CURRICULUM

FOR THE TRADE OF

FITTER STRUCTURAL

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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

CONTENTS

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

Co-ordinator for the course : R.N.MANNA, Training Officer, CSTARI, Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
1.	Sri Nirmalya Nath, Astt. Director of Trg.	CSTARI, Kolkata	Expert
2.	R.N.Manna, Training Officer	CSTARI, Kolkata	Expert
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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 FITTER STRUCTURAL trade)

A Unique Training Process

The Apprenticeship system of training is unique in that it is the only formal, structured, and nationally recognized education and training program available that combines the two most common forms of career and occupational learning: classroom instruction with on-the-job training.

Apprentices not only learn occupational skills in the classroom, their learning is expanded to include hands-on, paid, on-the-job training. Students learn and practice all phases of the trade/occupation in real-world applications.

Apprenticeship is a training strategy that, leads to a certificate of completion and nationally recognized skilled worker status. These credentials have explicit meaning, recognition, and respect in the eyes of Central and State Governments and relevant Industries.

The Apprenticeship Programs train men and women to craftsman status. By participating in a program, apprenticeship training shape applicants with character, aptitude, motivation and good personality traits into competent Craftsmen and Craftswomen who have in-demand skill sets, comprehensive knowledge, positive attitudes and superior abilities.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

7214.70 Structural Fitter is responsible to carry out fit up operations on structural steel elements and assemblies and excel at marking these steel elements in accordance with the workshop drawings. He/ she should be able to carry out fit up operations of assemblies in fabrication yard.
Erects columns, trusses and general fabrication work at site for construction of buildings, heavy foundations, hangars, sheds, etc. under guidance of Civil Engineer or Overseer. Examines drawings and other specifications.
Assembles and fits together various parts of heavy structures such as bridges, overhead canes, hoists, ship etc. in work-shop according to drawings under Instructions of structural Engineer and dismantles them for transporting to site for final construction. Checks parts to be fitted together. Cuts steel plates and angle iron using power shear or flame cutting equipments. Drills holes for bolts and rivets. Bends rods/plates using hand tools or bending machine and joins them together with wires or fasteners. Places them in forms and fixes them in position. Slings members in position with connecting pins to ensure that members fit together at site. Checks preparatory to permanent erection of structures at site. Checks alignment of parts with sprit level, etc. to ensure accuracy of fit. Dismantles parts of assembled structures to facilitate transportation to site. Assemble structural members by fitting, drilling, riveting, bolting or welding.
The individual should have good knowledge of safe working practices.

Reference NCO: **2004/7214.70**

5. GENERAL INFORMATION

1. **Name of the Trade** **: FITTER STRUCTURAL**

2. **N.C.O. Code No.** : 2004/ 7214.70

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 to ITI Passed out Trainees : one year for the trade of **Fitter**.

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** : **FITTER STRUCTURAL**
2. **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3. **Batch size** : 20 (Maximum)
4. **Power Norms** : 2 KW for Workshop
5. **Space Norms** : 70 Sq .m
6. **Examination** : The internal assessment will be held on completion of each Block.
7. **Instructor Qualification** :

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

OR

ii) NAC in the trade of **FITTER STRUCTURAL** 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.	Drawing Instruments : their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing of lines and their application (Hidden, centre, construction, Extension, Dimension, Section) Methods of Division of line segment	**30**	**Properties of Material** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys.	**20**
2	Drawing of Geometrical Figures: Angle, Triangle -different types, Rectangle, Square, Rhombus, parallelogram, Circle and its elements.		**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals. **Centre of gravity** and its practical application.	
3	Lettering and Numbering as per BIS SP46-2003: Single Stroke, Double Stroke, inclined, Upper case and Lower case		- Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces.	
4	Dimensioning: - types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text		**Mensuration :** parallelogram lengths of diagonals of square & rectangles. Pythagoras Theorem, Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Area of trapezoid,	
5	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. .	

