

**Syllabus
On**

SPONGE IRON SECTOR

Under

SKILL DEVELOPMENT INITIATIVE SCHEME (SDIS)

Based on

Modular Employable Skills (MES)

Designed in

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Government of India
Ministry of Labour & Employment
Directorate General of Employment & Training

List of the members attended the Trade Committee meeting for designing the course curriculum under **Skill Development Initiative Skills (SDIS)** based on **Modular Employable Skills (MES)** on “**Sponge Iron Sector**” held at Purulia, West Bengal on 03rd November’ 2012.

Shri RN Bandyopadhyaya, Director, CSTARI, Kolkata

Sl. No.	Name & Designation S/Shri	Representing Organisation	Remarks
1.	B. Gopichand, VP (Technical)	Bihar Sponge Iron	Chairman
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3.	S.B. Sardar, Asstt. Director	CSTARI, Kolkata	Member
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5.	S.K. Mandal, PCG	TATA Motors	Member
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11.	Yudhisthir Mahat, Chemist (P.H.E.)	Rajadera, Kotshila, Purlia	Member
12.	T.K. Sinha, G.M. (Mech.&Engg.)	Bihar Sponge Iron Ltd.	Member
13.	Debasish Dubey, Sr. Manager	Bihar Sponge Iron Ltd.	Member
14.	C. Guha, Retd. Sr. Q.C. Officer	Bihar Sponge Iron Ltd.	Member
15.	Sagarnil Guha	Disha Technical Institute	Member
16.	Dr. Nilesh Haldar	Ch. Scientist, Sai Services, Dhanbad	Member
17.	B. T. Mukherjee	B.E Elec. , B. Tech Power Plant, Golpark Kol- 29	Member
18.	Subimal Chattaraj	Purulia Cultural and Educational Society	Member
19.	Sadananda Gorai	Purulia Cultural and Educational Society	Member
20.	Sanjay Banerjee	Director CIT, Durgapur - 1	Member
21.	Dr. Debabrata Mukherjee	Asst. Teacher, Purulia	Member
22.	H. Kujur, D/Man	CSTARI, Kolkata	Member
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Course Curricula under Skill Development Initiative Scheme (SDIS) Based on Modular Employable Skills (MES) on Sponge Iron Sector

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Skill Development based on Modular Employable Skills (MES)

1. Background:

The need for giving emphasis on Skill Development, especially for the educated unemployed youth (both for rural & urban) has been highlighted in various forums. Unfortunately, our country's current education system does not give any emphasis on development of skills. As a result, most of the educated/uneducated unemployed youths are found wanting in this area, which is becoming their Achilles heel.

As India is on the path of economic development and the share of service sector's contribution to the GDP of the country is increasing (54% of GDP) it is becoming imperative that Government of India along with other nodal agencies play an important role in providing employable skills, with special emphasis on Skills.

Hence, need of the hour is some policy change at Apex level which will address the needs of the changing economy and look at providing mandatory skills training to all educated unemployed youths, with a view to have them gainfully employed. This shift in policy will ultimately benefit all the stake holders, namely the individuals, industry, Government and the economy by way of providing employment, increasing the output/productivity and ultimately resulting in a higher GDP for the nation.

2. Frame work for skill development based on 'Modular Employable Skills (MES)

Very few opportunities for skill development are available for the above referred groups (educated unemployed youth). Most of the existing skill development programmes are long term in nature. Poor and less educated persons cannot afford long term training programmes due to higher entry qualifications, opportunity cost, etc. Therefore, a new framework for skill development has been evolved by the DGET to address the employability issues.

The **key features of new framework for skill development** are:

- Demand driven short term training courses based on modular employable skills decided in consultation with Industries.
- Flexible delivery mechanism (part time, weekends, full time)
- Different levels of programmes (foundation level as well as skill up gradation) to meet demands of various target groups
- Central Government will facilitate and promote training while vocational training providers (VTP) under the Govt. and Private Sector will provide training.
- Optimum utilization of existing infrastructure to make training cost effective.
- Testing of skills of trainees by independent assessing bodies who would not be involved in conduct of the training programme, to ensure that it is done impartially.
- Testing & certification of prior learning (skills of persons acquired informally)

The Short Term courses would be based on “Modular Employable Skills (MES)”.

