

SYLLABUS FOR
FOUNDRYMAN

UNDER
CRAFTSMEN TRAINING SCHEME
&
APPRENTICESHIP TRAINING SCHEME

As approved by
GOVERNMENT OF INDIA

In consultation with
THE NATIONAL COUNCIL FOR
VOCATIONAL TRAINING

&
CENTRAL APPRENTICESHIP COUNCIL

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SYLLABUS FOR THE TRADE OF FOUNDRYMAN UNDER CRAFTSMAN TRAINING SCHEME

Period of Training : 1 year

COURSE OBJECTIVE:

Upon completion of one year training, the trainees shall be able to :

1. Appreciate the role of Foundryman in Foundry industry in the Engineering industry.
2. Prepare all types of sand mixtures used for non-ferrous metals cast iron casting.
3. Prepare all types of moulds for cast iron and non-ferrous metals casting by providing all types of gating systems.
4. Operate the melting furnace such as - pit furnace ; oil fired furnace and cupola furnace.
5. Repair and reline the melting furnaces such as pit furnace ; Oil fired furnace and cupola furnace.
6. Handle molten metal in crucible ; Ladle and pouring the same in moulds.
7. Clean and fettile casting with hand tools ; Grinder etc.
8. Produce non-ferrous and cast iron castings to tolerance of ± 1.5 mm.
9. Understand the concept of basic metallurgy.

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GENERAL INFORMATION

- | | |
|--|---|
| 1. Name of the Trade | : FOUNDRYMAN |
| 2. N.C.O. Code No. | : 726.10 725.70 |
| 3. Duration of Craftsman Training | : One Year |
| 4. Duration of Apprenticeship Training | : Three years including one year Basic Training. |
| 5. Entry Qualification | : Passed Class 10th Exam. under 10 + 2 system of Education or its equivalent. |
| 6. Rebate for Ex-Craftsmen Trainees | : One year |
| 7. Ratio of Apprentice to worker | : 1 : 7 |

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1ST WEEK TO 12TH WEEK .**ACHIEVEMENTS EXPECTED :**

After completion of 12 weeks training ; the trainee shall be able to :

1. Appreciate the role of foundry man in the foundry industry.
2. Prepare moulding sand for aluminium [Facing and Backing as per I.S.]
3. Prepare simple mould in boxes for aluminium with specified hardness by using too run, bottom run and parting line gate.
4. Prepare simple mould with horizontal and vertical core prints.
5. Use common hand tools.
6. Melt Aluminium in crucible furnace and pour the same in mould & prepare Al. castings to a tolerance of ± 1.5 cm.
7. Fettle the Aluminium casting.
8. Prepare open sand mould and bedded mould in floor.

Week No.	Practical	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 fractions - addition - subtraction - multiplication and division - application of fraction to shop problems.	Free hand sketching of straight lines : Rectangles squares ; circles : polygons etc.

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1	2	3	4	5
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 fettling - 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 sections such as square : semi-circular ; 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 blocks such as square : Rectangular & Round.	Difference between natural and Synthetic moulding sand-principle ingredients in moulding sand & their effect on physical properties - special additives in moulding sand & their effect.	Decimals - addition - subtraction, multiplication, conversion of Decimals to common fractions - shop problems.	Reading of simple Blue print of Geometrical models.
6.	Prepare facing and Backing sand - prepare simple moulds with	Facing sand : Backing sand and unit sand - composition of various	- do -	Free hand sketching with dimension of simple solid

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1	2	3	4	5
	Top run gates.	moulding sand. Types of moulds - advantages and disadvantages of sand mould and metal mould.		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] : ladle (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 applications.	Metric system - Metric weights and measurements - units - conversion factors (S.I. Units).	- do -

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1	2	3	4	5
10.	Prepare Bedded mould [Floor mould with core with bottom run gate].	Moulding process - floor moulding - different methods : advantages : disadvantages and their applications. Machine moulding - different types of moulding machines - sand slinger and sand berton.	- 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.

