CURRICULUM

FOR THE TRADE OF

FOUNDRYMAN

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENURESHIP
DIRECTORATE GENERAL OF TRAINING

CONTENTS

1. ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum. Special acknowledgement to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

1. Volkswagan Academy, Pune
2. OCL Ltd. (Dalmia Group), Odisha
3. Bharat Heavy Electricals Ltd., Ranipet, Tamil Nadu
4. TATA Motors, Pune
5. JBM Group, Chennai
6. MTAB Technology (P) Ltd., Chennai
7. Kirloskar Brothers Limited (KBL), Pune

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-ordinator for the course: Sh. Nirmalya Nath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
1.	N. Nath, ADT	CSTARI, Kolkata	Expert
2.	R. N. Manna, T.O.	CSTARI, Kolkata	Expert
3.	Jugal Kishor Biswas, Instructor	Govt. ITI Midnapore West Midnapore	Expert
4.	Damodar Mandal, T.O.	ATI, Kolkata	Expert

2. BACKGROUND

2. 1. Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

2. 2. Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

2. 3. Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.

- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.

- Scope has been extended also to non-engineering occupations.

- Establishments have been permitted to outsource basic training in an institute of their choice.

- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in **Foundryman** trade)

1. It will enhance the ability to performs any combination of following tasks in foundry concerned with melting metal, pouring metal into molds, removing castings from molds, dressing castings, moving foundry materials, and cleaning equipment and work areas: Moves sand, castings, flasks, or other materials about foundry by hand, using wheelbarrow or cart, or by loading them onto conveyor.
2. It will enhance the ability to removes gates, sprues, and other projections from castings with sledge, pneumatic hammer, power shear, or power hacksaw.
3. It will help the trainees to breaks up used sand molds with bar, shovels sand into drying oven and sand-mixing machine, and sifts sand through motor-driven screen for reuse in new molds.
4. It will help the trainees to assembles flasks, using wrench, bolts, and tap screws.
5. It will help the trainees to use sprays binder on surface of sand molds and dries surface with blowtorch.
6. It will enhance the ability to installs and removes steel jackets and bands used to hold snap molds together during casting.
7. It will enhance the ability to breaks up slag, using hammer, and shovels it into buckets for removal to dump and also chips out worn cupola and ladle linings using bar.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Study of pattern before preparing of mould**.** Tempers sand properly with binders, additives and moisture. Molder and core makers make moulds and cores for casting metal. Prepare mould from tempered sand using pattern and core box. Places pattern on mould plate .Wooden plate with arrangements to hold pattern. Makes mould in two halves (top and bottom) by ramming foundry sand around pattern. Removes pattern carefully and mends two halves of mould by trowel and smoothners. Makes vent holes by wire for escape of gas and other holes on top box for pouring metal into mould and for escape of excess molten metal (runners and risers).

Fixes dried 'cores' in proper position to have designed holes in casting. May prepare bottom half of mould in floor instead of in bottom box. May dry moulds by fire in case of heavy castings. In production foundry use Machines for preparing moulds. Vertical Pipe prepares mould for vertical casting heavy pipes. Setsbottom socket in moulding box (casing) by operating crane hoist. Gets ramming done, emoves socket pattern and repairs mould after withdrawal of body pattern. Black washes mould and gets it dried up. Sets socket core at bottom and gets main and top core lowered and placed securely in concentric position. Dressing the mould with refractory dressing materials.

Core Maker, prepares cores with core sand (foundry sand mixed with some bonding agent such as molasses) for casting cavities in metal parts. Sprays ash, silica or other non-adhering powder on sides of core box, partially fills box with core sand, and inserts metal strengthening pins, wires (grid bars). Fills in and compacts more sand until core box is full. Makes vent holes in core with wire. Removes core from core box and drying. Melts metals in cupola (furnace) for making metal castings. Sets furnace bed, lays firewood and ignites. Charges with bed coke, rakes fully ignited coke with long metal pokers to obtain required coke height. Supervises plugging of tuyears holes, tapping holes, etc. Charges Cupola with required quantity of raw materials scrap, coke, etc. to melt metal to specified temperature.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO:

i). **NCO-2004: 8123.10, 7211.50**

5. GENERAL INFORMATION

1. **Name of the Trade** **: FOUNDRYMAN**

2. **N.C.O. Code No.** : **NCO-2004:** 8123.10, 7211.50

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers: -** Duration of Basic Training: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: **6 months**

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: **18 months**

3.2 **For ITI Passed: -** Duration of Basic Training: - **NIL**

Duration of Practical Training (On -job Training): **12 months**

4. **Entry Qualification** : Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent

5. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

6. **Rebate for ITI passed trainees** : i) **One year** in the trade of **FOUNDRYMAN**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	Block– I	-----	Block – II	------
Practical Training (On - job training)	----	Block – I	------	Block – II

Components of Training	Duration of Training in Months																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **FOUNDRYMAN**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 11 KW for Workshop
5) **Space Norms** : 128 Sq.m.

