



Skill India
कौशल भारत - कुशल भारत

FOUNDRYMAN

NSQF LEVEL - 6



SECTOR- CAPITAL GOODS & MANUFACTURING

COMPETENCY BASED CURRICULUM
CRAFT INSTRUCTOR TRAINING SCHEME (CITS)



सत्यमेव जयते

GOVERNMENT OF INDIA

Ministry of Skill Development & Entrepreneurship
Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

EN-81, Sector-V, Salt Lake City, Kolkata – 700091



Directorate General of Training

FOUNDRYMAN

(Engineering Trade)

SECTOR – CAPITAL GOODS & MANUFACTURING

(Revised in 2019)

Version 1.1

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

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Developed By

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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency-based course for instructors of one-year duration. “Foundryman” CITS trade is applicable for Instructors of “Foundryman” CTS Trades.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus, promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal <http://www.nimionlineadmission.in>. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	Trade Technology	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	Engineering Technology	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	Training Methodology	
	TM Practical	320
	TM Theory	200
	Total	1600

2.3 PROGRESSION PATHWAYS

- Can join as an Instructor in a vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment

criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The external examiner during final examination will also check the individual trainee’s profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal assessment	Full Marks	Pass Marks	
						Exam	Internal assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
4.		Engineering Drawing	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
Total Marks			700	200	900	360	120

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%.There will be no Grace marks.

2.4.2 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 the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an acceptable standard of crafts instructorship with occasional guidance and engage students by demonstrating good attributes of a trainer.	<ul style="list-style-type: none"> • Demonstration of fairly good skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a reasonable standard of crafts instructorship with little guidance and engage students by demonstrating good attributes of a trainer.	<ul style="list-style-type: none"> • Demonstration of good skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with	<ul style="list-style-type: none"> • Demonstration of high skill level to establish a rapport with audience, presentation in

<p>instructional design, implement learning programme and assess learners which demonstrates attainment of a high standard of crafts instructorship with minimal or no support and engage students by demonstrating good attributes of a trainer.</p>	<p>orderly manner and establish as an expert in the field.</p> <ul style="list-style-type: none"> • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A high level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.
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3. GENERAL INFORMATION

Name of the Trade	FOUNDRYMAN-CITS
Trade Code	DGT/4028
Reference NCO 2015	2356.0100, 7211.0100, 8121.4200, 8121.4600, 8121.4700, 7211.0201
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	<p>Degree in appropriate branches of Mechanical/Production Engineering from recognized Engineering College / University.</p> <p style="text-align: center;">OR</p> <p>Diploma in appropriate branches of Mechanical/Production Engineering from recognized Engineering College / University.</p> <p style="text-align: center;">OR</p> <p>National Trade Certificate in Foundryman or related trades.</p> <p style="text-align: center;">OR</p> <p>National Apprenticeship Certificate in Foundryman or related trades.</p>
Minimum Age	18 years as on first day of academic session.
Space Norms	120 Sq. m
Power Norms	11 KW
Instructors Qualification for	
1. FOUNDRYMAN - CITS Trade	<p>B.Voc./Degree in Mechanical/Production Engineering from AICTE/UGC recognized University with two years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Mechanical/Production Engineering from AICTE/ recognized Board/ University or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC passed in Foundryman trade with seven years experience in relevant field.</p> <p>Essential Qualification: Relevant National Craft Instructor Certificate (NCIC) in Foundryman trade or in any of the variants under DGT.</p>
2. Workshop Calculation & Science	<p>B.Voc./Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in any Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field.</p> <p style="text-align: center;">OR</p>

	<p>NTC/ NAC in any Engineering trade with seven years experience in relevant field.</p> <p>Essential Qualification: National Craft Instructor Certificate (NCIC) in relevant trade. OR NCIC in RoDA or any of its variants under DGT.</p>					
3. Engineering Drawing	<p>B.Voc./Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience.</p> <p>Essential Qualification: National Craft Instructor Certificate (NCIC) in relevant trade. OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p>					
4. Training Methodology	<p>B.Voc./Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field.</p> <p>Essential Qualification: National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.</p>					
5. Minimum age for Instructor	21 years					
Distribution of training on Hourly basis: (Indicative only)						
Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	TM Practical	TM Theory
40 Hours	16 Hours	6 Hours	2 Hours	3 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; Instructs students in ITIs/Vocational Training Institutes in respective trades. Imparts theoretical instructions for the use of tools, mechanical drawings, blueprint reading and related subjects. Demonstrates processes and operations in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment & tools in stores.

