

**COMPETENCY BASED CURRICULUM**

**FOR THE TRADE OF**

**FITTER**

**UNDER**

**CRAFTSMAN TRAINING SCHEME (CTS)**

**IN SEMESTER PATTERN**

**BY**



Government of India

**GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
DIRECTORATE GENERAL OF TRAINING**

## CONTENTS

Sl. No.	Topics	Page No.
1.	Introduction	3-4
2.	Job roles: reference NOS& NCO	5-6
3.	NSQF level compliance	7
4.	Learning outcome	8-9
5.	General information	10
6.	Course structure	11
7.	General Training Plan, Examination & Pass regulation	12
8.	Assessable Outcome	13
9.	Assessable outcome with assessment criteria	14-21
10.	Syllabus content with time structure 10.1 Syllabus content for Professional Skill & Knowledge 10.2 Syllabus content of core skills	22-42
11.	Employability skills 11.1 General information 11.2 Distribution of topics between semesters for employability skill 11.3 Syllabus content of Employability Skill	43-49
12.	Infrastructure	50
13.	Assessment standard 13.1 Assessment guideline 13.2 Internal assessments (Formative assessment) 13.3 Final assessment- All India Trade Test (Summative assessment)	51-55
14.	List of trade committee members	56-57
15.	List of Tools & Equipment-Annexure-I	58-64
16.	Guidelines for instructors and paper setters- Annexure-II	65

# 1. INTRODUCTION

India is one of the youngest nations in the world. Our youth are our strength. However, a challenge facing the country is that of skilling our youth as per the demands of the industry. Recognizing the need for quickly coordinating the skill development and entrepreneurship efforts of all concerned stakeholders, the Government of India created the Ministry of Skill Development and Entrepreneurship on 9<sup>th</sup> November, 2014. To create further convergence between the Vocational Training System through Industrial Training Institutes (ITIs) and the new skill initiatives of the Government, the Training and Apprenticeship Training divisions from the Directorate General of Employment and Training (DGET) under the Ministry of Labour and Employment stand transferred to the Ministry of Skill Development and Entrepreneurship (MSDE) with effect from 16<sup>th</sup> April, 2015. This move brings over 11000 ITIs and scores of other institutions, and the Apprenticeship and Training divisions, under the Ministry.

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including Women's Vocational Training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Modular Employable Scheme (MES) under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

- Training courses under the CTS is being offered through a network of more than 11000 Government and Private Industrial Training Institutes (ITIs) located all over the country with a total seating capacity of more than 16 Lakhs with an objective to provide skilled workforce to the industry in 126 trades. Skill development courses exclusively for women are also being offered under CTS and other schemes through Government and Private ITIs and Regional Vocational Training Institutes (RVTIs) for Women.
- The Apprentices Act, 1961 was enacted with the objective of regulating the program of apprenticeship training in the industry by utilizing the facilities available within for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart on the job training for school leavers, and ITI passed outs to develop skilled manpower for the industry.
- The Ministry is implementing the Employable Scheme (MES) under the Skill Development Initiative Scheme to provide vocational training to people to develop skilled manpower for the industry through a network of Vocational Training Providers (VTPs) located across the country.

Central Staff Training and Research Institute (CSTARI), Kolkata is the nodal institute for the development/revision of curricula under all vocational training schemes of the Ministry. National Instructional Media Institute (NIMI), Chennai is to make available instructional material in various trades for the use of trainees and trainers to ensure overall improvement in the standard of institutional training under the CTS and ATS schemes. The

institute is actively involved in the development, production and dissemination of instructional media Packages (IMPs) comprising of books on Trade Theory, Trade Practical, Test/Assignment, and Instructor's Guide.

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27<sup>th</sup> December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curriculum, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

## 2. JOB ROLES: Reference NOS & NCO

Brief description of Job roles:

**Fitter General** sizes metal parts to close tolerances and fits and assembles them using hand tools for production or repairs of machines, or other metal products. Studies drawings to understand specification of different parts, fittings or assemblies to be made and their functions. Cuts and shapes required parts dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., Assembles parts by riveting, screwing, pinning etc. So as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools and replaces them by repaired or new ones. Tests completed article to ensure correct performance. May do simple turning of parts on machines and perform welding, brazing, annealing, hardening, tempering and like operations. May specialize in particular type of machine or product and be designated accordingly. May suggested alterations.

