

Syllabus for the trade
of
FOUNDRYMAN
(SEMESTER PATTERN)
UNDER
CRAFTSMAN TRAINING SCHEME

Designed in: 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN - 81, SECTOR – V, SALT LAKE CITY
Kolkata – 700 091

List of members of trade committee meeting for the trade of “Foundry man”

SL.NO.	NAME & DESIGNATION S/SHRI	REPRESENTING ORGANISATION	REMARKS
1.	Shri G.O. Nambiar Principal	C.T.I Guindy, Chennai – 600032	Secretary
2.	Shri K, Anganan, B.E. Senior Engineering(Foundry)	Binny Engineering, Meenambakkam, Chennai – 600114	Member
3.	Shri C. Radhakrishnan, Manager (Mfg.) India Cements Ltd. (Foundry Divn.)	Nandambakkam, Chennai – 600089	Member
4.	Shri S. Veera Raghavan Controller (Metallurgical Lab.)	Allison & Co., Chennai – 600002	Member
5.	Shri P.P. Prabhu Shri Aila Castings, No. 1, Dhanakoti Raja nStreet	Ekkattuthangal, Chennai – 600097	Member
6.	Shri S. Poovalagan Foundry Engineer, Rasha Machinery (P) Ltd. 133, G.S.T. Road,	Chrompet, Chennai-600 044	Member
7.	Shri D. Authiappan Regional Director	RDAT , Chennai-600 032	Member
8.	Shri R. Sambanlam Joint Director	Advance Training Institute , Chennai-600 032	Member
9.	Shri M.V. Rangaswamy Joint Director	C.I.M.T., Chennai-600 032	Member
10.	Shri. P. Sukumaran Nair A.D.T. (Retd.)	C.T.I., Chennai-600 032	Member
11.	Shri. T.G. Loganathan Principal, Govt. ITI North Chennai	Chennai	Member
12.	Shri P. Packlanathan, Training Officer	CTI, Chennai-600032	Member
13.	Shri V. Dhanasekaran Training Officer,	CTI, Chennai-600032	Member

14.	Shri K.V. Ramakrishnan Vocational Instructor (Moulder)	CTI, Chennai-600032	Member
15.	Shri S. Janakiraman Govt. ITI North Chennai	ATO,, Chennai-600032	Member
16.	Shri P.R. Jawalkoti Craft Instructor (Modular) Govt. ITI, Bijapur Road, Sholapur	Maharashtra	Member
17.	Shri P.B. Parbat Caft Instructor (Modular) Govt. ITI, Oundh Pune	Maharashtra	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member

24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. **Name of the Trade** : Foundryman
2. **NCO Code No.** : 726.10 725.70
3. **Duration** : One year (Two semesters)
4. **Power Norms :** : 11KW
5. **Space Norm :** : 128 Sq. Mtr
6. **Entry Qualification** : Passed 8th class Examination
7. **Unit Size(No. of Students)** : 16
8. **Instructor's/Trainer's Qualification :**

(a) Degree or Diploma in Mechanical/Metallurgy Engineering with 1 or 2 years post qualification experience respectively.
 Or, NTC in same or relevant trade with 5 years post qualification experience.
 Or, NAC in same or relevant trade with 4 years post qualification experience.

(b) Desirable Qualification: Preference will be given to a candidate with Craft Instructor Certificate.