Moulder, General prepares mould from foundry sand using pattern for casting metal parts. 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 the pattern. Removes pattern carefully and mends two halves of mould by trowel and smoothers. 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. May do additions and alternations in mould from drawing, using foot rule, knife and trowel. May be known as PIPE MOULDER if engaged in pipe moulding.

Die Casting Machine Operator operates die-casting machine to make zinc, aluminium and alloy castings for gears, carburettor bodies, machinery parts, equipment, etc. Charges furnace with slabs of metal and adds specified quantity of alloy. Transfers molten alloy to heated reservoir of machine with crane or hand ladle. Removes metal fragments from die surfaces and brushes cavities with compound to prevent casting from adhering to die. Regulates valves to heat furnace, circulate water through die and to force hot metal in to die. Move levers to open and close to halves of water-cooled die. Hooks completed casting from die with steel wire and cools it in water.

Core Maker, Machine makes cores, using machine, for placing in mould to have designed holes in metal castings. Selects die and spiral conveyor screw and fastens them to machine. Mixes sand and binding material and packs mixture into feed box of machine. Starts motor or turns crank by hand to rotate screw and to take mixture from box and press it through die to form core. Cuts off core as required, repairs damaged surfaces and passes it on for baking or drying in oven or heated chambers. May perform some tasks involved in making cores by hand.

Annealer, Metal anneals (softens) metals by heating and cooling, for easy machining, rolling, bending, etc., and for relieving internal stresses caused by working or by unequal contraction in casting. Starts furnace and heats material in it up to required temperature for specified time depending upon type and size of material. Stops furnace and allows material to cool down inside it. Anneals copper by heating and immediately quenching in water. May do pack annealing by putting material in sealed box and by heating and cooling it in furnace. May cool material in sand, lime or ash if working on open furnace. May be designated as NORMALISER, if engaged in normalizing (removing stresses) fatigued metal parts by process of repeated heating and cooling in air.

Casting Technician-Sand Moulding manages the specifications of the sand and molten metal, setting up and operating the casting equipment and forming and finishing the final output.

Reference NCO-2015:

2356.0100 - Manual Training Teacher/Craft Instructor.

7211.0100 - Moulder, General

8121.4200 - Die Casting Machine Operator

8121.4600 - Core Maker, Machine

8121.4700 - Annealer, Metal

7211.0201 - Casting Technician, Sand Moulding - Casting Supervisor

5. LEARNING OUTCOMES

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 TRADE TECHNOLOGY

1. Demonstrate workshop safety measures and different types of tools, equipment & raw material used in foundry.
2. Monitor different patterns, allowances of pattern, colouring & core made and repair defective pattern and boxes.
3. Evaluate Sand tempering for different types of mould making.
4. Assess different casting components by different metal with different moulding process.
5. Demonstrate heat treatment operations.
6. Evaluate metal working such as marking, sawing, filling, grinding, drilling, charging of cupola etc.
7. Plan and prepare Die casting machine to produce casting, moulds by moulding process, make cast iron castings and check defects.
8. Evaluate casting, fettle of casting & calculation of yield percentage.
9. Demonstrate complete core by joining half cores and mould by various types of gate to produce different types of metal casting.
10. Evaluate extra thick casting & finish it, reline & prepare different types of furnaces for melting cast metals and make Core using linseed oil & IVP oils.
11. Assess mould made without pattern & with sweep pattern and casting by investment casting process & binder less process.
12. Explain dust problem in Foundry Shop adhering to TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