Sizes metal accurately to required dimension by sawing, chipping, filing, etc, using hand tools for making specimens or finished components. Studies drawing or measures sample to record dimensions of part to be made. Holds specified material in vice and sizes it by processes of sawing, chipping and filing. Measures object while working using foot rules, calipers, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scribe, vernier, height gauges, vice-blocks, angle plate, sine plate, slip gauges, combination set, etc, depending on accuracies required, to indicate guide lines for finished sizes, holes to be drilled and pitch centres, threads to be cut and other working details as specified in drawing or sample. Clamps object securely in correct position in vice and files it to required dimensions according to punch marks and guide lines frequently measuring it with clippers, micrometer, vernier, gauges etc, Drills holes with hand drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measure finished article with dial indicator, micrometer, vernier, height gauges, screw gauges, plug gauges, sine plate slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those screws, rivets, pins, etc. as specified. May check dimension with shadow graph. May be designated as FITTER General according to nature of work done.

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.

**Reference NCO & NOS:**

**i)NCO-2004: 7233.10**

**ii) NCO-2004: 7233.20**

**NOS:-**

i) Sheet Metal Worker

Qualification Pack Code: CSC/Q 0301

ii) Fitter- Mechanical Assembly

Qualification Pack Code: CSC/Q 0304

iii) Operator Conventional turning

Qualification Pack Code: CSC/Q 0110

iv) Maintenance- Fitter Mechanic

Qualification Pack Code: CSC/Q 0901

v) Fitter fabrication

Qualification Pack Code: CSC/Q 0303

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### **3. NSQF LEVEL COMPLIANCE**

#### **NSQF level for Fitter trade under CTS: Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. professional knowledge,
- c. professional skill,
- d. core skill and
- e. Responsibility.

The Broad Learning outcome of Fitter trade under CTS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

<b>LEVEL</b>	<b>Process required</b>	<b>Professional knowledge</b>	<b>Professional skill</b>	<b>Core skill</b>	<b>Responsibility</b>
Level 4	work in familiar, predictable, routine, situation of clear choice	factual knowledge of field of knowledge or study	recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

## **4. Learning outcome**

The following are minimum broad general learning outcome after completion of the Fitter course of 02 years duration:

### **A. GENERIC OUTCOME**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
2. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.
3. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
4. Read and apply engineering drawing for different application in the field of work.
5. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

### **B. SPECIFIC OUTCOME**

9. Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.
10. Plan and organize the work in familiar predictable/routine environment for different types of fitting operations and check for work result.
11. Make choices to carry out routine jobs of marking out the components for filing, drilling, riveting, fitting and allied operations where choices are clear.
12. Understand and explain the constructional features and working principles of lathe, drilling machine and operate these machine to produce simple components as per required specification & requisite quality.
13. Demonstrate practical skills by using appropriate tools & equipment's and make gauges, slide fittings and simple jig & fixtures for drilling and also check for accuracy.
14. Dismantle and repair damaged mechanical components used for power transmission or any assembly and re-assemble & check the same for appropriate functioning.
15. Demonstrate practical skills and apply factual knowledge of field to maintain required tolerance of different mating surfaces by scraping and lapping.
16. Explain and apply working principle of welding, perform ARC & gas welding and sheet metal working by soldering, brazing operation using appropriate materials with minimal assistance.
17. Perform the basic day to day repair and maintenance along with erection of general machine tools viz. lathe, drilling machine.



18. Apply appropriate rule and select required tools to execute pipe joints, dismantle and assemble valves & fittings in pipes and test for leakages.
19. Perform forging to make different hand tools and heat treat the same.
20. Explain and apply factual knowledge of Limits, Fits and tolerance necessary for fitting applications.

***NOTE: Learning outcomes are reflection of total competencies of a trainee. Each learning outcome may include multiple assessment components. However assessment will be carried out as per assessable outcome and assessment criteria.***

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## **5. GENERAL INFORMATION**

1. **Qualification** : **FITTER**
2. **Ref.N.C.O./NOS Code No.** : 7233.10, 7233.20, CSC/Q 0301, CSC/Q 0304,  
CSC/Q 0110, CSC/Q 0901, CSC/Q 0303
3. **NSQF Level** : Level-IV
4. **Duration of Craftsmen Training** : Two years (Four semesters each of six months duration).
5. **Entry Qualification** : Passed 10<sup>th</sup> Class with Science and Mathematics under  
10+2 system of Education or its equivalent
6. **Trainees per unit** :16 (Max. supernumeraries seats: 5)