***Note:** At least one instructor must have Degree/Diploma in Mechanical/Metallurgy Engineering.

SYLLABUS FOR THE TRADE OF FOUNDRY MAN UNDER C.T.S

DURATION: Six Months

First Semester

Semester code:FDY:SEM-I

Week No.	Trade Practical	Trade Theory	Workshop Calculation & Science	Eng. Drawing
1.	Introduction the trainee to the Institution.	Explain the course objective and Introduction.		
2.	Sieve sand mix and Temper by shovel and sand mixer-muller.	History of foundry Industry-Development of foundry in India importance of foundry in industry types of foundries – advantages of metal casting – importance of quality and quality awareness.	Applied workshop problems involving multiplication and division – common fraction – addition – subtraction – multiplication and division – application of fraction to shop problems.	Free hand sketching of straight lines : Rectangles square ; circles : polygons etc.
3.	Ramming Practice in moulding boxes with hand Rammers to obtain desired Green hardness such as 60 ; 70 ; 80 ; 90 on “ Green Hardness Tester”.	Safety precautions- General while moulding and core making pouring and feting-common safety equipments used in foundry-First Aid.	– do –	Free hand sketching with dimension scale and proportional sketching.
4.	Use hand Tools : cut channels on rammed boxes with cross section such as square : semicircular ; Tepezoid and Triangular and finish with double enders ; cleaners etc.	Name : specification and their application of various hand tools used in foundry – common types of natural & synthetic moulding sand as per I.S. 3343-1965-properties of moulding sand.	– do –	Reading of simple Blue print of Geometrical models.
5.	Prepare unit sand : prepare mould for block such as square :	Difference between natural and Synthetic moulding sand-principle	Decimals – addition – subtraction, multiplication,	Reading of simple Blue print of Geometrical models.

	Rectangular & Round.	ingredients in moulding sand & their effect on physical properties- special additives in moulding sand & their effect.	conversion of Decimals to common fractions – shop problems.	
6.	Prepare facing and Backing sand Prepare simple moulds with Top run gates.	Facing sand : Backing sand and unit – composition of various moulding sand. Types of mould-advantage and disadvantage of sand mould and metal mould.	– do –	Free hand sketching with dimension of simple solid such as cubes : rectangular blocks : cylinders etc.
7.	Prepare mould with self leaving core pattern by using parting line gates.	Definition: advantages and disadvantages of “Green sand mould” Skin dry sand mould – Loam sand mould and cement bonded sand mould.	Conversion of common fractions to decimal- shop problems.	Sketching of views of simple solid as mentioned above when viewed perpendicular to their surface and axes.
8.	Prepare Green sand mould by using split pattern for aluminium casting use natural moulding sand Melt aluminium in pit furnace and pour the same into moulds, fettle aluminium casting.	Construction : operation and maintenance of “Pit furnace” name : types construction and use of common foundry equipments such as – moulding boxes [As per I.S. 1280-1958] : [As per I.S. 4475-1967] : crucible [As per I.S. 1748-1961].	– do –	Sketching of views of simple solid bodies mentioned above when viewed perpendicular to their surface and axes.
9.	Level the floor with spirit level and straight edge and prepare open sand mould.	Moulding process-Bench moulding – different methods, advantages, disadvantages and their application.	Metric system – Metric weights and measurements – units – conversion factors (S.I. Units)	– do –
10.	Prepare Bedded mould [Floor mould with code with bottom run gate].	Moulding process – floor moulding – different methods : advantages : disadvantages and their application. Machine moulding different types of moulding machines – sand slinger and sand bertor.	– do –	Free hand sketching of nuts and bolts with dimensions from samples.
11.	Prepare moulds with vertical core print. Prepare simple core and assemble in the mould.	Core - uses and types – composition of various cores sand mixtures.	Shop problems on metric systems of weight and measurement (SI Systems).	Free hand sketching of rivets and washers with dimensions from samples.
12.	Prepare simple mould with horizontal core print and assemble the core in horizontal position.	Types of core boxes – core venting and reinforcing of core-core baking – core making machines.	– do –	Free hand sketching of keys and screw threads with dimension from samples.
13.	Prepare moulds for copper and copper base alloy’s melts copper alloy in pit furnace or oil fired furnace & pour – Fettle copper base alloy’s castings.	Construction : operation & maintenance of oil fired furnace. Pattern – Pattern Materials.	Geometry – Properties of Lines : Angles : Triangles and Circles.	As in the preceding week.
14.	Prepare mould with	Pattern – Types of		Free hand sketching of

