of generator rotors and un-even air gaps.</li> <li>• Case studies, vibration monitoring and signature analysis.</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
18	Energy Auditing in Thermal Power Stations	<b>5 days</b>	<ul style="list-style-type: none"> <li>• Provisions of Energy Conservation Act, 2001</li> <li>• Energy Audit Report Structure</li> <li>• Energy Auditing of various components / systems</li> </ul>
19	Gas Turbine Controls and Instrumentation	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Salient features of different makes of Gas Turbine Controls</li> <li>• Gas Turbine Protections</li> </ul>
20	Installation, Repair & Maintenance Battery and chargers	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Different types of batteries &amp; chargers.</li> <li>• Selection &amp; sizing criteria of batteries</li> <li>• Installation of battery bank</li> <li>• Maintenance of battery bank &amp; chargers</li> <li>• Testing on battery banks</li> <li>• Trouble shooting of batteries</li> </ul>
21	Performance measurement, monitoring and analysis based diagnostics in CCPP.	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Impact on performance due to off design operating regime.</li> <li>• Performance indicators, monitoring, trending and analysis for detecting internal issues.</li> <li>• Thermodynamics and performance in CCPP.</li> <li>• Performance optimization in CCPP.</li> <li>• Mechanism of performance deterioration with respect to external &amp; internal operating condition changes.</li> <li>• Action plan for improving APC, heat rate</li> </ul>
22	Condition Monitoring based Maintenance of Power Plant Equipments	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Objectives of Condition Monitoring.</li> <li>• Major equipments to be covered in Condition Monitoring.</li> <li>• Condition Monitoring methods i.e Vibration analysis, thermography etc.</li> <li>• Procedures for Condition Monitoring, recording, documentation, fault diagnosis, rectification etc.</li> <li>• Trend analysis and Permanent monitoring</li> </ul>
23	Performance optimization of Steam Turbine and its Auxiliary Systems	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Thermodynamic aspects of steam turbine design</li> <li>• Performance analysis of steam turbine cycle</li> <li>• Performance assessment of FW heaters, condenser</li> <li>• Impact of operation parameters towards performance deviation</li> <li>• Accurate assessment and minimization of losses</li> </ul>
24	Turbine Governing System	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Modelling of Turbine and Governor</li> <li>• Importance of Speed Droop</li> <li>• Turbine Protections</li> <li>• Automatic Turbine Test</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
25	Condition Monitoring of Electrical Equipment in Power Plant	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Condition monitoring of transformer through DGA, SFRA, FDS and PD measurement, DP/Furfural analysis</li> <li>• Condition monitoring for Rotating machines including Current Signature Analysis for Induction Motors</li> <li>• Condition Monitoring of Switchyard Equipment by various techniques such as LA current monitoring, IRT etc.</li> <li>• Interpretation of Test Results</li> </ul>
26	Variable Frequency Drives: Design and Maintenance	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Power Electronic devices</li> <li>• Components of VFDs</li> <li>• VFD working principle and types of VFD</li> <li>• Motors design consideration for VFD.</li> <li>• VFD commissioning</li> <li>• VFD maintenance</li> <li>• Condition monitoring of VFD.</li> <li>• Fault diagnosis of VFD.</li> </ul>
27	Gas Turbine and Centrifugal Compressor Course	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Brayton, Carnot and Rankine cycles, Theory and principles of Gas Turbine working.</li> <li>• Construction details of Gas Turbine, air compressors, combustors.</li> <li>• Air intake system, GT exhaust, air intake and air filters, online cleaning of air filters,</li> <li>• Different type of starting arrangement of Gas Turbines, GT auxiliaries,</li> <li>• Electrical system for Gas Turbine power plant, Excitation and black start up.</li> <li>• Lubrication system and fuel supply arrangements, water injection and fuel treatment.</li> <li>• Start up, speed raising and synchronization and load raising,</li> <li>• Diffusion and pre-mix firing.</li> <li>• Construction details of centrifugal air compressors, principles and velocity diagrams.</li> <li>• Performance of centrifugal compressors and performance curves.</li> <li>• Surging and stalling of compressors, compressor washing,</li> </ul>