6. COURSE CONTENT

SYLLABUS FOR FOUNDRYMAN - CITS TRADE			
TRADE TECHNOLOGY			
Duration	Reference Learning Outcome	Trade Practical	Trade Theory
Practical 64Hrs Theory 24Hrs	Demonstrate workshop safety measures and different types of tools, equipment & raw material used in foundry.	<p>Occupational Safety & Health</p> <p>Importance of housekeeping & good shop floor practices.</p> <p>Health, Safety and Environment guidelines, legislations & regulations as applicable.</p> <p>Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments (PPE).</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message.</p> <p>Preventive measures for electrical accidents & steps to be taken in such accidents.</p> <p>Use of Fire extinguishers</p> <p>Technical English.</p> <p>Prepare different types of documentation as per industrial need by different methods of recording information.</p> <p>Basic Life support training:-</p> <p>Be able to perform DRSABCD:</p> <p>D: Check for Danger</p> <p>R: Check for a Response</p> <p>S: Send for help</p> <p>A: Open the Airway</p> <p>B: Check for normal Breathing</p> <p>C: Perform CPR (Cardio Pulmonary Resuscitation)</p> <p>D: Attach Defibrillator / Monitor as soon as available.</p> <p>Importance of trade training. Machinery used in the trade as well as Industries.</p>	<p>Introduction of First aid.</p> <p>Operation of electrical mains.</p> <p>Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure</p> <p>Soft Skills: its importance and Job area after completion of training. Introduction to 5S concept & its application.</p> <p>Importance of 5S implementation throughout CITS course-workplace cleaning, machine cleaning, signage, proper storage of equipment etc.</p> <p>Importance of Technical English terms used in industry -(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.</p> <p>Basic Life support (BLS):-</p> <p>Basic Life Support (BLS) techniques for drowning, choking, electrocution, neck and spinal injury, including CPR (cardiopulmonary resuscitation).</p> <p>Safety Precaution to be Followed While Under gone Through Various foundry operations.</p> <p>Foundry materials: Classification, Application, & I.S.I Specification for all Raw Materials used in Foundry. Refractory sand, Refractories, Binder, Fuels, Fluxes, Facing materials, Parting agents.</p>

		<p>Demonstrate open sand mold by trammeling method, Apply facing & backing sand for C.I casting.</p> <p>Demonstrate closed mold with Green molding sand, Melting of Al. Alloys in Crucible furnace and pouring the same in to the molds.</p> <p>Carry all types of sand tests.</p> <p>Demonstrate mold with different Joints (plain, Build up, Cutting, Floating).</p> <p>Demonstrate mold with Top Run gating system.</p>	<p>Engineering metals. Classification of Metals. (Ferrous, Non-Ferrous & Its Alloys. Ore to Metal Mfg. Of Ferrous Metals, Properties, Application I.S.I Specification. Effects Of elements normally Presents in Ferrous Metals. Effects of alloying elements in Cast Iron alloys and Steel Alloys.</p>
<p>Practical 64Hrs</p> <p>Theory 24Hrs</p>	<p>Monitor different patterns, allowances of pattern, colouring & core made and repair defective pattern and boxes.</p>	<p>Monitor mold with odd side pattern, mould with setting of Vertical core and Horizontal cores in a mold.</p> <p>Demonstrate mold with balanced core & Hanging Core, setting with Chaplet into a mold, along with suitable gating system.</p>	<p>Gating system: Introduction, Parts & Function, Types, Pre-Requisites, Ferro static Pressure.</p> <p>Pattern materials, types of pattern, colouring of pattern allowances, maintenances of patterns and types of core.</p> <p>Fettling: Fettle the all types of Casting, Mould Shake out-removal of runner & Riser, Surface cleaning, Finishing & Trimming. Inspection of Casting: Destructive and Non-Destructive methods, Casting Defects: Internal & External Defects. Salvaging of Castings: Foundry method, By welding methods.</p>
<p>Practical 48Hrs</p> <p>Theory 18Hrs</p>	<p>Evaluate Sand tempering for different types of mould making.</p>	<p>Evaluate mold with Bottom Run gating System. Demonstrate mold with Parting Line run gating system.</p> <p>Evaluate sand tempering, different types of mould making by using appropriate</p>	<p>Molding Sand & core sand. Composition, Types, Ingredients, additives. Properties of sand. Sand reclamation and Sand Preparation.</p>