	drawback method and false cheek method.	patterns- Allowances on pattern colouring of pattern as per I.S. 1513-1959 – care & maintenance of pattern.	– do –	Plan & elevation of simple objects like hexagonal bar : Square bar Circular bar : tapered bar and hollow bars.
15.	Prepare “Stack mould” and “Snap flask mould”.	Gating system – various types of Top run gate, Part line run gate & Bottom run gate.	Mass – Unit of mass Force- The wt. of body unit of wt. shop problems.	Free hand sketching of key’s s-screw –threads with dimensions from samples.
16.	Prepare mould with Loose piece patterns & core with Loose piece core box.	Pre-requisites of gating system – Risers : Feeders & directional solidification – chills : chaplets : Densers & Exothermic materials.	– do –	Explanation of simple orthographic projection – First angle.
17.	Prepare Cupola for charging chipping and doubling – prepare metal & slag spout ; Tap hole and slag hole ; sand bed; Lining of ladle.	Cupola – construction – parts of cupola and their functions – cupola zones – calculation of melting capacity of cupola.	Square root – square charge; square root of perfect square, the square root of whole no. and a decimals.	– do –
18.	Prepare charges for cupola charging – operate cupola furnace – melt cast iron & pour C.I. into mould.	Calculation of materials required for cupola charging – chipping & doubling of cupola – cupola operation.	– do –	Simple view of Hollow and solid bodies with dimensions. Use of different types of Lines & symbols for drawing.
19.	Prepare skin dry sand mould with irregular parting line. Cast it by C.I. & Identify casting defects.	Recent development in cupola – Possible defects occurring during cupola operation – causes and remedies.	C.G.S. & F.P.S. systems of Units of Force ; weight etc – their conversion Problem.	– do –
20.	Metal Working – Marking and sawing on straight line –chipping and Filing to desired size on diff. metals.	Description specification and use of common, marking, measuring; sawing; chipping and filing instruments used in metal work.	Simple ratio & proportion shop problems.	Simple view of hollow and solid bodies with dimension – use of different types of Lines and symbols for drawing.
21.	Grinding the metals to desired size by pedestal grinder and Flexible shaft grinder – Drilling on various metals.	Types of Grinders – Brief information about other metal cutting equipments – various types of drill bits and drilling machine.	Works – Unit of work : Energy; Power – Unit of power – applied problems.	View of simple hollow and solid bodies with dimensions. Use of different types of lines and symbols for drawing.
22.	Wood Working – Marking : sawing and planning on wood.	Brief description : specification and use of various wood working hand tools. Types of joints & their application in wood working.	– do –	Simple Isometric drawing Isometric view of simple object such as – square; Rectangles; Cubes; Rectangular blocks.
23.	Making important joints on wood and prepare simple pattern. and Repair the wooden patterns & core boxes.	Necessity of using contraction scale. Preparation of layout for simple pattern. and Importance of repairing the wooden pattern – methods of repairing the patterns & core boxes.	Algebra – Algebraic symbols, addition ; subtraction ; multiplication & division of expressions involving algebraic symbols – simple equation & transposition – problems.	– do –

24.	Carry out the different tests such as – moisture clay content : strength : permeability & sand grain fineness no. etc. of moulding sand. And Prepare dry sand mould with skelton pattern – prepare black wash (plumbago) & coat on mould and core.	Sand testing – Different methods of moisture test; permeability test clay content test – strength test, sand grain fineness test; refractoriness test of moulding sand. And Special casting process – definition; metals used composition; the process; use; advantages and disadvantage of CO ₂ process and shell moulding process.	Standard algebraic formula e.g. $[a+b]^2[a-b]^2$ etc. and Mensuration, area of rectangles; squares; triangles; circles; regular polygon etc.	Free hand sketching of fettling tools. And Use of drawing instrument ‘T’ square & drawing board etc.
25.	i) Project work ii) Industrial visit(Optional)			
26.	Examination			