The **concept for the MES** is:

- ✓ Identification of minimum skills set. Which is sufficient to get an employment in the Labour market.
- ✓ It allows skills up gradation, multi skilling, multi entry and exit, vertical mobility and lifelong learning opportunities in a flexible manner.
- ✓ It also allows recognition of prior learning (certification of skills acquired informally) effectively.
- ✓ The modules in a sector when grouped together could lead to a qualification equivalent to National Trade Certificate or higher.
- ✓ Courses could be available in different vocations depending upon the need of the employer organizations.
- ✓ MES would benefit different target groups like:
 - Workers seeking certification of their skills acquired informally
 - Workers seeking skill up gradation
 - Early school drop-outs and unemployed
 - Previously child Labour and their family

3. INTRODUCTION

Economic growth in India is increasingly supported by robust industrial growth. **Sponge Iron Sector** is one of the relatively lesser known but significant sectors that support almost all industrial/ commercial activities. However, notwithstanding its importance and size (INR 4 trillion), it has traditionally not been accorded the attention it deserves as a separate sector in itself. The level of inefficiency in **Sponge Iron** activities in the country has been very high across all modes.

The required pace of efficiency and quality improvement will demand rapid development of capabilities of service providers. And with these **Sponge Iron** activities being a service oriented sector, skill development will emerge as a key capability.

This lack of focus on developing manpower and skills for the sector has resulted in a significant gap in the numbers and quality of manpower in the **Sponge Iron Sector**. This gap, unless addressed urgently, is likely to be a key impediment in the growth of the sector in India and in consequence, could impact growth in industry and commercial/ manufacturing sectors as well. This underscores the need identifying areas where such manpower and skill gaps are critical, and developing focused action plans to improve the situation.

A look at the required initiatives for manpower development in the **Sponge Iron Sector** makes it clear that sustainable development of the sector’s manpower requires a collaborative public private effort. The level of commitment demonstrated by each stakeholder would largely determine the direction that the sector heads towards.

4. Age of Participants

The minimum age limit for persons to take part in the scheme is 14 years.

5. Curriculum Development Process :

Following procedure is used for developing course curricula

- Identification of Employable Skills set in a sector based on division of work in the Labour market.
- Development of training modules corresponding to skills set identified so as to provide training for specific & fit for purpose
- Development of detailed curriculum and vetting by a trade committee and by the NCVT (Close involvement of Employers Organizations, State Governments and experts, vocational Training providers and other stakeholders are ensured at each stage).

6. Development of Core Competencies:

Possession of proper attitudes is one of the most important attributes of a competent person. Without proper attitudes, the performance of a person gets adversely affected. Hence, systematic efforts will be made to develop attitudes during the training programme.

The trainees deal with men, materials and machines. They handle sophisticated tools and instruments. Positive attitudes have to be developed in the trainees by properly guiding them and setting up examples of good attitudes by demonstrated behaviors and by the environment provided during training.

Some important core competencies to be developed are:

Core Competencies:

The core competencies developed by the candidates in Level - I are :

- (i) Safety Consciousness and safe working practices
- (ii) Learn continuously
- (iii) Ability to work in a team
- (iv) Proper Communication Skills
- (v) Ability to Analyze and take decisions from GAD
- (vi) Ability to identify the right materials for installation
- (vii) Care for tools and equipments
- (viii) First Aid proficiency
- (ix) Ability to co-ordinate work from other agencies to ensure smooth progress of work at site
- (x) Mechanical Proficiency
- (xi) Punctuality, discipline and honesty
- (xii) Respect for rules and regulations
- (xiii) Quality Consciousness
- (xiv) Positive Attitude and Behavior
- (xv) Responsibility & Accountability
- (xvi) Technical proficiency in installation of elevators
- (xvii) Enhancing the Ride Comfort
- (xviii) Troubleshooting Issues with ease
- (xix) Site Management

- (xx) Leadership
- (xxi) Motivating the work force and ensuring maximum productivity
- (xxii) Identifying and developing the skills of the work force under him.

7. Duration of the Programmes:

Time taken to gain the qualification will vary according to the pathway taken and will be kept very flexible for persons with different backgrounds and experience. Duration has been prescribed in hours in the curriculum of individual module, which are based on the content and requirements of a MES Module. However, some persons may take more time than the prescribed time. They should be provided reasonable time to complete the course.

8. Pathways to acquire Qualification:

Access to the qualification could be through:

An approved training Programme.