6	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings		- Area of cut-out regular surfaces: circle and segment and sector of circle.	
7	Construction of Geometrical Drawing Figures: - Polygons and their values of included angles. - Conic Sections (Ellipse)		- Volume of simple solid blocks - Volume of cut-out solids: hollow cylinders, frustum of cone, block section.	
8	Drawing of Solid figures (Cube, Cuboids, Cone and Frustum of Cone) with dimensions.		**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	
9	Free Hand sketch of hand tools and measuring tools used in the trade.		**Friction** – Limiting frication – measuring of friction – examples. Simple problems on straight and bell crank levers. Laws of friction, co-efficient of friction and angle of friction. Problems on inclined plane.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	Drawing of riveted joints, different types of threads, bolts, nuts, locking devices, keys, cotters, couplings, bearings, pulleys cotters screw joint, knuckle joint etc. Making drawings of lap and butt and single or double strap riveted joints.	**30**	stress, strain and modules of elasticity, ultimate, strength, factor of safety and different types of stresses	**20**
2	Free hand sketching of pipe joints-flanged, socket & screwed sleeve joints and preparation of drawings of pipe joints. Free hand sketching of simple machine parts and production of working diagrams		Elementary principle of triangle of forces and parallelogram of forces. Resolution and composition of forces. Application to lifting tackles like chain pulley block, crane, wall crane, etc. problems. Moment of a force-couples-simple problems. Example in simply supported and loaded beams-General conditions of equilibrium for a series of forces acting on a body. Stable, non stable and neutral equilibrium of bodies-simple explanation.	
3	- Construction of simple curves of interpretation-simple exercises. - Development of surfaces of prism, cylinders, pyramids and cones		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, Expansion of solids, liquids and gases due to heat, co-efficient of expansion. Brief description of transference of heat-conduction, convection and radiation.	
4	Reading of advanced blue prints including structural drawings and other allied items such as materials, list.		Electricity and its various effects. Electric current-positive and negative terminals, use of switches and fuses. Types of current- AC, DC, Units of current, resistance and voltage; Simple electric circuit-Ohm's law-simple calculation. Conductor,	

			insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.	
5	- Drawings of fabricated channels or I section Girders. - Drawings of fabricated channels simple poof trusses, purlins, braced columns glazing or window frames and welded girders.		**Trigonometry:** Trigonometric ratios, 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).	
6	- Drawing of fabricated jobs like brackets, bed plates. - Drawings for welding vessels, pipes, ducts, etc.		**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine.	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills (275 hrs.)	Professional Knowledge (120 hrs.)
1	• Instructions in Health & Safety precautions as applicable to the trade. • Marking out from drawings in mm/ inch. Marking for cutting to shape.	Safety precautions: Safety at work- correct technique to avoid accidents. Safety precautions to be observed in general- particularly in the shop floor. Fire Extinguishers, protective equipment and protective clothing-their importance and use. Electrical safety and fuses. Knowledge of elementary first aid Description, use and care of different marking off and layout tools.
2	• Chipping. • Grinding of Chisels.	Description, use and care of different hand tools and holding devices. Common shapes of chisels (cold). Safety precautions for chipping. Method of chipping and cutting. Method of removing welds and rivets by chipping and grinding. Use of pneumatic chisels for chipping.
3	• Sawing. • marking for drilling • Drilling and drill grinding • Dressing of grinding wheel.	Types of Drills, Their nomenclature and uses. Use of templates. Use of master plates for batch drilling. Types of grinding machines. Special safety precautions for grinding. Description, use and care of different grinding wheels.
4.	• Tapping. • Threading with dies.	Different thread forms and their uses.
5 - 6	• Filling to marking and size. • Use of micrometers. • "Use of vernier – linear and angular.	Description, use and care of different precision measuring instrument.
7- 8	• Scraping & sharpening of scrapers. • Drilling counter boring, counter sinking & spot facing • Use of jigs and templates with location points	Jigs & templates making: Simple set outs. Intersections various tapes their purpose and use. Jigs-use of jigs for drilling plates and angles simple fixtures and clamping device. Use of jig bushes
9-11	• Simple marking out of sheet metal • Making simple joints of sheet metal. • Simple riveting.	Description and use of different marking and hand tools for sheet metal work. Riveting: Types of rivets and riveting, Hand riveting. Cold & Hot, Method of riveting. Use of pneumatic riveting. Method of holding up. Use of hydraulic riveting. Checking rivets, removing bad rivets.
12	• Reaming.	: Description of croppers, shearing machines and