SYLLABUS FOR THE TRADE OF FOUNDRY MAN UNDER C.T.S

Duration – six months

Second semester

Semester code:FDY:SEM-II

1.	Prepare Dry sand mould for cast iron with odd sided pattern.	Brief description : types; advantages & disadvantages of ‘Die casting’ – centrifugal casting and ceramic moulding process.	Specific gravity; Density calculation on mass : Volume and density by using related formula.	Construction of simple figures of solids with dimensions and Titles.
2.	Prepare simple “Loam sand mould” for simple pan/bell shape casting.	Brief description : advantages; disadvantages and use of ‘Investment casting process’. Binderless dry sand (Full mould) process; Plaster of paris moulding process.	– do –	– do –
3.	Prepare Pit mould on foundry floor.	Slush casting process; Continuous casting process Permanent mould casting process; Nishiyama process (by using ferrosilicon powder)	– do –	– do –
4.	Prepare a mould with pattern having cover core print – Assemble cover core in mould cast by cast iron – Fettle C.I. casting.	Common casting defects appearance – causes and remedies – salvaging of castings.	Simple problems on straight ball cranked levers.	Use of different types of scales in British and metric system.
5.	Prepare simple CO ₂ mould.	Fettling of casting – knock out and removal of casting from mould-removal of gates and risers; Fins and unwanted projection – surface	– do –	Lettering numbers and alphabets.

		cleaning – trimming and finishing.		
6.	Prepare simple CO ₂ core; assemble in CO ₂ mould & cast by cast iron.	Inspection of casting – destructive method – non-destructive methods. Refractory materials used in foundry and their grades as per I.S.	Calculation on volume and weight of simple solid bodies such as cubes; Hexagonal prisms – shop problems.	Free hand sketching of simple objects with dimension.
7.	Prepare mould for setting “Balancing core” and set balance core in mould with the help of chaplets.	Binders-common binders used in foundry and their application and their grades as per I.S. common “Facing materials” used in foundry and their application and their grades as per I.S.	– do –	Free hand sketching of plan elevation of simple objects like Hexagonal bar; square bar; circular bar; Tapered hollow bars etc.
8.	Prepare mould to assemble “Hanging core” and set hanging core in mould.	Common “Fluxes” used in foundry and their application. Common “Fluxes” used in foundry. Manufacturing process of coke – Good qualities of coke-specification of coke as per I.S.	Heat and Temperature Thermometric scale – Fahrenheit scales and Centigrade scales and their conversion. Name and use of temperature measuring instruments.	– do –
9.	Prepare mould for using “Chills”: Densifiers and fix chill and densifiers in mould.	Difference between “Metal and Non-metal” – Difference between ferrous metal and non-ferrous metal. Physical & Mechanical properties of metals.	– do –	Views of simple solid and hollow bodies cut section.
10.	Prepare core halves; Bake and join by different methods.	Iron ore – pretreatments of iron ore-pig iron – manufacturing process – grades as per I.S. and use cast iron – manufacturing process; grades as per I.S. and use.	Simple problems on Lines; Angles; Triangles and Circles.	– do –
11.	Prepare mould with “pencil gate”; Finger gate and cast it by Aluminium.	Common cast iron – Alloy’s manufacturing process of chilled cast iron; S.G. iron and malleable cast iron.	– do –	Reading of simple Blue print.
12.	Prepare mould with wedge gate and ring gate and cast it by copper base alloy.	Effect of elements normally present in ferrous metals – effect of alloying elements in ferrous metals – iron carbon Equilibrium diagram for plain carbon steel.	Calculation of volume of sand required for moulds. Calculation of weight of sand and mould boxes.	– do –
13.	Prepare mould with Branch gate mould with match plate pattern and cast it by cast iron.	Steel manufacturing process classification – common steel alloys and use.	Logarithms.	Further exercise on blue print reading.
14.	Prepare mould with relief sprue gate; skin bob gate and cast it by cast iron.	Wrought iron – manufacturing process – use. Copper	– do –	– do –