9. Methodology

The training methods to be used should be appropriate to the development of competencies. The focus of the programme is on “performing” and not on “Knowing”. Lecturing will be restricted to the minimum necessary and emphasis to be given for learning through practical on-site training for the installation of elevators & escalators.

The training methods will be individual centered to make each person a competent one. Opportunities for individual work will be provided. The learning process will be continuously monitored and feedback will be provided on individual basis. Demonstrations using different models, audio visual aids and equipment will be used intensively.

10. Instructional Media Packages

In order to maintain quality of training uniformly all over the country, instructional media packages (Imps) will be developed by the National Instructional Media Institute (NIMI), Chennai

11. Assessment:

DGE&T will appoint assessing bodies to assess the competencies of the trained persons. The assessing body will be an independent agency, which will not be involved in conducting the training programme. This, in turn, will ensure quality of training and credibility of the scheme. Keeping in view, the target of providing training/testing of one million persons throughout the country and to avoid monopoly, more than one assessing bodies will be appointed for a sector or an area.

12. Certificate:

Successful persons will be awarded competency-based certificates issued by **National Council for Vocational Training (NCVT)**.

Course Matrix :

LEVEL - I

Module – 1:

Assistant Process Operator

Module – 2:

Assistant Quality Controller

Module – 3:

Assistant Power Plant operator

LEVEL - I

Module No. 1

1. Name : **Assistant Process Operator**
2. Sector : Sponge Iron
3. Code No. : SPI 101
4. Entry Qualification : Minimum 8th Class Passed
5. Age : 16 years and above.
6. Duration : 400 Hours
7. Terminal Competency : On completion of this module, the incumbent will able to assist the process operator in sponge iron industry.
8. Space Norms :70 sq. mtr.
9. Power Norms : 1.5 KW
10. Qualification of Instructor :Degree in Metallurgy/Mechanical Engineering with 1 year experience.
Or
Diploma in Metallurgy/Mechanical Engineering with 2 years experience

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Safety precautions before work: Wear a) Helmet b) Hard Glass c) Safety Shoes d) Nose Mask • Operation and exercise of a) Walky-talky b) Hot plate c) Oven d) Muffle furnace e) Balance pH meter f) Conductivity/TDS meter g) Other common instruments • Demonstration of D.R.I Process • Display of different types of kiln • Demonstration of Rotary kiln and cooler • Demonstration of Coal and Gas based rotary kiln • Practice with different process parameters of hematite ore and coal • Demonstration of hematite ore sample and its contaminants • Display of extra oxygen required for D.R.I process • Demonstration of different coal samples • Exercise of coal sampling • Demonstration of common instruments required for sampling Iron ore sampling from field • Exercise on coal and iron ore testing before final feeding in D.R.I kiln • Demonstration of Iron ore contamination with BHQ, Soft ore and other reactive materials • Demonstration of use and function of dolomite ore in D.R.I process for sponge iron making • Display of horizontal shaft kiln of 50, 100 and 500 T.P. D capacity • Exercise of raw materials feeding system in rotary kiln • Demonstration of coal processing before feeding • Exercise and operational idea 	<ul style="list-style-type: none"> • Introduction of safety awareness • Definition of sponge iron • Contaminations in iron ore • Types of iron ore • Use of iron ore in ancient age • Stock of iron ore in World • Reasons to prefer hematite ore over other iron ores • Concept of using pellets • Direct reduction process and its application • Function of oxygen in D.R.I process • Role of heat exchange • Concept about metallization theory of hematite ore • Details idea about Iron testing procedure • Explanation of gratification depending on metallization • Function of CO in sponge iron process • Idea about oxygen extraction from ore • Discussion with different carbon testing procedures • Use of coal in sponge iron D.R.I process • Details idea about Coal characterization • Coal testing and different parameters • Character of sub bituminous coal • Concept of various coal-iron ratios • Grade analysis of sponge iron • Different chemical reactions in iron processing • Measurement of air volume • Temperature measurement by thermocouple • Types and functions of klin • Different parts and selection of a klin • Function of ABC • Idea about DSC • Functions of stack cap and emergency cap • Functions of cooler and product