6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical/Metallurgy Engineering/Advanced Diploma in Foundry Technology** Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of **Foundryman** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required**: - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.	**30**	**Units & Measurements**- FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**20**
2.	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3.	**Dimensioning**- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	

5.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1^{st} angle and 3^{rd} angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	**30**	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**20**
2.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**Heat & Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	
3.	Free hand Sketches for simple pipe line with general fittings.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	
4.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	
5.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines** **Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process:** - Heat treatment and advantages.	

			Annealing, Normalizing, Hardening, Tempering.	
6.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
7.			**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**			

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1	Sieve sand mix and Temper by shovel and sand mixer-muller. Green sand mould with simple bracket pattern.	Types of foundries. Advantages of metal casting.
2	Carry out the different tests such as -moisture content, clay content: strength: permeability & sand grain fineness no. etc. of moulding sand.	Sand testing - Different methods of moisture content test; permeability test clay content test - strength test, sand grain fineness test; refractoriness test of moulding sand.
3	Wood Working - Marking: sawing and planning on wood. Making important joints on wood and prepare simple pattern.	Brief description: specification and use of various wood working hand tools. Types of joints & their application in wood working.
4	Ramming Practice in moulding boxes with hand Rammers to obtain desired Green hardness such as 60; 70; 80; 90 on “Green Hardness Tester".	Patterns: Pattern materials .Types of pattern, Maintenance of pattern.
5	Open mould and closed mould with simple bracket patterns,	Patterns: colouring of pattern. Pattern allowances. Types of core. Care and maintenance of pattern.
6	Use hand Tools : cut channels on rammed boxes with cross section such as square : semicircular ; Trapezoid 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.
7	Prepare unit sand: prepare mould for block such as square, Rectangular & Round. Prepare core.	Difference between natural and Synthetic moulding sand-principle ingredients in moulding sand & their effect on physical properties-special additives in moulding sand & their effect.
8	Prepare facing and Backing sand Prepare simple moulds with Top run gates. Prepare mould with self-leaving core pattern by using parting line gates.	Binders and additives.
9	Prepare Cupola for charging chipping and doubling - prepare metal & slagspout; Tap hole and slag hole; sand bed; Lining of ladle. Prepare charges for cupola charging -operate cupola furnace - melt cast iron& pour C.I. into mould. Prepare skin dry sand mould with irregular parting line. Cast it by C.I. &Identify casting defects.	Types of moulding sand and there composition. Crucible furnace and cupola furnace.
10	Follow board mould practice. No bake mould practice. Binderless mould	No bake system of mould. Shell moulding.
11	Prepare moulds with vertical core print. Prepare simple core and assemble in the mould. Prepare	Types of core boxes - core venting and reinforcing of core, core baking, core making

	simple mould with horizontal core print and assemble the core in horizontal position.	machines.
12	Prepare mould with drawback method and Prepare "Stack mould" Loose piece mould.	Venting. Mould Dressing.
13	**Revision & Internal Assessment**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Prepare Dry sand mould for cast iron with odd sided pattern. Prepare simple "Loam sand mould" for simple pan/bell shape casting.	Brief description: types; advantages & disadvantages of 'Die casting' - centrifugal casting .Investment casting processes. Binderless or(Full mould) process
2	Prepare simple CO2 mould. Prepare simple CO2 core; assemble in CO2 mould & cast by cast iron. Prepare simple oil sand core by using linseed oil and IVP oils.	Fettling of casting - knock out and removal of casting from mould- removal of gates and risers; Fins and unwanted projection - surface cleaning -trimming and finishing. Inspection of casting - destructive method - nondestructive methods. Refractory materials used in foundry and their grades as per I.S.
3	Prepare Pit mould on foundry floor. Prepare a mould with pattern having cover core print -Assemble cover core in mould cast by cast iron - Fettle C.I. casting.	Slush casting process; Continuous casting process Permanent mould casting process; Nishiyama process (by using ferrosilicon powder) Common casting defects appearance - causes and remedies - salvaging of castings.
4	Prepare mould for setting "Balancing core" and set balance core in mould with the help of chaplets.	CO2 Moulding, Gating system. Difference between "Metal and Non-metal" - Difference between ferrous metal and non-ferrous metal. Physical & Mechanical properties of metals.
5	Prepare mould for using "Chills": Denseners and fix chill and denseners in mould.	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.
6	Prepare core halves; Bake and join by different methods.	Common cast iron - Alloy's manufacturing process of chilled cast iron; S.G. iron and malleable cast iron.
7	Prepare mould with "pencil gate"; Finger gate and cast it by Aluminium.	Effect of elements normally present in ferrous metals - effect of alloying elements in ferrous metals - iron carbon equilibrium diagram for plain carbon steel. Inoculation: purpose of inoculation.
8	Prepare mould with wedge gate and ring gate and cast it by copper base alloy.	Steel manufacturing process classification - common steel alloys and use. Microstructure of various metals (e,g,- Grey cast iron, S.G.Iron, steel, Cu- alloys etc.)
9	Prepare mould with Branch gate mould with match plate pattern and cast it by cast iron.	Wrought iron - manufacturing process - use. Copper manufacturing process - properties & uses.
10	Prepare mould with relief sprue gate; skin bob gate and cast it by cast iron.	Brief information about Blast furnace, Electric furnaces such as Arc furnace & Induction furnace.