		<p>hand tools. Mould with parting line gate, top gate and bottom gate.</p> <p>Evaluate different types of Core by using different types of Core Boxes and making of core by different types of Core Binder and also baking then in Oven and other Methods.</p>	
<p>Practical 48Hrs</p> <p>Theory 18Hrs</p>	<p>Assess different casting components by different metal with different moulding process.</p>	<p>Demonstrate mold with core; by using of self cored pattern and split pattern having Horizontal & Vertical Core print.</p> <p>Demonstrate core sand, preparation of core, Reinforcement and Venting of core.</p> <p>Backing & Baking of core, trimming of core & dressing of core.</p>	<p>Design of casting Introduction Sand casting, Pattern: Types, materials, Allowance, Color coding, Care & maintenance. Core Boxes: Types, Materials, coloring. Core: Classification of core. Venting & Reinforcing, Backing & Baking of core.</p>
<p>Practical 32Hrs</p> <p>Theory 12Hrs</p>	<p>Demonstrate heat treatment operations.</p>	<p>Evaluate heat treatment in different metals and its alloy.</p>	<p>Introduction of heat treatment. Different type of heat treatment. Heat Treatment in different metals and its alloy. Difference type of heat chamber</p>
<p>Practical 80Hrs</p> <p>Theory 30Hrs</p>	<p>Evaluate metal working such as marking, sawing, filling, grinding, drilling, charging of cupola etc.</p>	<p>Evaluate Mold with Chill or Denseners, setting the core into a mold, along with suitable gating system (use chill, denseners, Exo- thermic materials).</p> <p>Demonstrate induction furnace for charging, demonstrate charges for charging, operate and melt aluminium/ magnesium and pour aluminium/ magnesium into the mould and identify defects.</p> <p>Evaluate Furnace operation. Relining and Patching of Tilting / Pit furnace, demonstrate Ladle lining by Fire clay mixture and Carbon Die oxide sand.</p>	<p>Different type of coolant. Iron-carbon diagram, TTT, CCT diagram.</p> <p>Furnace.</p> <p>Brief Information about the Construction, operation, Maintenance of Melting Furnace (Solid-Liquid-Gas-Electrical Fuel).</p> <p>I. Cast Iron Melting-Cupola, Rotary Furnace, Electrical Arc Furnace.</p> <p>II. Steel Melting-Electric Arc & Induction Furnace - Types, construction, operation, and maintenance, Converter.</p> <p>II. Non-ferrous metal melting. Crucible Furnace, Pot furnace, Reverberatory furnace, Rotary furnace,</p>

			<p>Induction furnace Charging the Metals & Chemical analysis. Measure Molten Metal Temperature by Using Of Pyrometers: Introduction, Necessity, Thermocouple, Pyrometer, Optical Pyrometer, Radiation Pyrometer, Infrared Thermograph</p> <p>Cupola construction, operation zones in cupola.</p> <p>Lining of cupola.</p> <p>Cupola specification.</p>
<p>Practical 32Hrs</p> <p>Theory 12Hrs</p>	<p>Plan and prepare Die casting machine to produce casting, moulds by different moulding process, make cast iron castings and check defects.</p>	<p>Demonstrate Core by Preparation of mold by molding Machine.</p> <p>Hand molding machine & use of Special tools.</p> <p>Core Shooters.</p>	<p>Brief Information about Modern /All types of Moulding and Core Making Machines.</p> <p>Molding Machines, Introduction, Functions, Advantages, Disadvantages, Types. Core Making Machines, Introduction, Functions, Advantages, Disadvantages, Types.</p>
<p>Practical 48Hrs</p> <p>Theory 18Hrs</p>	<p>Evaluate casting, fettle of casting & calculation of yield percentage.</p>	<p>Demonstrate mold with Stack molding methods.</p> <p>Evaluate Special mold by Full mold process.</p> <p>Use of expanded polystyrene / Thermo Cole pattern.</p>	<p>Special Casting Process: Detailed information about the Special Casting Process. Including all types of DIE Casting. Introduction-Classification-Advantages-Disadvantages - Application. (Metal Mould Casting, Gravity Die casting, Pressure Die Casting, Centrifugal casting, Slush casting)</p> <p>Non-Metal Mould casting. Carbon dioxide molding, Shell Molding, Lost Wax Process, Plaster Mould, Binder less dry sand process. Etc.</p> <p>Detailed Information about Lay-out of different Foundries. Foundry Mechanization, Construction, Merit of Modernization, Application. (Materials Handling Equipment-Industrial Trucks-Cranes- Hoists-Conveyors-Slides and Chutes -Tractors and Trailers-Robots).</p>