28	Steam Turbine-Generator Control for Operators	<b>5 days</b>	<ul style="list-style-type: none"> <li>• Steam Turbine Fundamentals, steam cycle theory, Turbine Sections and Component Descriptions.</li> <li>• Turbine Systems: Lubricating Oil Systems, Gland Steam, abnormal operations of these systems.</li> <li>• Turbine Supervisory-Eccentricity, Speed Detection, Valve Position, Vibration, Shell Expansion, Differential Expansion.</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Steam Turbine Control: Speed Control, Load Control, Pressure controls, Initial and limit pressure controls.</li> <li>• Steam Turbine Control: Critical speeds and rotor dynamics, speed raising and over speed protection.</li> <li>• Steam Turbine Control: Co-ordinated master controls, boiler and turbine follow modes ,run back, frequency influence.</li> <li>• Generator excitation systems, principles of AVR.</li> <li>• Generator cooling systems, Hydrogen filling and sealing system.</li> <li>• Steam turbine and Generator protections, plant emergencies.</li> <li>• Generator synchronization, Generator Transformer, auxiliary and station transformer, neutral grounding.</li> </ul>
29	Statistical Process Control (SPC) & Measurement System Analysis (MSA)	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Introduction to Statistics, Understanding Process, Process Control</li> <li>• Understanding Variation, Types of Variation, Causes of Variation</li> <li>• Identifying causes, Introduction to Control Charts, Application of Control Charts</li> <li>• Selecting and plotting charts, Interpretation of charts, Improving process capability</li> <li>• Importance of Measurement, Measurement Errors, Components of MSA</li> <li>• Short &amp; long study – GRR, Attribute MSA, Tips to improve MSA</li> </ul>
30	Controls and Instrumentation	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Introduction to Distributed Control System (DCS)</li> <li>• Introduction to Programmable logic controller (PLC)</li> <li>• Basic of Field Instrumentations</li> <li>• Basic of Vibration Monitoring System</li> <li>• Furnace safeguard supervisory system (FSSS)</li> <li>• Digital Electro Hydraulic control system (DEH)</li> </ul>
31	Balance of Plant Mechanical Systems for Thermal Power Plant.	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Water Intake and Pre-treatment (cover both fresh and sea water)</li> <li>• Water post-treatment.</li> <li>• CW and ACW systems</li> <li>• Fuel Oil System (HFO &amp; LDO)</li> <li>• CHP</li> <li>• AHP</li> <li>• Compressed Air System</li> <li>• Fire Water System</li> <li>• Fire Detection &amp; Protection</li> <li>• Effluent &amp; Sewage Treatment System</li> <li>• HVAC</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
32	Best Practice in Coal & Ash Handling Plants in Thermal Power Plants	<b>3 days</b>	(covering both PC and CFBC) <ul style="list-style-type: none"> <li>• Coal Analysis and Importance of different constituents.</li> </ul> <b>CHP</b> <ul style="list-style-type: none"> <li>• Coal Storage and Stacking</li> <li>• Coal Quantity &amp; Quality Estimation</li> <li>• GCV determination</li> <li>• Coal Stockpile Utilization Strategies</li> <li>• Coal Blending Practices</li> <li>• Coal Conveying Practices</li> <li>• CHP Maintenance Practices</li> <li>• HSE practices</li> </ul> <b>AHP</b> <ul style="list-style-type: none"> <li>• Ash analysis and its importance</li> <li>• Bottom ash handling</li> <li>• Fly ash handling</li> <li>• Ash conveying practices</li> <li>• Ash storage practices</li> <li>• HSE Controls</li> </ul>
33	Best Practices O & M of Coal Mills	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Coal Sizing for different type of boilers</li> <li>• Coal Quality and Coal Mills</li> <li>• Type of Coal Mills and their application</li> <li>• Operation of coal mills</li> <li>• Maintenance of coal mills</li> </ul>
34	Boiler Performance & Life Extension	<b>3 days</b>	<ul style="list-style-type: none"> <li>• Coal quality and boiler performance</li> <li>• Factors affecting boiler performance</li> <li>• PTC 4.1</li> <li>• Performance parameter measurement</li> <li>• Performance calculation examples / exercises</li> <li>• Determining boiler performance with field instruments and regular tracking.</li> <li>• Operational practices towards better performance.</li> <li>• Maintenance practices towards better performance.</li> <li>• Regular NDT</li> <li>• RLA</li> <li>• Life extension strategies</li> </ul>