### **Distribution of training on Hourly basis:**

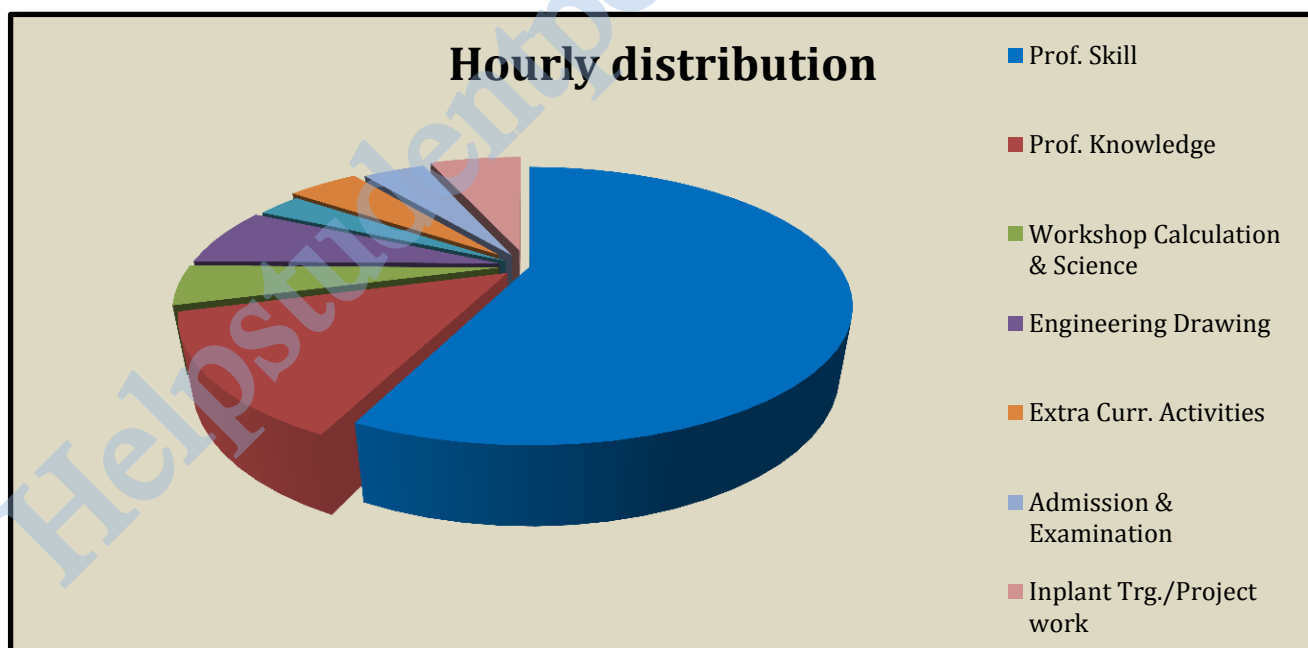
Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

## 6. COURSE STRUCTURE

1. Name of the Qualification :- **FITTER**
2. Total duration of the course: - **24 Months**
3. Training duration details : -

	COURSE ELEMENTS	HOURLY DISTRIBUTION
A	PROFESSIONAL SKILL	2200 HRS
B	PROFESSIONAL KNOWLEDGE	530 HRS
C	WORKSHOP CALCULATION & SCIENCE	180 HRS
D	ENGINEERING DRAWING	265 HRS
E	EMPLOYABILITY SKILLS	110 HRS
F	EXTRA CURRICULAR ACTIVITIES/LIB.	180 HRS
G	INPLANT TRG./PROJECT WORK	240 HRS
H	ADMISSION & EXAMINATION	160 HRS

### PIE-CHART



## **7. General Training Plan, Examination & Pass regulation**

### **General Training Plan**

The skills stated in assessment outcome are to be imparted in accordance with the instructions contained within Section 10 in respect of the content and time structure of the vocational education and training (General Training Plan).

### **Examination**

Each Semester examination is to take place after the end of the six months of training. The each semester examination encompasses such skills as are listed for that period of training (Detail in Section -10) and also includes theoretical knowledge, Core skills & Employability Skills. The Employability Skills will be covered in first two semesters only.

#### **Candidates are to demonstrate that they are able to:**

1. Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
2. Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
3. Apply professional knowledge, core skills & employability skills while performing the task.
4. Check the job as per drawing/assembly for functioning, identify and rectify errors in job/assembly.
5. Document the technical parameters related to the task undertaken.