<p>of different coal crusher namely Role crusher, Jaw crusher and Impactor crusher</p> <ul style="list-style-type: none"> • Demonstration of Iron ore crusher • Display of ground hopper, vibro feeder, motorized vibro feeder, magnetic vibro feeder • Demonstration of Conveyor belt, types of conveyor belt, belt size, its thickness and ply • Demonstration of equipments used in long distance carrying system e.g. pulley, carrying idler or roller, guide roller and roller frame • Demonstration of different types of coupling used in conveyor belt • Display of coolers according to the capacity of the kiln • Demonstration water spraying system • Exhibition of Dual pendulum valve and its necessity • Visit of product house and explanation of its activity • Demonstration of magnetic separator and its use • Exercise of gratification of Sponge iron as metalized • Demonstration with Pilates in respect of iron ore 	<p>house</p> <ul style="list-style-type: none"> • Different screens • Types of coupling and its use • Concept of horizontal shaft kiln • Concept about the capacity of sponge iron plant • Difference between rotary and shaft kiln • Types and working principle of furnace • Introduction with raw material feeding system • Coal processing • Types of coal crusher and their functions • Properties of raw materials • Concept of Jaw crusher • Different types of pulley • Concept of roller, Worm wheel, gear box, Transmission Gear box • Types of conveyor Belt • Concept of dual pendulum valve • Idea and working principle of magnetic separator • Working principle of Electrostatic precipitator • Functions of water gun • Function of I.D fan and its calculations • Preventive measures in sponge iron plant
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*** Preventive measures in sponge iron plant**

- Sponge iron is red level industry according to the assessment of Central pollution control board. Equipments are necessary to run the sponge iron industry
The equipments are:
 - i) The bag filter and bag house
 - ii) The pulse – jet, bag filter the electrostatic precipitator
 - iii) The 3 field or 4 field E.S.P concept in sponge plant
 - iv) The I.D fan of an E.S.P and calculation of pressure of a I.D fan
 - v) Water sprinkler to dedusting the plant area
 - vi) The heat radiator

Safety Tools/ Equipment:

Sl. No.	Description	Quantity
1.	Fire extinguisher (soda acid)	4 Nos
2.	Chemical foam extinguisher	2Nos
3.	Carbon- dioxide extinguisher	2 Nos
4.	Materials/chemical safety data sheet	As per requirement
5.	Personal protective equipments kit (gumboot, helmet, gloves, aprons, air plugs, nose mask.	10kits
6.	Tool kit	2 Nos
7	Glass	3 Nos
8	Tongue	4 Nos
9	Apron	6 Nos
10	Helmet	4 Nos
11	Safety Shoes	6 Prs
12	Hand Gloves	6 Prs
13	Nose Mask	20 Nos

Tools/ Equipment:

Sl. No.	Description	Quantity
1.	Shovel	20 Nos
2.	Double wheel Barrow	2 Nos
3.	Magnets	4 Nos
4.	Spectrophotometer	1 No.
5.	Conductivity cum TDS meter	1 No.
6.	Distillation unit	1 No.
7	Drying oven	1 No.
8	Hot plate	1 No.
9	Muffle furnace	1 No.
10	Balance	1 No.
11	Fume chamber	1 No.
12	Magnetic separator	1 No.
13	Disc Mill	1 No.
14	Electric heater	1 No.
15	Exhaust fan	1 No.
16	Wooden self	1 No.

17	Water cooler	1 No.
18	Sat magma	1 No.
19	Magnetic stirrer	1 No.
20	Desiccators	1 No.
21	pH Meter	1 No.
22	Turbidity meter	1 No.
23	Storyline for Carbon and Sulphar	1 No.
24	Platinum Crucible	1 No.
25	V.M/Ash Crucible	1 No.
26	Enamel Tray	1 No.
27	Filter stand	1 No.
28	Temperature gauge	1 No.
29	Pressure gauge	1 No.

LEVEL - I

Module No. 2

1. Name : **Assistant Quality controller**
2. Sector : Sponge Iron.
3. Code No. : SPI 102
4. Entry Qualification : Minimum 10th Class passed
5. Age : 16 Years and above.
6. Duration : 400 hrs.
7. Terminal Competency : On completion of this course incumbent will be able to Assistant quality controller in sponge iron industry
8. Space Norms : 30 Sq. mtr.
9. Power Norms : 1.5 K.W.
10. Qualification of Instructor : M.Sc in chemistry with 3 years experience in the relevant field