<p>Practical 128 Hrs</p> <p>Theory 48Hrs</p>	<p>Demonstrate complete core by joining half cores and mould by various types of gate to produce different types of metal casting.</p>	<p>Demonstrate mold and core by air setting binders. Demonstrate mold and core flask less system, No-bake system. Demonstrate mould & core by Carbon Die oxide Process. Demonstrate mold & core by Shell molding Process. Demonstrate mold with Special molding Process like INVESTMENT CASTING process.</p>	<p>Introduction to Inspection and Testing Procedures - Visual Inspection, Dimensional Inspection, Examination of Surface. Sound Test, Pressure Testing \ Leak Testing, Testing Of Mechanical Properties: Tensile Testing Hardness Testing The brinell Test or The Rockwell Test, Fracture Test, Impact Test, Creep Testing. Heat-Treated all Types of Metal Casting and Salvaging of Metallurgical Problems NON- DESTRUCTIVE TEST: Introduction, Radiography, (X-ray & y- ray) Magnetic Particle Inspection, Fluorescent - Penetrate Inspection. Ultrasonic Inspection. SOME ADVANCEMENTS IN INSPECTION AND TESTING Instrumented Impact Testing, Thermal Inspection, X-Ray Diffraction Analysis, Materials Characterization Automation of Surface Defect Detection, Image Analysis, Industrial Computed Tomography, Computerized Testing.</p>
<p>Practical 32Hrs</p> <p>Theory 12Hrs</p>	<p>Evaluate extra thick casting & finish it, reline & prepare different types of furnaces for melting cast metals and make Core using linseed oil & IVP oils.</p>	<p>Demonstrate a solid casting & Hollow Casting by using of Gravity Die casting Machine.</p>	<p>THE USE OF STATISTICAL METHODS IN QUALITY CONTROL OF CASTING. (a)Sampling Inspection, (b)Control Charts. Design of new casting Software package for the design and production of casting. Program Structure the knowledge-base- Parting line analysis Feeder head design Gating design- Pattern plate layout concluding.</p>
<p>Practical 32Hrs</p> <p>Theory 12Hrs</p>	<p>Assess mould made without pattern & with sweep pattern and casting by investment casting process & binder</p>	<p>Assess preparation of a Solid Casting & Hollow casting by using of Pressure Die Casting Machine. Fore Moulding.</p>	<p>Energy Conservation and Environment Control. Energy conservation in Melting, & Casting, Heat-Treatment. Energy saving, Environmental pollution in foundries and its</p>

	less process.		control. Cost and Estimation of Casting. Casting weight calculation
Practical 32Hrs Theory 12Hrs	Explain dust problem in Foundry Shop adhering to TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.	Explain preparation of Casting by Centrifugal casting Machine.	QUALITY CONTROL IN FOUNDRIES: Introduction, Quality Control In Pattern And Mold Making, QUALITY Control In Melting, Quality Control in Heat-treatment, Quality Control in Fettling and Cleaning, Quality Control in Final Inspection, Dust control in foundries.

SYLLABUS FOR CORE SKILLS

- | |
|--|
| 1. Workshop Calculation & Science(Common for all Engineering CITS trades) (80 Hrs) |
| 2. Engineering Drawing (Group I) (120Hrs) |
| 3. Training Methodology (Common for all CITS trades) (320Hrs + 200Hrs) |