The details of the examination and assessment standard are as per section-11.

### **Pass regulation**

For the purposes of determining the overall result, weighting of 25 percent is applied to each semester examination. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%.

## **8. ASSESSABLE OUTCOME**

### **Assessable outcome after completion of two years Fitter course**

#### **I. Generic**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.
5. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
6. Read and apply engineering drawing for different application in the field of work.
7. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
8. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
9. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
10. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

#### **II. Specific**

11. Prepare profile with an appropriate accuracy as per drawing
12. Manufacture different hand tools by forging and heat treat the same
13. Manufacture simple sheet metal items and join by soldering & brazing
14. Join MS sheet by riveting
15. Join mechanical components/metal parts by ARC welding
16. Cut and join MS parts with gas welding
17. Make and match male-female threaded components using hand tools
18. Fasten mechanical components/sub-assemblies together with different fastener using hand tools.
19. Make sliding fit of components to appropriate accuracy and assemble them
20. Repair and assemble simple machine parts from blue print and rectify faults of assembly
21. Make facing, plane turning, step turning, chamfering, grooving, knurling, drilling and boring
22. Turn standard tappers and check with gauge
23. Make different gauges and lap finish the same as per drawing
24. Make dowel pin assemble and lap surfaces for appropriate accuracy
25. Make simple jigs and fixture for drilling
26. Dismantle and assemble valves and fittings in pipes and test for leakage
27. Repair and assemble damaged mechanical components used for power transmission
28. Make dovetail slide fitting and scrape and lap surfaces for appropriate accuracy
29. Test accuracy of machine tools
30. Perform simple repair of machineries and erect and align small machine

## **9. ASSESSABLE OUTCOME WITH ASSESSMENT CRITERIA**

**ASSESSABLE OUTCOME ALONGWITH ASSESSMENT CRITERIA TO BE ACHIEVED AFTER EACH SEMESTER & COMPLETION OF QUALIFICATION**

- i) The training shall be conducted as per syllabus defined in reference no: Section 10.
- ii) The trainee shall demonstrate the competencies which are defined below in assessable outcome and assessment criteria.
- iii) All the assessable outcomes are to be tested during formative assessment, Theory & Practical examinations, various observation and viva-voce.
- iv) Assessable outcome of Employability Skills, Workshop Calculation & Science and Engineering Drawing shall be tested separately and also be applied in Theory and Practical examinations.
- v) These assessable outcomes and assessment criteria will serve as guide lines for Trainers, Paper setters, Moderators and Assessors.

### **GENERIC ASSESSABLE OUTCOME:**

<b>ASSESSABLE OUTCOMES</b>	<b>ASSESSMENT CRITERIA</b>
1. Apply safe working practices	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Protective Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
2. Comply environment	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.

regulation and housekeeping	2.2 Deploy environmental protection legislation & regulations
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner
	2.4 Avoid waste and dispose waste as per procedure
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Interpret & use company and technical communication	3.1 Obtain sources of information and recognize information.
	3.2 Use and draw up technical drawings and documents.
	3.3 Use documents and technical regulations and occupationally related provisions.
	3.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	3.5 Present facts and circumstances, possible solutions & use English special terminology.
	3.6 Resolve disputes within the team
4. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.	3.7 Conduct written communication.
	4.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics. 4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	4.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics. 4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
	5.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics. 5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Read and apply engineering drawing for different application in the field of work.	5.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics. 5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
	6.1 Semester examination to test basic skills on engineering drawing. 6.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
7. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	6.1 Semester examination to test basic skills on engineering drawing. 6.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
	7.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation. 7.2 Their applications will also be assessed during execution of assessable outcome.
8. Explain energy conservation, global warming and pollution and	7.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation. 7.2 Their applications will also be assessed during execution of assessable outcome.
	8.1 Semester examination to test knowledge on energy conservation, global warming and pollution. 8.2 Their applications will also be assessed during execution of

contribute in day to day work by optimally using available resources.	assessable outcome.
9.Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	9.1 Semester examination to test knowledge on personnel finance, entrepreneurship. 9.2 Their applications will also be assessed during execution of assessable outcome.
10. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.	10.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services. 10.2 Their applications will also be assessed during execution of assessable outcome.