	• Scraping of bearing • Identification of steel, C.I. etc.	guillotine shears, punching machines, edge planning machines and nibbling machines and their use. Plate roots and its use. Pyramid roll for plate bending of plates, angle iron, pipes, etc. Hot bending and joggling of angles. Bending angles and channels after cutting the flanges-blanking and press work
13.	**Revision**	
	Internal Assessment 03days	

B. Block –II
Basic Training

Week No.	Professional Skills (275 hrs.)	Professional Knowledge (120 hrs.)
1 - 2	• Marking of gusset plates, joint section beams. joints columns, curved and bent plates and section. Marking for built up section. Allowing for rolling tolerance. • Inspection of finished materials. Techniques of checking slope length shape etc	• Templates for cutting to size. Templates for drilling. Use of prick punch, back marks, standard back marks and cross centres. Edge distances. Templates for gussets, templates for marking angles, techniques of marking several items from a simple template. Template for marking joint sections. • Machining allowances- allowances allowing for distortion in welding and cutting. Allowances for temperature variations. Use of working points and intersection points.
3 - 4	• Simple welding (Arc and Gas) • Simple soldering • Marking for beveling and chamfering. marking after assembly for welding, marking of sloping members.	**Welding & Gas cutting**: Welding tools and welding accessories, protective clothing, etc. Different processes of welding - oxy-acetylene, electric and Thermal - Brief description & application, welding methods.Common gases used in welding- oxygen, hydrogen-Acetylene, TIG & MIG, CO_2 , Argon different types of joint and its application properties. Storage and use of various gasses used in welding. Gas cutting-profile and straight line-oxy-acetylene flame lighting and adjustment Use of different types of flames – oxidizing, reducing & neutral. Flame cutting-free hand, guided and mechanical. Flame cutting factors, Elementary electricity as applied to electric welding. Types of arc welding, carbon metallic, resistance etc. and application. Principal of arc welding. The welding arc-its characteristics, advantages and disadvantages, welding machines – D.C. Generators. A.C. Transformers-rectifiers-their description and operation, Different types of electrodes purposes of flux coating. Method of coating position of flux-characteristics of flux. Various welding position Edge preparation application. Method of heating of metals, Distortion-causes and effects. Method employed to minimize distortion. Types of welding. Welding of different metals, Techniques employed in gas and arc welding. Common defects in arc and gas welding. Non destructive method of flow detection like M.P.T. Ultrasonic di-penetration, Radiography, knowledge of relevant I.S.I. specification regarding materials, fasteners, electrodes and tolerances, Safety precautions during welding 60 hrs
5 - 6	• Fitting of mating parts. • Cutting key way and fitting keys.	Description and use of different mechanical fasteners.

7 - 8	• Fitting & removal of studs. • Assembly of Structural parts.	Simple techniques of assembly. Assembling of riveted plate girder trusses. Assembling of laced and lattice structures. Using fixture for clamping and location. Use of drifts for faring holes.
9 – 10	• Repair works. • Use of gauges & templates. • Use of sine bar & Slip gauges.	Rectification of mistakes and errors, slinging loads, Use of chain, wire sling, tackle, clamps, level table and level stallage. Marking of simple fixture, Preventing or allowing for welded distortion. Assembling of welded I-section. Assembling of cylindrical tanks including fitting and lining of vessels. Use of jointing cement. Lagging & insulation
11	**PIPING WORK** • Cutting, bending, threading, joining and assembly. • Marking of pipes and intersections	Commonly used pipes- Use of tools such as pipe cutter, pipe wrenches, pipe vices, etc. Pipe threads- standard pipe threads- dies and taps. Standard pipe fitting methods of fitting or replacing the fitting – repair and erection of pipes line. Methods of preventing leaks at the Joints. pipe bending methods- use of bending fixture, pipe bending machine etc.
12	• Elementary concept of material handling like methods of slinging and use of various material handling equipment and fixtures.	Roof trusses-their description, types and use.
13.	**Revision**	
	Internal Assessment 03 days	