13TH WEEK TO 25TH WEEK

ACHIEVEMENTS EXPECTED :

After completion of 25 weeks training ; the trainee shall be able to :

1. Prepare mould with self core ; split and loose piece patterns.
2. Prepare mould by draw back method ; false cheek method ; stack moulding process and snap flask method.
3. Prepare mould by using various gating systems.

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4. Operate and maintain oil fired furnace.
5. Melt copper based alloy's in pit furnace and oil fired furnace (Tilting) and produce copper base alloys castings to tolerance of ± 1.5 mm.
6. Prepare the cupola for operation.
7. Prepare the charges for cupola operation.
8. Operate the cupola ; Handle the molten cast iron and produce C.I. castings to a tolerance of ± 1.5 mm.
9. Operate grinders and fettle the cast iron casting.
10. Repair the broken wooden patterns and core boxes.
11. Carry out the different tests on moulding sand.

1	2	3	4	5
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 drawback method and false cheek method.	Pattern - Types of patterns - Allowances on pattern - colouring of pattern as per I.S. 1513-1959 - care & maintenance of pattern.	- do -	Free hand sketching of Plan & elevation of simple objects like hexagonal bar : Square bar Circular bar : taperd bar and hallow bars.
15.	Prepare "Stack mould" and	Gating system - various types of	Mass - Unit of mass Force -	Free hand sketching of

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1	2	3	4	5
	"Snap flask mould"	Top run gate, Part line run gate & Bottom run gate.	The wt. of body. unit of wt. shop problems.	key'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 : Denseners & 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.	Explanation of simple. Orthographic projection First angle.
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 diff. types of Lines & symbols for drawing.
19.	Prepare skin dry sand mould with irregular parting line. Cast	Recent developments in cupola - Possible defects occurring during	C.G.S. & F.P.S. systems of Units of - Force ; weight	- do -

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1	2	3	4	5
	it by C.I. & Identify casting defects.	cupola operation - causes and remedies.	etc. - Their conversion Problem.	
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 dimensions - 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.	Work - Unit of work : Energy ; Power - Unit of power - applied problems.	View of simple hollow and solid bodies with dimensions. Use of diff. types of lines and symbols for drawing.
22.	Wood Working - Marking ; sawing and planing 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.	Make important joints on wood and prepre simple pattern.	Necessity of using contraction scale. Preparation of layout for	Algebra - Algebraic symbols, addition ; subtraction	- do -

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1	2	3	4	5
		simple pattern.	; multiplication & division of expressions involving algebraic symbols - simple equation & transposition - problems.	
24.	Repair the wooden patterns & core boxes.	Importance of repairing the wooden pattern - methods of repairing the patterns & core boxes.	- do -	- do -
25.	Carry out the different tests such as - moisture clay content ; strength : permeability & sand grain fineness no. etc. of moulding sand.	Sand testing - Different methods of moisture test ; permeability test - clay content test - strength test, sand grain fineness test ; refractoryness test of moulding sand.	Standard algebraic formula e.g., $[a + b]^2$ $[a - b]^2$ etc.	Free hand sketching of fettling tools.

26TH WEEK TO 38TH WEEK**ACHIEVEMENTS EXPECTED :**

After completion of 38 weeks training ; the trainee shall be able to :

1. Assemble cover core and Balanced core in mould.
2. Prepare moulds by different methods.
3. Prepare moulds for all non-ferrous and cast iron casting.