## SPECIFIC ASSESSABLE OUTCOME:

### Semester-I

11. Prepare profile with an appropriate accuracy as per drawing	11.1 Identify tools and equipment's for measuring and use of these tools.
	11.2 Select raw material and visual inspect for defects.
	11.3 Identify basic Hand Tools for filing, chiseling and use these tools.
	11.4 Mark according to drawing.
	11.5 File the job using different methods and perform in accordance with standard specifications and tolerances
	11.6 Follow relevant legislation, industry guidelines and enterprise policies/procedures.
	11.7 Measure all dimensions in accordance with standard specifications and tolerances.
12. Manufacture different hand tools by forging and heat treat the same	12.1 Identify Hand Tools for forging and use.
	12.2 Observe safety procedure during forging as per standard norms and company guidelines.
	12.3 Forge jobs / articles as per drawing.
	12.4 Heat treat forged jobs to bring desired character.
	12.5 Grind the job to bring close tolerance as per drawing.
13.Manufacture simple sheet metal items and join by soldering	13.1 Identify Hand Tools for Sheet Metal work and use.
	13.2 Observe safety procedure during Soldering, brazing and sheet metal work as per standard norms and company guidelines.
	13.3 Mark and develop various forms as per drawing using sheet metals.
	13.4 Make of simple items with sheet metal as per drawing.
	13.5 Identify Hand Tools and different items for Soldering, & Brazing and use.



	13.6 Solder and Braze for jointing purpose.
14. Join MS sheet by riveting	14.1 Identify Tools and equipments for riveting and use.
	14.2 Prepare the job for lap and butt joint.
	14.3 Identify different type of rivets and use as per requirement.
	14.4 Identify tools for drilling and use these tools.
	14.5 Mark according to drawing.
	14.6 Drill through holes on the job.
	14.7 Rivet to prepare a job as per given drawing / sample following standard practices.
	14.8 Observe safety procedure during riveting as per standard norms and company guidelines.

## Semester-II

15. Join mechanical components/metal parts by Arc welding	15.1 Observe safety/ precaution during an Arc welding.
	15.2 Select appropriate equipment & plan for welding.
	15.3 Weld metal parts / mechanical components by Arc as required viz., square, butt, T joints, corners, fillets.
	15.4 Check Arc welded part for proper welding.
16. Cut and join M.S. parts with Gas welding	16.1 Observe safety/ precaution during gas welding cutting.
	16.2 Select appropriate equipments & plan for welding.
	16.3 Weld M.S. parts by gas welding under H.P. and L.P. and using appropriate filler metal & type of joints necessary.
	16.4 Check gas welded parts for proper welding
	16.5 Perform gas cutting of M.S. plate using oxy-acetylene torch in different shapes.
17. Make and match male and female threaded components using hand tools	17.1 Make appropriate hole by drilling on female parts
	17.2 Make appropriate thread in the female part using suitable tap as per specific standard.
	17.3 Form external threads on male part using suitable dies as per specific standard and to match with female part.
	17.4 Match male and female threaded components and check for proper matching.
18. Fasten mechanical components / subassemblies together with different fastener using hand tools.	18.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	18.2 Plan work in compliance with standard safety norms.
	18.3 Demonstrate possible solutions and agree tasks within the team.
	18.4 Fasten mechanical components / subassemblies together using different / appropriate fastener
	18.5 Inspect the proper fastening and check for proper functionality of assembly
19. Make sliding fit of components to appropriate accuracy and assemble them	19.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	19.2 Plan work in compliance with standard safety norms.
	19.3 Prepare components according to the drawing and as per appropriate accuracy for slide fit.

	19.4 Assemble components and check functionality of components.
	19.5 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
20. Repair and assemble simple machine parts from blue print and rectify faults of assembly	20.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	20.2 Plan work in compliance with standard safety norms.
	20.3 Demonstrate possible solutions and agree tasks within the team.
	20.4 Select specific parts to be repaired and ascertain for appropriate material and estimated time.
	20.5 Repair and assemble the parts in the machine with the help of blue print.
	20.6 Check for functionality of part and ascertain faults of the part/ machine in case of improper function.
	20.7 Rectify faults of assembly.