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Demonstrate workshop safety measures and different types of tools, equipment & raw material used in foundry.	Demonstrate selection of appropriate foundry tools & equipment.
	Demonstrate raw materials used in foundry.
	Demonstrate function of every raw material.
	Explain proper use of every tools and equipment.
	Demonstrate wrong use of tools & defective tools & equipment.
	Demonstrate workshop safety & discipline.
2. Monitor different patterns, allowances of pattern, colouring & core made and repair defective pattern and boxes.	Monitor selection of pattern for the mould.
	Demonstrate making of the floor & level it and level checked with spirit level & straight edge.
	Demonstrate making of the core with the help of core box and assemble the mould with core.
	Assess selection of all charging materials for casting.
	Demonstrate furnace preparation for melting the metal as per type of metal.
	Demonstrate pouring of melting metal into the mould cavity with special care, maintaining all safety measures.
	Demonstrate mould making with loose piece pattern.
	Demonstrate mould making and assemble it.
	Explain all step of operation during working.
	Ensure safety procedure during above operations.
	Check dimensional accuracy as per standard procedure.
	Avoid waste and use raw materials economically.
	3. Evaluate Sand tempering for different types of mould making.
Check the moisture content of the mixing sand.	
Evaluate selection of raw material for sand mixer.	
Demonstrate mixing of sand with right quantity.	
Analyse Sand tested with different testing equipment and check accuracy of the equipment.	
Demonstrate tools & equipment required for producing green sand mould.	
Assess making of green sand moulds by using appropriate hand tools.	
Demonstrate repairing of mould, if necessary.	
4. Assess different casting components by different	Evaluate proper tools and equipment for making specific mould.
	Assess selection of all raw materials and prepare mould.

metal with different moulding process.	Evaluate selection of pattern required for the job.
	Demonstrate selection of core box for making cover core.
	Demonstrate making of mould and insert core carefully.
	Demonstrate pouring of molten metal carefully.
	Ensure safety during handling and pouring of molten metal.
	Analyse Fettling of the job.
	Evaluate the finished job as per specification.
5. Demonstrate heat treatment operations.	Demonstrate safe working of furnace for melting metal and its alloy.
	Demonstrate selection of raw materials for charging of furnace.
	Demonstrate making of mould & pour molten metal to the mould.
	Demonstrate all safety & precaution maintained during heat treatment operations.
6. Evaluate metal working such as marking, sawing, filling, grinding, drilling, charging of cupola etc.	Demonstrate tools & equipment for making sawing, chipping, filling, grinding & drilling.
	Evaluate cupola construction, operation and charging.
	Demonstrate performing of above operation carefully in pit furnace.
	Observe safety & precaution during operation.
	Check the accuracy of the job.
7. Plan and prepare Die casting machine to produce casting, moulds by moulding process, make cast iron castings and check defects.	Demonstrate the machine required for gravity die casting.
	Ensure that the quality of the machine is useable.
	Demonstrate releasing agent in applied in the metallic dies.
	Analyse pouring temperature of molten metal.
	Check the quality of the castings.
	Demonstrate steps of making the mould.
	Demonstrate maintaining of heating temperature for removal of wax from the mould.
	Demonstrate extra care for handing the investment mould.
	Check the quality of the casting.
8. Evaluate casting, fettle of casting & calculation of yield percentage.	Demonstrate the tools and equipment required for making casting.
	Demonstrate chills & denser.
	Locate position for chills.
	Demonstrate pouring of molten metal by observing safety.
	Assess Fettling of the casting carefully.
	Check the accuracy and quality of the job.
	Calculate percentage of yield of casting.
9. Demonstrate complete core by joining half cores	Demonstrate and check core box for making jobs.
	Demonstrate maintaining heating temperature of core baking oven.