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** : **FITTER STRUCTURAL**

2) **Duration of On-Job Training** : a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3) **Batch size** : a)Selection of Apprentices as per apprenticeship guidelines.

b) Max. 20 trainees per group

4) **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.

5) **Instructor Qualification** :

i) Degree/Diploma in **CIVIL / MECHANICAL** Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NAC in the trade of **FITTER STRUCTURAL** with three year post qualification experience in the relevant field.

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

6) **Tools, Equipments & Machinery required** : - As per Annexure – II

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

A. BLOCK – I

JIGS AND TEMPLATE MAKING

1. Making templates for simple objects – marking, cutting to size, Setting out and use of inter-sections points, reference points & reference lines, Allowance for machining and edge planning.
2. Making fixtures for assembly and Welding.
3. Making simple drilling jigs and templates.
4. Gauges for bending.
5. Development on sheet metal for making bunkers or hoppers.
6. Setting out for three dimensional structures.
7. Marking gusset plates, joints section beams, joints columns.
8. Marking curved and bent plates & sections, Providing marks to facilitates assembly.
9. Inspection & checking.

PREPARATION

1. Cutting plates by guillotine shears, by cropper.
2. Cropping of sections.
3. Straightening plates and sections.
4. Edge planning.
5. Bending plates (hot and cold).
6. Punching, Press work, Nibbling.

RIVETING

1. Hand riveting hot.
2. Use of Pneumatic riveting.
3. Use of Hydraulic riveting.

B. BLOCK – II

WELDING AND GAS CUTTING

1. Safety precautions in gas & electric welding.
2. Use of hand tools used in gas welding & cutting.
3. Use of welding torch, regulation of flame.
4. Use of high pressure acetylene bottles.
5. Use of acetylene generators and oxygen cylinders.
6. Fusion runs with and without rods by gas.
7. Straight line beads on M.S. Sheets and plates by gas.
8. Butt joints on M.S. by gas welding/ brazing.
9. Use of hand tools used in electric welding.
10. Study of electric arc welding machines and regulation of current and voltage.

11. Straight line beads by electric welding on mild steel Using different sizes of electrodes.
12. Square butt joint, open corner joint, fillet tag and Tee joint by electric welding on mild steel.
13. Gas welding.
14. Preparation of joints for welding.
15. Tack welding techniques.
16. Single and multi-run welding techniques.
17. Special problems on assembling for welding.

CHIPPING AND GRINDING

1. Use of pneumatic chisels for chipping.
2. Removing welds and rivets.
3. Grinding flush.

ASSEMBLY

1. Assembling of simple structures, simple trusses, end cleats, brackets to beams.
2. Use of lifting tackles, slings, lifting, devices, slinging fabricated structure for fitting.
3. Assembling of riveted joints.
4. Assembling of simple structures for welding,
5. Assembling of welding I-sections.
6. Use of level table for leveling and positioning.
7. Marking of simple fixtures.
8. Preventing or allowing for welding distortion, Correction of errors.
9. Assembling of tanks and vessels.
10. Fixing pipe and fitting vessels.
11. Use of jointing cements in vessels.
12. Use of lagging material and insulation in vessels.

PAINTING AND DESPATCH

1. Paints-Primary and finishing coats.
2. Distinguishing marks for dispatch and erection.
3. Loading lorries and wagons.
4. Lashing and tying loads.