11	Reline the pit furnace, oil fired furnace.	Brief information about open hearth furnace, Air furnace, Rotary furnace, Paddling furnace and convertors.
12	Reline the cupola furnace. Prepare simple casting by gravity die casting process.	Heat treatment of casting Hardening, Tempering, Annealing, Normalising, Quenching, Nitriding Cyaniding etc.
13	**Revision & Internal Assessment**	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4.	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),	

	Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **FOUNDRYMAN**

2) **Batch size** : a) Apprentice selection as per Apprenticeship guidelines.
b) Maximum 20 candidates in a group.

3) **Examination** : i) The internal assessment will be held on completion of each block
ii) NCVT exam will be conducted at the end of 2nd year.

4) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical/Metallurgy Engineering/Advanced Diploma in Foundry Technology** Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of **Foundryman** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

5) **Infrastructure for On-Job Training** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I (09 months)

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information
3. Sand tempering with binders & additives for preparing of Green sand, Dry sand, loam sand mould etc. and carry out different sand test.
4. Perform wood working and making important wooden joints and identify different types of pattern, core boxes. Repairing defective patterns & core boxes.
5. Identify different types of tools &equipment used in foundry.
6. Select different types of sand like Green sand, Dry sand, Loam sand, backing sand etc. and perform ramming practice, mould making, core making& gating system.
7. Metal melting with pit furnace, oil furnace, cupola furnace, construction & charging of cupola.
8. Perform metal working, marking, sawing, chipping, filling, grinding & drilling.
9. Make different types of mould like- Dry sand mould, Green sand mould, Loam sand mould, pit mould, CO_2mould Shell mould etc.
10. Making different types of core and setting into the mould and know about the uses of chills gaggers etc.
11. Making moulds with different types of gate like pencil gate finger gate, wedge gate etc.
12. Reline of different types of furnaces, laddles and melting practice and making casting.
13. Perform different types of die casting process and investment casting process.
14. Handle various type of Temperature measuring equipment to measure the temperature of liquid metal.
15. Finishing tools and tackles and Modern process of riser cutting breaker.

B. BLOCK – II (09 months)

1. Carry out all tests on moulding sand.
2. Prepare large moulds and core by pit moulding, sweep moulding & by using Skeleton pattern.
3. Prepare mould by special casting process such as Carbon die oxide process shell moulding process Investment casting process, Centrifugal casting process etc.
4. Operate Die casting machine to produce casting.
5. Apply dressing materials to all types of moulds and cores
6. Use chills, chaplets and Denseners for various metals and obtain directional solidification
7. Use different insulating exothermic materials to improve efficiency of riser / feeders
8. Operate all types of moulding machine, core making machine, sand reclamation plant and dust filter etc.
9. Fettle all types of metal by using various types of fettling equipment – Identify casting defects.
10. Carry out all mechanical test by instrument spectrometer etc. on metal casting
11. Prepare the charges for various metals and alloys. Use different types of fuel used in furnace.
12. Select different Refractory materials for various foundry purposes.
13. Use different Fluxes for various metals and Degasing.
14. Maintain and operate different foundry Furnaces such Arc furnace, Induction furnace, Rotary furnace etc.
15. Pour liquid Metal by using various liquid metal handling equipment.
16. Operate all type of core ovens and bake the cores.
17. Identify different types of casting defects and try to reduce the problems.
18. Salvage all metal casting
19. Operate all types of equipments used for Inspection of casting
20. Various types of Heat-treatment process.
21. Reduce dust problem in Foundry Shop.
22. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST

(SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]
- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries involved in foundry work.
2. Structural Fabrication like bridges, Roof structures, Building & construction.
3. Automobile and allied industries
4. Service industries like road transportation and Railways.
5. Ship building and repair
6. Infrastructure and defence organisations
7. In public sector industries (Central and State) and private industries in India & abroad.
8. Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: FOUNDRYMAN

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

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

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Item	Quantity
1	Hammers Ball Peen 0.45 kg	11
2	Ball peen 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 15 cm	11
22	Screw drivers 18 cm	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 perforted 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 15 cm	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 CO2 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
57	Weighing machine (cap: 0.001 to 150gm)	1 no.

C : GENERAL MACHINERY 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 trolly 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 model SPM Simplex model motorized Rotary gear oil pump pre-heater.	1 no.
11	Sand Testing Equipment- permeability meter, Universal Strength tester, Sieve shake, standard sand rammer, Shatter Index Tester, Clay content Tester, Speedy Moisture teller.	1each
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 x 90 x 90 cm electric hot air circulated with maximum	1 no.

	temperature 350^{o}C adjustable	
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.
21	Induction furnace (Cap:50Kg) suitable for non-ferrous metals	1 no.

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: FOUNDRYMAN

LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20 nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20 nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20 nos.
4.	Mini drafter	20 nos.
5.	Drawing board (700mm x500 mm) IS: 1444	20 nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 nos.
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: FOUNDRYMAN

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.