Practical Competencies	Theoretical Competencies
<ul style="list-style-type: none"> • Safety precautions before work: Wear a) Apron b) Hard Glass c) Safety Shoes d) Nose Mask • Operation and exercise of h) Hot plate i) Oven j) Muffle furnace k) Balance pH meter l) Conductivity/TDS meter m) Other common instruments • Demonstration of coal sampling from wagon after unloading • Observation (Physical) a) Size of coal b) Name of coal and Mines c) Type of contaminations d) Approx % of moisture e) % of Steam and slack in coal • Exercise of sampling: a) Nos of samples b) % of -3 mm is to be calculated after screening • Practical measurement of Bulk Density: a) Measured volume of coal b) Measured weight of coal c) Density = (Mass/Volume) • Demonstration of manually dressing of coal sample by hammer and passed through -8mm size • Drying of coal sample at 110⁰C • Measurement of % of surface moisture (Initial wt. – Final wt.)/ (Wt. of sample) • Demonstration of Divide / coning and quartering the surface moisture free coal a) Measured amount of coal is powdered in a disc mill /pulveriser 	<ul style="list-style-type: none"> • Chemical used in lab, their Handling and up-keep in lab • Importance of safety measures taken for handling of chemicals • Details idea about Hazard chemicals • Theory and routine practice about common laboratory instruments a) Hot plate b) Oven c) Muffle furnace d) Others • Formation of coal in nature • Sources of coal in India • Types of mines a) Open cast b) Underground mines • Contaminations of coal: a) Shelly b) Soil c) Stone • Coal gratification depending on the VM, Ash etc • Use of coal in industry • Percentage ratio of coal and iron ore in rotary klin in sponge iron • Idea about sampling a) Coal b) Iron ore c) Dolomite d) Others • Importance of coning and quartering • Details about sample preparation a) Coal b) Iron ore c) Dolomite d) Others • Preliminary knowledge about iron ore • Chemistry behind iron ore formation