and mould by various types of gate to produce different types of metal casting.	Demonstrate controlling of mixed sand composition.
	Check accuracy of dimensions and hardness of the core.
	Demonstrate all hand tools, equipment and raw materials required for this job.
	Demonstrate mixing of sand with correct proportion.
	Demonstrate maintaining of Core during meeting.
	Demonstrate maintaining of correct actions during working.
	Demonstrate repairing the mould, if necessary.
10. Evaluate extra thick casting & finish it, reline & prepare different types of furnaces for melting cast metals and make Core using linseed oil & IVP oils.	Demonstrate tools and equipment required.
	Select raw material required for the job.
	Demonstrate raw materials required for reline and repair.
	Evaluate maintaining of correct proportion of charge materials.
	Assess maintaining of relining thickness.
	Evaluate maintaining of preheating temperature and heating time.
	Ensure maintaining of all safety and precaution during melting practice.
	Check quality of casting.
	Check hardness of cores after curing.
	Check quality and finishing of the core.
11. Assess mould made without pattern & with sweep pattern and casting by investment casting process & binder less process.	Select suitable sweep pattern for sweep moulding.
	Demonstrate raw materials for the mould.
	Mix the sand properly.
	Check dimensions of mould cavity after mould making without pattern.
	Check the dimension of the mould cavity after mould making by sweep pattern.
12. Explain dust problem in Foundry Shop adhering to TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.	Demonstrate equipment maintenance.
	Ensure that equipments achieve perfect production.
	Demonstrate strategic tool to grow and sustain.
	Illustrate continuous improvement in continuous manner.
	Maintain record keeping system for all the process work.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR FOUNDRYMAN (CITS)			
(For batch of 25 candidates)			
S No.	Name of the Tool & Equipment	Specification	Quantity
A. TRAINEES TOOL KIT			
1.	Tool tray steel	145x145x5 cm	26 nos.
2.	Taper trowel	18cm round	26 nos.
3.	Heart and square trowels	3x1.2x1.2cm	26 nos.
4.	Trowel heart and scoop		26 nos.
5.	Trowel square and scoop		26 nos.
6.	Trowel double scoop		26 nos.
7.	Trowel double square		26 nos.
8.	Tool Spoon	32x16cm -25x6cm	26 nos.
9.	Cleaner	6x300m	26 nos.
10.	Cleaner	9x300m	26 nos.
11.	Vent wire	3 mm	26 nos.
12.	Peg Rammer		26 nos.
13.	Flat rammer	75mmx25mm height	26 nos.
14.	Rapping spike forged and hardened		26 nos.
15.	Hand bellow	25 cm	26 nos.
16.	Safety goggles	With clear glass	26 nos.
17.	Goggles	antiglau heat proof	26 nos.
18.	Cleaner flange		26 nos.
19.	Egg smoother		26 nos.
20.	Smoother rounder corner		26 nos.
21.	Smoother square corner		26 nos.
22.	Steel rule	300mm	26 nos.
23.	Apron leather or asbestos		26 nos.
24.	Legging pad		26 nos.
25.	Hand gloves	Leather or asbestos	26 nos.
B. INSTRUMENT AND GENERAL SHOP OUTFIT			
26.	Hammers Ball Peen.	0.45kg	13 nos.
27.	Ball Peen Hammers	650 to 700 grams	13 nos.
28.	Sledge Hammers	8kg	5 nos.
29.	Claw Hammers	0.75kg	2 nos.
30.	Chisel Cold Flat	2 x 22 cm	13 nos.

31.	Chisel	200 x 15 mm	13 nos.
32.	File flat	30 cm Bastared	13 nos.
33.	File flat	30 cm second cut	13 nos.
34.	File flat round	30cm Bastard	13 nos.
35.	Folding rule	60 cm	5 nos.
36.	Steel rule	600 mm	5 nos.
37.	Caliper odd leg		3 nos.
38.	Caliper inside	15cm	5 nos.
39.	Scriber		5 nos.
40.	Centre Punch	15 cm	5 nos.
41.	Hacksaw	30cm adjustable	13 nos.
42.	C Clamps	20 cm	13 nos.
43.	C Clamps light duty steel	30 cm	13 nos.
44.	Screw Drivers	25 cm with 15mm blade	5 nos.
45.	Screw Drivers	15 cm	5 nos.
46.	Screw Drivers	18 cm	5 nos.
47.	Pliers	20 cm 5	5 nos.
48.	Try Square	for wood work	5 nos.
49.	Brick layers hammer	20cm	5 nos.
50.	Hand lamp wandering lead		2 nos.
51.	Degassing bale	10 cm Perforated hood	2 nos.
52.	Bench Vice	12 cm jaw	5 nos.
53.	Work bench for bench vice	245 x 125x 75	1 nos.
54.	Blow lamp		5 nos.
55.	Hand saw		5 nos.
56.	Steel measuring	tap 3 mts.	1 no
57.	Trammel		2 nos.
58.	Shovel Hand		13 nos.
59.	Engineers Try Square	15 cm	5 nos.
60.	Lockers Steel	with 8 drawers each	3 nos.
61.	Black board with easel		1 no
62.	Fire Extinguishers foam chemical type		2 nos.
63.	Fire Extinguishers soda Ash, etc type Co2 gas type		1 each
64.	Fire buckets	2 for water and 3 for sand	5 nos.
65.	Stand for Fire buckets		1 no
66.	Face shield clear		13 pairs