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1	2	3	4	5
	it by C.I. & Identify casting defects.	cupola operation - causes and remedies.	etc. - Their conversion Problem.	
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 dimensions - 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.	Work - Unit of work : Energy; Power - Unit of power - applied problems.	View of simple hollow and solid bodies with dimensions. Use of diff. types of lines and symbols for drawing.
22.	Wood Working - Marking; sawing and planing 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.	Make important joints on wood and prepre simple pattern.	Necessity of using contraction scale. Preparation of layout for	Algebra - Algebraic symbols, addition; subtraction	- do -

(11)

1	2	3	4	5
		simple pattern.	; multiplication & division of expressions involving algebraic symbols - simple equation & transposition - problems.	
24.	Repair the wooden patterns & core boxes.	Importance of repairing the wooden pattern - methods of repairing the patterns & core boxes.	- do -	- do -
25.	Carry out the different tests such as - moisture clay content; strength; permeability & sand grain fineness no. etc. of moulding sand.	Sand testing - Different methods of moisture test; permeability test; clay content test - strength test, sand grain fineness test; refractoryness test of moulding sand.	Standard algebraic formula e.g., $[a + b]^2 [a - b]^2$ etc.	Free hand sketching of fettling tools.

26TH WEEK TO 38TH WEEK

ACHIEVEMENTS EXPECTED :

After completion of 38 weeks training; the trainee shall be able to :

1. Assemble cover core and Balanced core in mould.
2. Prepare moulds by different methods.
3. Prepare moulds for all non-ferrous and cast iron casting.

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4. Maintain and operate pit furnace ; oil fired tilting furnace and cupola furnace.
5. Melt and pour all non-ferrous metals and cast iron.
6. Fettle non-ferrous and cast iron castings.
7. Inspect the casting and detect the defects in castings and suggest remedies.
8. Understand the concept of Basic metallurgy.

1	2	3	4	5
26.	Prepare dry sand mould with skelton pattern - prepare black wash (plumbago) & coat on mould and core.	Special casting process - definition ; metals used composition ; the process ; use ; advantages and disadvantage of CO ₂ process and shell moulding process.	Mensuration, area of rectangles ; squares ; triangles ; circles ; regular polygon etc.	Use of drawing instrument 'T' square & drawing board etc.
27.	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.	- do -	- do -
28.	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.	Specific gravity ; Density - calculation on mass : Volume and density by using related formula.	Construction of simple figures of solids with dimensions and Titles.

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1	2	3	4	5
29.	Prepare Pit mould on foundry floor.	Slush casting process ; Continuous casting process Permanent mould casting process ; Nishiyama process (by using ferrosilicon powder)	- do -	- do -
30.	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.
31.	Prepare simple CO ₂ mould.	Fettling of casting - knock out and removal of casting from mould - removal of gates and risers ; Fins and unwanted projections - surface cleaning - trimming and finishing.	- do -	Lettering numbers and alphabets.
32.	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 dimensions.

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1	2	3	4	5
33.	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 applications 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.
34.	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 -
35.	Prepare mould for using "Chills" : Denseners and fix chill and denseners 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.
36.	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 -	Simple problems on Lines ; Angles ; Triangles and Circles.	- do -

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1	2	3	4	5
		cast iron - manufacturing process ; grades as per I.S. and use.		
37.	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.
38.	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 -

39TH WEEK TO 52ND WEEK ACHIEVEMENTS EXPECTED :

After completion of one year of training ; the trainee shall be able to :

1. Prepare sand mixture for non ferrous metals and cast iron castings.
2. Prepare mould for non ferrous metals and cast iron.
3. Prepare mould by various methods and process.
4. Prepare mould by employing various types of gating systems.
5. Prepare core sand by using various binders.
6. Prepare core for different metals.

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7. Prepare moulds and cores as per the patterns and core boxes supplied and cast with in the dimensional accuracy of 1 - 1.5 mm.
8. Maintain and operate pit furnace ; oil fired furnace and cupola furnace.
9. Melt and pour non ferrous metals and cast iron.
10. Clean and fettie non ferrous and cast iron castings.
11. Detect the defects in casting and suggest the remedies.
12. Understand the concept of basic metallurgy.