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. Structural / Fabrication like bridges, Roof structures and Building & construction industries.
2. Service industries like road transportation and Railways.
3. Ship building and repair industries
4. Infrastructure and defence organisations
5. In public sector (Central and State) and private industries of related field in India & abroad
6. Self employment

ANNEXURE – I

10. TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: FITTER STRUCTURAL

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1	Steel Rule 15 cm with metric graduation	21 nos.
2	Try Square 10 cm blade.	21 nos.
3	Caliper inside 15 cm spring.	21 nos.
4	Caliper 15 cm hermaphrodite	21 nos.
5	Caliper outside 15 cm spring	21 nos.
6	Divider 15 cm spring	21 nos.
7	Straight Scriber 15 cm.	21 nos.
8	Centre Punch 10 cm	21 nos.
9	Screw driver 15 cm	21 nos.
10	Chisel cold flat 10 cm	21 nos.
11	Hammer ball peen 0.45 kg. With handle	21 nos.
12	Hammer ball peen 0.22 kg. With handle.	21 nos.
13	File flat 25 cm. second cut	21 nos.
14	File flat 25 cm. smooth	21 nos.
15	File half round second cut 15 cm.	21 nos.
16	Hacksaw frame fixed 30 cm.	21 nos.
17	Safety goggles.	21 nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (indicative)
1.	Steel Rule 30 cm	4 nos.
2.	Steel Rule 60 cm.	4 nos.
3.	Straight edge 45 cm steel	2 nos.
4.	Surface plate 45 x 45 cm CI / Granite.	1 nos.
5.	Marking table 91 x 91 x 122 cm.	1 no.
6.	Universal scribing block 22 cm.	2 nos.
7.	V-Block pair 7 cm and 15 cm with clamps	2 nos.
8.	Square adjustable 15 cm blade.	2 nos.
9.	Angle plate 10 x 20 cm.	1 nos.
10.	Spirit Level 15 cm metal	1 no.
11.	Punch letter 3 mm set.	1 no.
12.	Punch number set 3 mm.	1 no.
13.	Punch prick 6mm	2 nos.
14.	Portable hand drill (Electric) 0 to 6 mm	1 nos.
15.	Drill twist straight shank 1.5 to 12 mm by 0.5 mm	1 Set
16.	Drill twist straight shank 8 mm to 15 mm by ½ mm	1 Set
17.	Taps and dies complete set in box B.A	1 no.
18.	Taps and dies complete set in box with-worth.	1 no.
19.	Taps and dies complete set in box 3-18 mm set of 10	1 no.
20.	File warding 15 cm smooth	4 nos.
21.	File knife edge 15 cm smooth	4 nos.
22.	File cut saw 15 cm smooth	2 nos.
23.	File Rounded edge 15 cm smooth	2 nos.
24.	File triangular 15 cm smooth	2 nos.
25.	File round 20 cm second cut	4 nos.
26.	File square 15 cm second cut	4 nos.
27.	File square 25 cm second cut	4 nos.
28.	Feeler gauge 10 blades	1 set
29.	File triangular 20 cm second cut.	4 nos.
30.	File triangular 15 cm second cut.	4 nos.
31.	File flat 30 cm second cut.	4 nos.
32.	File flat 20 cm bastard	4 nos.
33.	File flat 30 cm bastard.	4 nos.
34.	File half round 25 cm second cut.	4 nos.
35.	File Swiss type needle set of 12.	2 sets