<ul style="list-style-type: none"> b) Measured amount of powdered coal taken on a watch glass c) Dried the sample at 110°C for 1 hr d) Weight is taken e) % of inner moisture = (Initial wt. – Final wt.)/ Wt of sample taken f) Total moisture = Surface moisture + Inner moisture • Analysis of fixed carbon in coal • Chemical analysis of coal: <ul style="list-style-type: none"> a) Determination of reducibility b) Ash percentage c) Silica content d) Sulphur content • Operational exercise of: <ul style="list-style-type: none"> a) Filtration b) Evaporation c) Distillation d) Other common experiments • Analysis of Iron ore: • Physical observation <ul style="list-style-type: none"> a) Size of ore b) Contaminations (bonded hematite, quartz,, laterite, soil etc.) c) Moisture • Procedure of sampling: <ul style="list-style-type: none"> a) Measured amount of ore is taken b) Coning and quartering of sample c) Manually dressed d) Make the proper size • Determination of <ul style="list-style-type: none"> a) LOI (Loss of ignition) b) Inner moisture • Physical tests: <ul style="list-style-type: none"> a) Tumbler test b) Shutter test • Demonstration on fractionalization of iron ore • Determination of MPS (Means particle size) : • Chemical analysis: <ul style="list-style-type: none"> a) % of Al₂O₃ b) SiO₂ c) % of Cao and MgO d) % of Sulphur • Dolomite analysis: 	<ul style="list-style-type: none"> • Different types of iron ore • Composition of different ores • Priority of hematite ore over the other available iron ore • Abundance of iron in our country/Iron mines • Difference between hard massive and soft massive ore • Importance of BHQ (Banded hematite quartz) • Role of laterite in sponge iron making • Contamination of laterite with iron ore • Definition of <ul style="list-style-type: none"> a) Tumber index b) Abrasion • Definition of Shutter index • Direct reduction in sponge iron making • Calculation of Mean particle size (MPS) • Idea about sponge iron • Grade analysis of sponge iron • Role of CO and CO₂ formed in sponge inside the klin • Ratio of carbon and iron • Calculation of Yield test • The theory of metallic iron balance • Degree of metallization • Theory and calculations of Material balance • Details about the chemical reactions occurred in sponge iron formation <ul style="list-style-type: none"> a) Combustion b) Reduction c) Reactions in DRI process d) Other related processes • Role of dolomite in sponge iron making • Preparation of different chemical solutions • Application of chemical solutions in sponge iron making • Nature of the chemicals • Primary standard and secondary standard • Chemical used in chemical lab, their nature, identification, physical Testing, Handling and up-keep in
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<ul style="list-style-type: none"> • Physical observation <ul style="list-style-type: none"> a) Size of ore b) Contaminations c) Moisture • Procedure of sampling: <ul style="list-style-type: none"> a) Measured amount of ore is taken b) Coning and quartering for moisture containing sample c) De moisture by electric hot plate • Chemical analysis: <ul style="list-style-type: none"> a) % of CaO b) % of MgO c) % of Fe₂O₃ d) % of TAI (Total acid insoluble) e) % of LOI (Los of ignition) • Demonstration of feed materials (Coal , Iron ore and Dolomite) on conveyer belt in Rotary klin • Exercise of sample collections from weigh- feeder and belt • Routine analysis of Physical and Chemical properties of Feeding materials • Demonstration for any abnormal properties and necessary Care/ rectification • Display of Cooler discharge process • Collection of sample after passing through magnetic separator • Demonstration on CHAR or waste product • Chemical analysis of product: <ul style="list-style-type: none"> a) % of Fe Metallic b) % of non mag. • Determination of degree of metallization • Yield test • Determination of % of carbon and sulphar by Strolein method • Complete analysis of Accretion formed inside rotary klin • Analysis of waste product: <ul style="list-style-type: none"> a) Total iron content b) Fixed carbon • Analysis of ESP deposited • Miscellaneous Analysis: <ul style="list-style-type: none"> a) Inspection of Anchor 	<p>lab.</p> <ul style="list-style-type: none"> • Different analysis techniques <ul style="list-style-type: none"> a) Gravimetric b) Titrametric c) Fusion d) Other common techniques • Coal and its characterization • Different parameters of coal <ul style="list-style-type: none"> a) Moisture content b) Volatile matters c) Sulphar content d) Calorific value e) Others • Definition of CHAR and ESP • Use of Anchor in Rotary klin • Function of Jaw crusher • Model of sponge iron industry • Flow chart of different processes in sponge iron plant • The working principle of common machines utilized in plant • Identification and Selection of glass wares used in lab. • Type and selection of containers used for chemicals. • Method of Transfer of chemicals. • Preparation of various reagents, Solution, indicators and distilled water • What is corrosion • Various corrosion prevention methods • Preventive measures in lab
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<ul style="list-style-type: none"> b) Size and types of anchor c) Chemical analysis for Chrome, Nickel and manganese by titrametric method d) Carbon and sulphar by strolein method • Inspection of Jaw crusher: <ul style="list-style-type: none"> a) % of manganese b) % of Carbon c) % of Sulphur • Special analysis of Alloy Steel: <ul style="list-style-type: none"> a) Chemical analysis for Chrome, Nickel and manganese by titrametric method b) Carbon and sulphar by strolein method • Analysis regarding complaint for quality of dispatched products e.g. <ul style="list-style-type: none"> a) Analysis of Iron metallic : By Titrametric method (treatment with mercurours chloride and ferrous chloride) b) Analysis of Non mag in the product : Proxible analysis • Demonstration on chemical dozing in power plant & cooler • Demonstration on corrosion and corrosion protection of parts of kiln <ul style="list-style-type: none"> a) Chemical inhibition b) Physical methods for corrosion protection 	
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Safety Tools/ Equipment:

Sl. No.	Description	Quantity
1.	Fire extinguisher (soda acid)	4 No
2.	Chemical foam extinguisher	2No.
3.	Carbon- dioxide extinguisher	2 No.
4.	Materials/chemical safety data sheet	20 sheets
5.	personal protective equipments kit (gumboot, helmet, gloves, aprons, air plugs, nose mask.	10kit
6.	Tool kit	2 No.
7	Glass	3 No.
8	Tongue	4 No.
9	Apron	6 No.

10	Helmet	4 No.
11	Safety Shoes	6 Pr.
12	Hand Gloves	6 Pr.
13	Nose Mask	20 No.

Tools/ Equipment:

Sl. No.	Name of Tools/Equipment	Quantity
1.	Centrifuge	1 No.
2.	Portable pH meter	1 No.
3.	Pipette stand	1 No.
4.	Burette stand	1 No.
4.	Spectrophotometer	1 No.
5.	Conductivity cum TDS meter	2 No.
6.	Distillation unit	1 No.
7	Drying oven	1 No.
8	Hot plate	4 No.
9	Muffle furnace	1 No.
10	Balance	2 No.
11	Fume chamber	1 No.
12	Magnetic separator	1 No.
13	Water bath	1 No.
14	Electric heater	2 No.
15	Autoclave	1 No.
16	Suction pump	1 No.
17	Water cooler	2 No.
19	Magnetic stirrer	2 No.
20	Desiccator	4 No.
21	pH Meter	2 No.
22	Turbidity meter	2 No.
24	Platinum Crucible	2 No.
25	V.M/Ash Crucible	20 No.