1	2	3	4	5
39.	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.	Logrithms.	Further exercise on blue print reading.
			- do -	
40.	Prepare mould with relief sprue gate, skin bob gate and cast it by cast iron.	Wrought iron - manufacturing process - use. Copper manufacturing process - properties & uses.		- do -
41.	Prepare mould with Horn gate [Gear wheel type pattern] and mould with stepped gate.	Manufacturing process, properties and use of Aluminium, Tin, Zinc, Lead.	Use of Logarithmic tables, multiplication and division.	- do -
42.	Industrial visit to observe the special casting process - machine. moulding process, operation of	—	—	—

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1	2	3	4	5
	different furnaces sand reconditioning process. Inspection of casting. Fettling process etc.			
43.	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.
44.	Reline the pit furnace.	Brief information about Blast furnace, Electric furnaces such as Arc furnace & Induction furnace.	Ploting & Reading of simple graph.	- do -
45.	Reline the oil fired furnace.	Brief information about open hearth furnace, Air furnace, Rotary furnace, Puddling furnace and converters.	Electricity and its uses positive and negative terminals - use of switches, fuses, conductors and insulators.	Orthographic projection of different castings.
46.	Reline the cupola furnace.	Heat treatment of casting - Hardening, Tempering, Annealing, Malleabilishing, Normalising, Quenching, Nitriding Cyaniding etc.	Levers - Types - Simple problems on mechanical advantage of various levers.	- do -

1	2	3	4	5
47.	Prepare simple oil sand core by using linseed oil and I.V.P. oils.	Calculation of ferrostatic pressure - calculation of weight required on a mould.	Pulley - Types - Machinical advantage related problems.	- do -
48.	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 sketching of simple objects related to the trade and preparation of simple working drawings from the sketches.
49.	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 -
50.	Prepare simple casting by Investment casting process and binderless dry sand process.	Foundry mechanisation - 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.
51.	Revision of the major skills of the trade.	Revision of major knowledge portion of the trade.	Revision.	Revision.
52.	FINAL TRADE TEST			

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**LIST OF TOOLS AND EQUIPMENTS
TRAINEES KIT**

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

**TOOLS, MEASURING INSTRUMENTS
AND SHOP OUTFIT**

Sl. No.	Item	Quantity
1.	Hammers Ball pein 0.45 kg.	8
2.	Ball pein hammers 650 to 700 gms	8
3.	Sledge hammers 8 kg	4
4.	Claw hammers 0.75 kg	2
5.	Chisel cold flat 2 x 22 cm	8
6.	Chisel 200 x 15 mm	8
7.	File flat 30 cm Bastard	8
8.	File flat 30 cm Second cut	8
9.	File half round 30 cm bastard	8
10.	File half round 30 cm second cut	8
11.	Folding rule 60 cm	4
12.	Steel rule 600 mm	4
13.	Caliper odd leg	2
14.	Caliper inside 15 cm	4

1	2	3
15. Scriber		4
16. Centre punch 15 cm		4
17. Hack saw 30 cm adjustable		8
18. C Clamps 20 cm		8
19. C Clamps 30 cm light duty steel		8
20. Screw drivers 25 cm with 15 mm blade		4
21. Screw drivers 15 cm		4
22. Screw drivers 18 cm		1
23. Pliers 20 cm		4
24. Plane grooving 6 mm cutter		2
25. Cutting pliers		2
26. Try Square (for wood work)		4
27. Brick layers hammer 20 cm		4
28. Hand lamp wandering lead		2
29. Degassing bale 10 cm perforated hood		2
30. Bench vice 12 cm jaw		4
31. Work bench for bench vice (245 × 125 × 75 cm)		1
32. Blow lamp (Kerosene)		4
33. Hand saw		2
34. Steel measuring tape - 3 meter		1
35. Trammel		2
36. Shovel hand		8
37. Engineers try square 15 cm		4
38. Lockers steel with 8 drawers each		4
39. Black board with easel		1
40. Fire buckets (2 for water and 3 for sand)		4
41. Stand for fire buckets		1
42. Fire extinguisher foam chemical type		2
43. Fire extinguisher soda ash, etc type CO ₂ gas type		1 each
44. Face shield clear		8
45. Helmet (engineers)		8
46. Gunanlets leather felling		8 pair
47. Gunanlets leather or asbestos for furnace		8 pair
48. Footware asbestos over shoes		8 pair
49. First Aid Box based on burn treatment		1
50. Lividers firm joint 20 cm		4
51. Moulding boxes 30 × 40 × 15 cm RSDL		32 pairs
52. Moulding boxes 75 × 75 × 25 cm RSDL		16 pairs
53. Snap flast 40 × 35 × 12 cm RSDL	As I.S. 1280-	1 pair
54. Snap flast 30 × 30 × 10 cm RSDL	1958	1 pair
55. Spirit level		4 nos.
56. Wheel Barrows		2 nos.