36.	File round 30 cm bastard.	4 nos.
37.	File hand 15 cm second cut.	8 nos.
38.	Card file.	4 nos.
39.	Oil Stone 15 cm x 5 cm x 2.5 cm	4 nos.
40.	Stone carborandum 15 cm x 5 cm x 5 cm x 4 cm.	2 nos.
41.	Oil Can 0.25 liters.	2 nos.
42.	Pliers combination 15 cm	2 nos.
43.	Soldering Iron 350 gm.	2 nos.
44.	Blow Lamp 0.50 liters.	2 nos.
45.	Spanner D.E. 6 -26 mm set of 10 pcs.	2 set.
46.	Spanner adjustable 15 cm	1 nos.
47.	Interchangeable ratchet socket set with a 12 mm driver, sized10-32 mm set of 18 socket & attachments.	1 set
48.	Box spanner set 6-25 mm set of 8 with Tommy bar.	1 set
49.	Glass magnifying 7 cm	1 nos.
50.	Clamp toolmaker 5 cm and 7.5 cm set of 2.	2 nos.
51.	Clamp “C” 5 cm	2 nos.
52.	Clamp “C” 10 cm	2 nos.
53.	Hand Reamer adjustable cover max 9 ,12,18mm – set of 3	1 set
54.	Hand Reamer taper 4 -9mm set of 6 OR 4 -7 mm set of 4.	1 set
55.	Reamer parallel 12 – 16mm set of 5.	1 no.
56.	Scraper flat 15 cm.	4 nos.
57.	Scraper triangular 15 cm	2 nos.
58.	Scraper half round 15cm	2 nos.
59.	Chisel cold 9 mm cross cut	2nos
60.	Chisel cold 19 mm flat	2 nos.
61.	Chisel cold 9 mm round nose.	2 nos.
62.	Stud Extractor EZY – out	2 nos.
63.	Combination Set 30 cm.	2 nos.
64.	Micrometer 0 – 25 mm outside.	2 nos.
65.	Micrometer inside 25 – 50 mm with extension rods.	1 no.
66.	Vernier caliper 15 cm	2 no.
67.	Vernier height gauges 30 cm.	1 no.
68.	Vernier bevel protractor.	1 no.
69.	Screw pitch gauge.	1 no.
70.	Wire gauge, metric standard.	1 no.
71.	Drill twist Taper Shank 12 mm to 25 mm x 1.5.	1 no
72.	Drill chuck 12 mm.	1 no.
73.	Pipe wrench 40 cm	1 no.
74.	Pipe vice 100mm	1 no.

75.	Adjustable pipe die set cover pipe size 15, 20, 25,32,38,50 mm with die stock	1 no.
76.	Wheel dresser (One for 4 units).	1 no
77.	Machine vice 10 cm.	1 no.
78.	Machine vice 15 cm.	1 no.
79.	Sleeve drill Morse 0 – 1, 1 – 2, 2 – 3.	1 Set
80.	Vice bench 12 cm jaws.	20 nos.
81.	Vice leg 10 cm jaw.	2 nos.
82.	Bench working 240 x 120 x 90 cm.	4 nos.
83.	Almirah 180 x 90 x 45 cm.	2 nos.
84.	Lockers with 8drawers (standard size).	3 nos.
85.	Metal rack 182 x 182 x 45 cm	1 no.
86.	Black board with easel.	1 no.
87.	Fire extinguisher (For 4 Units)	2 nos.
88.	Fire buckets.	2 nos.
89.	Wing compass 25.4 cm or 30 cm.	2 nos.
90.	Hand hammer 1 kg. with handle.	2 nos.
91.	Torque wrench (14 to 68 Nm)	1 no.
92.	Discussion Table 8' x 4' x 2½ '	2
93.	First- aid box	As required

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	Drilling machine pillar sensitive 0-20 mm cap with swivel table motorized with chuck & key.	1 no.
2	Drilling machine bench sensitive 0-12 mm cap motorized with chuck and key.	2 nos.
3	D.E. pedestal Grinding machine with 200mm diameter wheels rough and smooth with twist drill grinding attachment.	1 no.
4	Transformer welding set 150 amps.-continuous welding current, with all accessories and electrode holder	1set
5	Oxy -acetylene gas welding set equipment with hoses, regulator and other accessories.	1set

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: FITTER STRUCTURAL

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+1 set
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20+1 set
4.	Mini drafter	20+1 set
5.	Drawing board (700mm x500 mm) IS: 1444	20+1 set

B : FURNITURE REQUIRED

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

ANNEXURE – II

11. INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: FITTER STRUCTURAL

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishment. 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 concerned industry may impart the training in cluster mode / in any other industry / at ITI.

ANNEXURE-III

12. 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.