Glassware's:

Sl. No.	Name of Tools/Equipment	Quantity
1	Pipette	12 No.
2	Burette	12 No.
3	Beaker	12No.
4	Flask	15 No.
5	Watch glass	12 No.
6	Platinum wire	2 No.
7	Glass rod	40 No.
8	Weighing bottle	1 No.
9	Funnel	4 No.
10	Measuring cylinder	3 No.

LEVEL - I

Module No. 3

1. Name : **Assistant Power Plant Operator**
2. Sector : Sponge Iron
3. Code No. : SPI 103
4. Entry Qualification : Minimum 8th Class Passed
5. Age : 16 Years and above.

6. Duration : 400 Hours
7. Terminal Competency : On completion of this module, the incumbent will able to assist power plant operator in sponge iron industry

8. Space : 100 sq meter
9. Power norms : 1.5 KW

10. Instructor's Qualification : Degree in Electrical Engineering/Diploma with one year experience in the relevant field

Practical Competencies	Theoretical Competencies
<ul style="list-style-type: none"> • Safety precautions before work: Wear a) Helmet b) Hard Glass c) Safety Shoes d) Nose Mask • Exercise and Operation of a) Walky-talky b) Oven c) Muffle furnace d) Balance e) pH meter f) Conductivity/TDS meter g) Other common instruments • Visit to water treatment plant and demonstration the activities • Observation and demonstration of working of DM water plant • Demonstration on Fuel Types e.g. Washery rejects, F grade coal and Char • Determination of coal and char ratio • Demonstration on Size of feed coal and Diesel as start up fuel • Display of Bed material • Exercise of size distribution of bed materials, chemical composition (alumina, silica etc and bulk density) and fusion temperature • Demonstration on Sieve analysis • Demonstration of Chemical dosing of water from raw water to DM water • Display of different types of Boiler e.g. Low pressure boiler , High pressure boiler etc • Demonstration on water feeding in boiler system • Display and demonstration of working of pressure control system • Demonstration on different types of Boiler feed water pump (Feeders, main drug chain feeder, screw feeder, rotary feeder) • Inspection of water level by gauge glass • Display of startup burners • Demonstration of boiler pressure pump and pressure parts e.g. a) economizer, b) Steam drum, c) Down comer tube d) furnace • Demonstration on bed evaporator and 	<ul style="list-style-type: none"> • Fundamental knowledge in physics • Fundamental knowledge in chemistry • Use of boiler in different industry • Basic components concept of boiler • Summary of boiler accident • Introduction to Economizer • Efficiency calculation • History Indian boiler act • Procedure of inspection, Repair and operation engineering • Measurements of several electrical parameters • Fuel consumption • Introduction of turbine • Introduction to different fans, pumps, power back up system • Lubricant use in turbine • Concept of analog and digital signal • Transmitters • Introduction to pressure parts circuit, boiler blow-down, sample cooler and analysis • Chemical dosing system • Combustion system • Startup oil firing system • Basic concept of burners • Basic concept of furnace • Introduction to different parameters • Combustion control system • Basics about valves • Maintenance and repairing of boiler parts • Use of chemicals for water treatment • Operator job description and duties • Use of hand tools and power tools • Major tools in power plant • Principle of pyrometer

saturated steam supply tube

- Display of secondary super heater tube
- Exercise with air and gas system
 - a) FD fan
 - b) Air pre heater
 - c) Air ducts
- Demonstration on flue gas system and Electrostatic precipitator
- Demonstration on Blow down: High temperature and pressure steam careful inspection
- Display of different drain systems e.g. CBD drain, IBD drain
- Make up water in condensate water
- Demonstration on Primary and Secondary super heater
- Display of Stack emission and control
- Demonstration of pyrometer
- Demonstration on fuel feeding and firing system:
 - a) Fuel bunker
 - b) Screw feeder
 - c) Combustor
 - d) Bed drain pipe
- Display of Boiler start up of a cold boiler
- Procedure of coal firing start up without oil firing
- Operational control
 - a) Load operation
 - b) Bed level control
 - c) Bed ash alkali control
 - d) Adequate bed temperature
- Demonstration on Boiler shut down
 - a) Planned shut down
 - b) Boiler emergency trip
- Demonstration Boiler safety
 - a) Emergency procedures
 - b) Operational procedures for safety
- Exercise for preventive maintenance of
 - a) Fan
 - b) Valves
 - c) Pneumatic actuators
 - d) Transmitters
 - e) Conditioned based maintains
- Demonstration on annual maintenances
 - a) Planning before overhaul
 - b) Shut down and cooling the boiler
 - c) Inspection after cooling
 - d) Drum inspection
 - e) Inspection in the furnace
 - f) Safety valves, start up vent valves and