35	Tube Failure in Boilers- Causes & Remedial Measures	<b>2 days</b>	(cover both PC & CFBC) <ul style="list-style-type: none"> <li>• Water and Steam flow</li> <li>• Combustion &amp; Hot Gases Flow</li> <li>• Boiler Metallurgy</li> <li>• Steam &amp; Water Chemistry</li> <li>• Critical areas in a boiler</li> <li>• External and Internal failure mechanism</li> <li>• Failure common causes</li> <li>• Preventing Failures</li> </ul>
36	Pumps Operation & Maintenance	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Types of pumps and application</li> <li>• Construction features</li> <li>• Characteristic curves</li> <li>• Pump selection</li> <li>• Safe operating practices (start-up, normal operation, shut-down, changeover)</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
			<ul style="list-style-type: none"> <li>• Preventive Maintenance Practices</li> <li>• Common failure causes and remedies</li> </ul>
37	Bearing Maintenance & Shaft Alignment	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Journal &amp; Antifriction Bearings, concepts and applications</li> <li>• Bearing hydrodynamics</li> <li>• Construction features and metallurgy</li> <li>• Operational monitoring</li> <li>• Maintenance practices</li> <li>• Failures, causes &amp; remedies</li> </ul>
38	Valve maintenance	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Type of valves and application</li> <li>• Valve selection</li> <li>• High pressure valves</li> <li>• Operation practices</li> <li>• Maintenance Practices</li> <li>• Failures, causes and remedies</li> <li>• Motorized valves and actuators</li> </ul>
39	Renovation & Modernization of Thermal Power Stations	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Elements of R&amp;M               <ul style="list-style-type: none"> <li>➢ Performance</li> <li>➢ Obsolescence</li> <li>➢ Upgradation</li> </ul> </li> <li>• Importance of maintenance with regard to R&amp;M</li> <li>• Assessing plant condition – RLA</li> <li>• Retain, Repair, Replace decisions</li> <li>• R&amp;M of Boiler</li> <li>• R&amp;M of Turbine</li> <li>• R&amp;M of BoP</li> <li>• R&amp;M of controls</li> <li>• R&amp;M planning &amp; timelines</li> <li>• Execution aspects</li> <li>• Performance Testing after R&amp;M</li> </ul>
40	Project management in power Sector	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Planning Power Plants</li> <li>• Key development phases</li> <li>• Overall project timelines for different type of power plants</li> <li>• L1, L2 and L3 schedules</li> <li>• PM in different phases</li> <li>• Project closure</li> </ul>
41	Environmental Issues, Challenges & Solutions for Power Plants	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Introduction &amp; Historical Trends</li> <li>• Future environmental outlook</li> <li>• Environmental guidelines and standards</li> <li>• Key environmental issues with different type of plants.</li> <li>• Power Plant emissions / wastes / discharges from different systems and their effect on the environment.</li> <li>• Present technologies for environmental pollution control</li> <li>• Future of env control technologies.</li> </ul>

Sl. No.	Programme	Duration	Broad Contents
42	Earthing & Grounding	<b>1 day</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Key design aspects of earthing / grounding</li> <li>• Earthing pit</li> <li>• Earthing / grounding calculations and exercises</li> <li>• Regular testing &amp; monitoring</li> <li>• Maintenance aspects, earthing pit recharging</li> </ul>
43	High Voltage Testing of Power System Equipments	<b>1 day</b>	<ul style="list-style-type: none"> <li>• Introduction to High Voltage testing.</li> <li>• Testing on Generators</li> <li>• Testing on Transformers</li> <li>• Testing on Motors</li> <li>• Testing on Power cables</li> <li>• Testing on Busducts.</li> <li>• Testing on Switchgears.</li> <li>• Difference between destructive and Non-destructive testing.</li> </ul>
44	Operation, Maintenance & Repairs of LT & HT motors	<b>2 days</b>	<ul style="list-style-type: none"> <li>• Introduction to Motors.</li> <li>• Design and constructional features of Motors.</li> <li>• Design Standards of motors.</li> <li>• Difference on HT and LT motors.</li> <li>• Testing on Motors.</li> <li>• Parameters observations on running of motors.</li> <li>• Various maintenance schedules</li> </ul>