		manufacturing process – properties & uses.		
15.	Prepare mould with Horn gate [Gear wheel type pattern] and mould with stepped gate.	Manufacturing process, properties and use of Aluminium, Tin, Zine, Lead.	Use of Logarithmic tables, multiplication and division.	– do –
16.	Industrial visit to observe the special casting process machine moulding process, operation of different furnaces sand reconditioning process. Inspection of casting. Fettling process etc.	-----	-----	-----
17.	Prepare mould for extra thick casting with large feeder heads and cast it by cast iron.	Manufacturing process of copper base alloys, Aluminium base alloys and magnesium base alloys.	Reading of simple graph.	Isometric view of Simple castings.
18.	Reline the pit furnace.	Brief information about Blast furnace, Electric furnaces such as Arc furnace & Induction furnace.	Plotting & Reading of simple graph.	– do –
19.	Reline the oil fired furnace.	Brief information about open hearth furnace, Air furnace, Rotary furnace, Paddling furnace and convertors.	Electricity and its uses positive and negative terminals use of switches, fuses, conductors and insulators.	Orthographic projection of different castings.
20.	Reline the cupola furnace.	Heat treatment of casting Hardening, Tempering, Annealing, Malleabilishing, Normalising, Quenching, Nitriding Cyaniding etc.	Lever – Types – Simple problems on mechanical advantage of various levers.	– do –
21.	Prepare simple oil sand core by using linseed oil and IVP oils.	Calculation of ferrostatic pressure calculation of weight required on a mould.	Pulley – Types – Mechanical advantage related problems.	– do –
22.	Prepare simple regular shape mould without pattern. (By cutting practice).	Calculation of molten metal requirement for different size mould (Al, Brass, Copper, C.I. etc.)	Friction – Types – Coefficient of friction and related problems.	Free hand sketing of simple objects related to the trade and preparation of simple working drawings from the sketches.
23.	Prepare simple casting by gravity die casting process.	Cost estimation of simple castings of different metals.	Meaning of Horse Power, and Break Horse Power, simple problems on work energy and power.	– do –
24.	Prepare simple casting by Investment casting process and binderless dry sand process	Foundry mechanization – layout of a small foundry – List of material handling equipments and their use.	Stress, Strain – applied problems.	Free hand sketches of Rivets, screws, Nut and Bolt.
25.	Revision			

Trade:- FOUNDRY MAN
LIST OF TOOLS & EQUIPMENTS

A. TRAINEES KIT FOR 16 TRAINEES AND ONE INSTRUCTOR

Sl. No.	Item	Quantity
1	Tool tray steel 145 x 145 x 5 cm	16+1
2	Taper trowel 18 cm round	16+1
3	Heart and square trowels 3 x 1.2 x 1.2 cm	16+1
4	Trowel heart and scoop	16+1
5	Trowel square and scoop	16+1
6	Trowel double scoop	16+1
7	Trowel double square	16+1
8	Tools Spoon 32 x 16 mm – 25 x 6 m	16+1
9	Cleaner 6 x 300 m	16+1
10	Cleaner 9 x 300 m	16+1
11	Vent wire 3 mm	16+1
12	Peg rammer	16+1
13	Flat rammer 75mm x 25mm height	16+1
14	Rapping spike forged and hardened	16+1
15	Hand bellows – 25 cm	16+1
16	Safety goggles (with clear glass)	16+1
17	Goggles (antiglau heat proof)	16+1
18	Cleaner flange	16+1
19	Egg smoother	16+1
20	Smoother round corner	16+1
21	Smoother square corner	16+1
22	Steel rule 300mm	16+1
23	Apron leather or asbestos	16+1
24	Legging pad	16+1
25	Hand gloves (Leather or asbestos)	16+1

B. Tools, Measuring Instruments and Shop Outfit

Sl. No.	Item	Quantity
1	Hammers Ball Pein 0.45 kg	11
2	Ball pein hammers 650 to 700 gms	11
3	Sledge hammer 8 kg	5
4	Claw hammers 0.75 kg	3
5	Chisel cold flat 2x22 cm	11
6	Chisel 200x15 mm	11
7	File Flat 30 cm Bastard	11
8	File Flat 30 cm Second cut	11
9	File half round 30 cm bastard	8
10	File half round 30 cm second cut	11
11	Folding rule 60 cm	5
12	Steel rule 600 mm	5
13	Caliper odd leg	3
14	Caliper inside 15 cm	5
15	Scriber	5
16	Centre punch 15 cm	5
17	Hacksaw 30 cm adjustable	11
18	C Clamps 20 cm	11
19	C Clamps 30 cm light duty steel	11