- Chemistry involve in boiler system (combustion, Daltons law etc.)
- Chemical equations (acid, base etc)
- Basic knowledge in machine safety
- Classification of water
- Water processing
- DM water in power plant
- Treatments of water
- Solution of solid and liquid
- Basic idea about coal
- Coal chemistry
- Fuel combustion
- Basic knowledge in instrumentation
- Concept of analog and digital signal
- Concept of transmitter
- Concept of Chemical dosing system
- Concept Combustion system
- Concept of combustor and furnace
- Introduction of chimney
- Calculation needed in boiler system
- Fuel management
- Pressure ratio calculation
- Operator job description and duties in turbine
- Importance of DM plant in power plant
- Contaminants in water
- Treatments for demineralization
- Solution of solids and liquids
- Basic principles and working of TDS meter, Spectrophotometer etc
- Pumps utilized in power plant
- Classification of pumps in DM plant
- Solution of solids and liquids in DM plant
- Colloids and dialysis
- De ionization of water

<ul style="list-style-type: none"> other isolating valves g) Expansion joints h) Isolation and cladding At last light up of a boiler • Demonstration on boiler preservation procedures <ul style="list-style-type: none"> a) Dry storage preservation b) Weight storage c) Nitrogen blanket d) Preservation of rotating equipments e) Preservation of instruments • Demonstration of refractory and insulation 	<ul style="list-style-type: none"> • Water for industrial use • Measurements of Turbidity, Salinity • Water parameters by spectrophotometers
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Tools & Equipments for One batch:

Sl. No.	Description	Quantity
1.	Fire extinguisher (soda acid)	4 Nos
2.	Chemical foam extinguisher	2Nos
3.	Carbon- dioxide extinguisher	2 Nos
4.	Materials/chemical safety data sheet	As required
5.	Personal protective equipments kit (gumboot, helmet, gloves, aprons, air plugs, nose mask.	10 Nos
6.	Tool kit	2 Nos
7	Glass	3 Nos
8	Tongue	4 Nos
9	Apron	6 Nos
10	Helmet	4 Nos
11	Safety Shoes	6 Prs
12	Hand Gloves	6 Prs
13	Nose Mask	20 Nos
14	Ear plug	20 Nos
15	Heat proof jackets	20 Nos
16	Welding glass and screen	20 Nos Each
17	Screw driver set ster type	2Nos
18	Bolt cutter	2Nos
19	Digital Multimeter	1 No.
20	Ammeter	1 No.
21	Coal nozzle	1 No.
22	Ecomiser coil	1 No.
23	Boiler bank tube	1 No.

24	Air preheater tube	1 No.
25	Tube and plate	1 No.
26	Super heater-header	1 No.
27	Super heater coil	1 No.
28	Steam drum	1 No.
**29	ID Fan	1 No.
**30	FD fan	1 No.
**31	SA fan	1 No.
**32	PA fan	1 No.
33	Thermocouples	1 No.
34	Safety valves	1 No.
35	BRG Puller	1 No.
36	Spanner	1 No.
37	Machine vice	1 No.
38	Digital multimeter	1 No.
39	Laser thermometer	1 No.
40	Insulation tester	1 No.
41	Radiation thermometer	1 No.
42	Installation tester	1 No.
43	Voltage director	1 No.
44	Digital AC DC tongue tester	1 No.
45	Pin bush	1 No.
46	Love joy flex	1 No.
**47	DM Water pump	1 No.
**48	Pump model	1 No.
**49	Cooling water recirculation pump	1 No.
**50	Soft water pump	1 No.
**51	Electromechanical vibrator feeder	1 No.
**52	Boiler feed pump	1 No.

**** Practical related to these machines will be done in the Industry**