67.	Helmet (engineers)		13 pairs
68.	Gauntlets leather Fettling		13 pairs
69.	Gauntlets leather or asbestos for Furnace		13 pairs
70.	Footwear asbestos over shoes		13 pairs
71.	First aid Box based on burn Treatment		1 set
72.	Dividers Firm joint	20 cm	5 nos
73.	Moulding Boxes	30 x 40 x 15 cm RSDL	25 pairs
74.	Moulding Boxes	75 x75 x 25cm RSDL	13 pairs
75.	Snap Flask	40 x 35 x 12 cm RSDL	2 Pairs
76.	Slip Flask	40 x 35 x 12 cm RSDL	2 pairs
77.	Sprit level		5 nos.
78.	Wheel barrows		2 nos.
79.	Plane grooving 6mm cutter		2 nos.
80.	Cutting Pliers		2 nos.
81.	Set of Spanners , and Alegen keys		2 set each
82.	Venire calipers		1no.
83.	Set of Tongs For Melting & Charging.		2sets
84.	Equipment for conducting BLS (Basic Life Saving) training.		1 set
85.	Air Compressor with maximum working pressure of	17.5kg/sq.cm	1 no.
86.	Pneumatic Rammer with Rubber head		2 nos.
87.	Pneumatic Chisel (with suitable Chisel)		1 no.
88.	Molding Sand Muller	100 Kg, Core Sand Muller 50kg capacity	Each one unit
89.	Mould Green Hardness tester - dial type -Risdale dials standard		1 Unit
90.	Core hardness tester		1 Unit
91.	L.P.G Cylinder With heating torch (Industrial Purpose)		1 Unit
92.	Heating and Plumbing Unit to suit with Heating Pressure Gauge etc. Oil tank Motorized Rotary pump-Pre heater.	oil Fired Tilting type Crucible Furnace	1 Unit
93.	Sand testing Equipments - Permeability meter, Universal Strength tester, Sieve Shaker, Standard Sand Rammer, Shutter Index Tester, Clay Content Tester, Speedy Moisture tester. Electric Hot Air oven.		Each One Set
94.	Molding Machine Hand squeeze With Stripping device pin lift type. With	latest version	1 Unit

	Suitable Compressor &Lifting Device.		
95.	CO2 Gas cylinder with nozel		1 Unit
96.	Testing Of Mechanical Properties: Tensile Tester, Hardness Tester, The brinell Tester, The Rockwell Tester, Fracture Tester, Impact Tester, Creep tester. Specification: Equipments suitable for Training Purposes.		1 Unit
97.	Electrical Melting Furnace: With all accessories.	Induction 100 kg. melting of C.I or Steel or Brass.	1 Unit
98.	Metal Chemical Composition Analyzers or spectrometer		1 Unit
99.	Heat -Treated Furnace (Electrical Furnace)		1 Unit
100.	Centrifugal Casting Machine		1 Unit
101.	Equipment for conducting BLS (BASIC Life support) training.	Optional	1 set
102.	Air conditioner		As required

ANNEXURE – I

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the expert members who had contributed immensely in this curriculum.

List of Expert members participated for finalizing the course curriculum of Foundryman (CITS) trade.			
SNo.	Name & Designation Sh/Mr/Ms	Organization	Remarks
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Turbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K. Jain, Professor	IIT, Roorkee, Roorkee-247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat-382424	Member
4.	Dr. P.V. Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
7.	Dr. P.P. Bandyopadhyay Professor	IIT Kharagpur, Kharagpur-721302, West Bengal	Member
8.	Dr. P.K. Ray, Professor	IIT Kharagpur, Kharagpur-721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	Uday Apte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A. Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
Mentor			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member

24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas (DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N. Renukaradhya, Dy. Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V. Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M. Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr. Instructor	Govt. ITI Dhanuvachapuram Trivendrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
Other industry representatives			
42.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
43.	Venkata Dasari	Skill Sonics, Bangalore	Member
44.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
45.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	L.R.S. Mani	Ohm Shakti Industries, Bengaluru	Member