LIST OF EQUIPMENTS IN GENERAL INSTALLATIONS

Sl. No.	Name of Equipment	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.

Sl. No.	Name of Equipment	Quantity
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.	L.P.G. Cylinder with heating torch.	1 no.
9.	Cylinder trolley suitable to CO ₂ cylinder and Indane Gas Cylinder	
10.	Heating and pumping unit to suit to oil fired tilting type crucible furnace with Heating pressure gauge etc. Westman model S.P.M. Simplex model motorised Rotary gear oil pump pre-heater.	1 no.
11.	Sand Testing Equipments-permeability meter, Universal Strength tester, Sieve shaker, 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 35 cm power operated	1 no.
15.	Core oven 180 × 90 × 90 cm electric hot air circulated with maximum temperature 350°C adjustable.	1 no.
16.	Cupola capacity 1.5 tons/hour. 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/hrs. ridding capacity	1 no.
19.	Sand Erator	1 no.
20.	Oil Fired tilting type crucible furnace to fit no. 100 crucible.	1 no.

SYLLABUS FOR THE TRADE OF FOUNDRYMAN UNDER APPRENTICESHIP TRAINING SCHEME

Period of Training - 3 years

The period of Training for this trade is 3 years, consisting of Basic Training for a period of 1 year and shop floor training for the remaining period. The syllabus for this trade should be considered as a guide for imparting apprenticeship training according to the facilities available in industry.

List of operations/skills Related instructions to be learnt during the practical training which includes Basic Training

FIRST YEAR

All freshers should undergo 1 year basic training followed by 2 years training on the shop floor. During the first year (Basic Training), the syllabus for the trainees of Industrial Training Institutes should be followed.

Sl. No. List of Operations/Skills to be learnt during the Second and Third year of the Apprenticeship

1. Handle all safety equipments including fire fighting equipments.
2. Prepare sand for all metals and their alloys.
3. Carry out all test on moulding sand.
4. Prepare sand by using all types of binders for mould & core.
5. Prepare mould and core for all metals and alloys.
6. Prepare large moulds and core, pit mould, sweep mould and by using Skeleton Pattern.
7. Prepare mould by special casting process such as CO_2 process Shell moulding process Investment casting process, Centrifugal casting process etc.
8. Operate Die casting machines to produce castings.
9. Apply dressing materials to all types of moulds and cores.
10. Use chills : Chaplets and Densifiers for various metals.
11. Use different Exo-thermic materials and obtain directional solidification.
12. Operate all types of moulding machines : core making machines, sand reconditioning plant.
13. Fettle all types of metals by using various types of fettling equipments – Identify castings defects.
14. Carry out all mechanical tests on metal casting.
15. Prepare the charges for various metals and alloys.
16. Select different Refractory materials for various foundry purpose.
17. Use different Fluxes for various metals and Degaussing.
18. Maintain and operate different foundry Furnaces such as Arc furnace, Induction furnace, Rotary furnace etc.
19. Pour liquid metal by using various liquid metal handling equipments.
20. Operate all types of core ovens and bake the cores.
21. Salvage all metal castings.
22. Operate all types of equipments used for Inspection of castings.
23. Handle various types of Temperature measuring equipments to measure the temperature of liquid metals and furnaces.
24. Heat treat the casting by various methods.
25. Any other recent developments available in the Foundry where the apprentice undergoing training.