20	Screw drivers 25cm with 15mm blade	11
21	Screw drivers 15cm	11
22	Screw drivers 18cm	11
23	Pliers 20cm	5
24	Plane grooving 6mm cutter	3
25	Cutting Pliers	3
26	Try Square (for wood work)	11
27	Brick layers hammer 20cm	11
28	Hand lamp wandering lead	3
29	Degasing bale 10cm perforated hood	3
30	Bench vice 12cm jaw	5
31	Work bench for bench vice (245x125x75cm)	11
32	Blow lamp (Kerosene)	5
33	Hand saw	3
34	Steel measuring tape – 3 meter	2
35	Trammel	3
36	Shovel hand	11
37	Engineers try square 15cm	5
38	Lockers steel with 8 drawers each	5
39	Black board with easel	2
40	Fire buckets (2 for water and 3 for sand)	5
41	Stand for fire buckets	2
42	Fire extinguisher foam chemical type	3
43	Fire extinguisher soda ash, etc type CO ₂ gas type	1 each
44	Face shield clear	11
45	Helmet (engineers)	11
46	Guantlets leather fettling	11pairs
47	Guantlets leather fettling	11pairs
48	Footware asbestos over shoes	11pairs
49	First Aid Box based on burn treatment	1
50	Lividers firm joint 20cm	5
51	Moulding boxes 30 x 40 x 15 cm RSDL	40 pairs
52	Moulding boxes 75 x 75 x 25 cm RSDL	21 pairs
53	Snap flast 40 x 35 x 12 cm RSDL	1 pair
54	Snap flast 30 x 30 x 10 cm RSDL	1 pair
55	Spirit level	5
56	Wheel Barrows	2

C.List of Equipments & General Installations

Sl. No.	Item	Quantity
1	Air Compressor with maximum working pressure of 17.5 kg/cm ²	1 no.
2	Pneumatic Rammer with Rubber Rammer head	1 no.
3	Pneumatic Chisel (with suitable chisel)	1 no.
4	Moulding Sand mixmuller 35 kg capacity with motor impeller 30 RPM	1 no.
5	Mould Green Hardness Tester dial type Risdale diels st.	1 no.
6	Core hardness tester	1 no.
7	CO ₂ cylinder with CO ₂ probe and Rubber Hoses with nozzle 12 mm wheel valve.	1 no.
8	LPG Cylinder with heating torch	1 no.
9	Cylinder trolley suitable to CO ₂ cylinder and Indane Gas Cylinder	1 no.
10	Heating and pumping unit to suit to oil fired tilting type crucible furnace with Heating pressure gauge etc. Wesman	1 no.

	model SPM Simplex model motorized Rotary gear oil pump pre-heater.	
11	Sand Testing Equipment- permeability meter, Universal Strength tester, Sieve shake, standard sand rammer, Shatter Index Tester, Clay content Tester, Speedy Moisture teller.	1 each
12	Moulding Machine hand squeeze with stripping device pin lift type.	1 no.
13	Weighing machine 300 kg by 100 gms	1 no.
14	Pedestal grinder DE 35cm power operated	1 no.
15	Core oven 180 x 90 x 90 cm electric hot air circulated with maximum temperature 350°C adjustable	1 no.
16	Cupola capacity 1.5 tons/hours. Motorised blower and pipe line volume gauge, pressure gauge, charging platform, blast control valve spark arrester.	1 no.
17	Sand Sampler	1 no.
18	Auto Sand riddle with 3 tons/hors. ridding capacity	1 no.
19	Sand Erator	1 no.
20	Oil Fired tilting type crucible furnace furnace to fit no. 100 crucible	1 no.