Note : Above mentioned operations/skills are desirable. Trainees must carry out the maximum skill/operations, possible in the establishment where they undergo training.

SYLLABUS FOR RELATED INSTRUCTION (THEORY)

Related instruction should be imparted to all the apprentices during entire period of training including Basic training. The syllabus given for related instruction should be considered as a guide :

1. Trade Theory
2. Workshop Calculation and Science
3. Engineering Drawing
4. Social Studies

FIRST YEAR

The content of the syllabus for apprentices during first year training should be same as the content of one year course for the I.T.I. trainees in this trade.

SECOND AND THIRD YEAR

TRADE THEORY

(3 Hours/week or 150 hours/year approximately)

1. Revision of the first year portion.
2. Safety precautions to be followed while operating various equipments and machines in foundry ; handling liquid metal ; Fettling the casting and detailed information about the handling of fire fighting equipments and other safety devices.
3. Composition of various moulding and Core sands used for steel and its alloys.
4. List out various binders used in steel foundry.
5. Name and method of application of various Facing materials for steel casting.
6. Detailed information about all types of moulding and core making machines.
7. Detailed information about the construction ; operation and maintenance of Blast furnace ; Arc furnace, Induction furnace Open hearth furnace ; Air furnace ; Rotary furnace and converters.
8. Detailed information about "sand testing".
9. Detailed information about special casting process including Die Casting.
10. Detailed information about the methods and the equipments used for Fettling of different metal castings.
11. Detailed information about the manufacturing process of cast iron, steel and Non-ferrous metals.
12. Detailed information about the manufacturing process of copper base alloys – Aluminium alloys – cast iron alloys and steel alloys including magnesium alloys.
13. Classification of copper base alloy, aluminium alloy, cast iron alloy and steel alloy as per I.S.
14. Effects of elements normally presents in ferrous metals–effect of alloying element in cast iron alloys and steel alloys.
15. Detailed information about heat treatment of castings and slaving of castings.
16. Detailed information about the layout of different foundries foundry mechanisation, construction and use of different materials handling equipments used in foundry.
17. I.S.I. specification for all raw materials used in foundry.
18. I.S.I. specification for all metals and their alloys.
19. Estimation cost of casting.
20. Revision and Test.

II.

WORKSHOP CALCULATION AND SCIENCE

(One hour per week or 50 hours per year approx.)

1. Revision of previous years work.
2. Percentage and its application–problems appropriate to the Trade group.
3. Further problems in mensuration work, power and energy.
4. Friction-simple problem on straight and bell crank levers.
5. Mensuration and further problem as applicable to the trade.

6. Elementary principles of parallelogram and triangle of force. Force on piston, ram etc.
7. Mechanical advantage-velocity ratio-useful work. Mechanical efficiency of machine.
8. Gear and belt drives. Determination of horse power, speed and size of pulley's and Gears.
9. Velocity, Acceleration and Retardation.
10. Centre of gravity.
11. Specific Gravity.
12. Descriptive explanation of expansion of solids, liquids and gases - due to heat - coefficient of expansion, brief description on transference of - heat, heat conduction, convection and radiation.
13. Minimum tenacity, elasticity, malleability, brittleness, hardness, compressibility and ductility.
14. Meaning of stress, strain modules of elasticity, ultimate Tensile strength, factor of safety and different types of stress.
15. Quality of heat-unit of heat, B.T.H.U. - C.H.U.
16. Heat and Temperature. Thermometric scale Fahrenheit scale to centigrade and vice versa.
17. Measurement of Temperature - Name and brief description of temperature measuring instruments used in workshop including those high temperature e.g., optical and immersion pyrometer.

III.

ENGINEERING DRAWING

(2 hours per week or 100 hours per year approx.)

1. Revision of previous years work.
2. Explanation of I.S.I. Standards for Engineering Drawing. I.S. - 696 1960.
3. Working drawings of simple machines and engine parts.
4. Advanced blue print reading.

IV.

SOCIAL STUDIES

1. The syllabus has already been approved and is same for all the trades.