### Semester-III

21. Make facing, plane turning, step turning, chamfering, grooving, knurling, drilling and boring	21.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	21.2 Plan work in compliance with standard safety norms.
	21.3 Set up job on lathe machine in accordance with standard operating procedure.
	21.4 Produce turning components as per drawing and accuracy by observing standard operating procedure.
	21.5 Comply with safety rules when operating the machine.
	21.6 Check accuracy/ correctness of job using appropriate gauge.
	21.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
22. Turn standard tapers and check with gauge	22.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	22.2 Plan work in compliance with standard safety norms.
	22.3 Set up job on lathe machine in accordance with standard operating procedure.
	22.4 Produce standard tapers as per specified accuracy in

	drawing by observing standard operating procedure.
	22.5 Comply with safety rules when operating the machine.
	22.6 Check accuracy/ correctness of job using appropriate gauge.
	22.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
23. Make different gauges and lap finish the same as per drawing	23.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	23.2 Plan work in compliance with standard safety norms.
	23.3 Demonstrate possible solutions and agree tasks within the team.
	23.4 Produce gauge by observing appropriate method and as per specification of drawing.
	23.5 Perform Lapping of gauge after appropriate heat treatment to obtain required finish as per drawing.
	23.6 Comply with safety rules when performing the above operations.
	23.7 Check tolerance and accuracy of gauge with appropriate tools and equipment as per drawing.
24. Make dowel pin assembly and lap surfaces for appropriate accuracy	24.1 Plan to make dowel pin assembly as per drawing
	24.2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	24.3 Demonstrate possible solutions and agree tasks within the team.
	24.4 Produce pin and hole as per drawing using appropriate tools & machines.
	24.5 Perform Lapping and other appropriate operations for fitting of pin and hole.
	24.6 Assemble and check parts for accuracy as per drawing.

## Semester-IV

25. Make simple jigs or fixtures for drilling	25.1 Set up workplace/ assembly location with due consideration to operational stipulation
	25.2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	25.3 Plan to make dowel pin assembly as per drawing
	25.4 Demonstrate possible solutions and agree tasks within the team.
	25.5 Read and understand blue print drawing for making simple jigs or fixture
	25.6 Produce different parts of jig/ fixture as per the drawing and accuracy with appropriate machining processes.
	25.7 Perform heat treatment of appropriate parts to make jig/ fixture

	25.8 Assemble different parts as per the drawing to make the jig/ fixture
	25.9 Comply with safety rules when performing the above operations.
	25.10 Set the prepared jig/ fixture and check the functionality of jig/ fixture and accuracy of the job for appropriate output.
26. Dismantle and assemble valves and fittings in pipes and test for leakage	26.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	26.2 Plan to Dismantle and assemble valves as per drawing.
	26.3 Dismantle valves and fittings in pipes and check for defect as per standard procedure.
	26.4 Demonstrate possible solutions in case of defect and agree tasks within the team for repair or replacement.
	26.5 Assemble valves and various pipe fittings as per sketch/ drawing.
	26.6 Test for leakage and appropriate functioning of valves.
	26.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
27. Repair and assemble damaged mechanical components used for power transmission	27.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	27.2 Plan to repair and assemble mechanical components use for power transmission as per drawing.
	27.3 Perform appropriate repairing of mechanical components with accuracy and observing appropriate machining processes.
	27.4 Check the accuracy of the repaired components with appropriate equipment's.
	27.5 Assemble the repaired mechanical components of power transmission.
	27.6 Comply with safety rules when performing the above operations.
	27.7 Check different parameters of power transmission e.g. R.P.M, slackness of belts, matching of gears/ clutches, loss of RPM etc.
	27.8 Check for functionality of power transmission system as per standard parameters.
	27.9 Perform appropriate trouble shooting and put the transmission system in the operations.
28. Make dovetail slide fitting and scrape, lap surfaces for appropriate accuracy	28.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	28.2 Plan to make dovetail slide fitting repair with appropriate accuracy as per drawing.
	28.3 Produce components of dovetail slide with appropriate accuracy by observing standard procedure.
	28.4 Scrape and lap the components for appropriate accuracy.
	28.5 Assemble components of dovetail slide and check for appropriate accuracy
	28.6 Comply with safety rules when performing the above operations.
29. Test accuracy of	29.1 Understand and interpret testing procedure as per manual of

machine tools	machine tools and select testing equipment.
	29.2 Install machine tool as per standard procedure.
	29.3 Measure and calculate functional values.
	29.4 Ascertain level accuracy and surface integrity
	29.5 Track functional values and check these at interfaces.
	29.6 Conduct systematic trouble shooting
	29.7 Check and set alignment for spindle, axis and other related subassembly.
	29.8 Check functionality of system and machine tools.
	29.9 Comply with safety rules when performing the above operations.
30. Perform simple repair of machineries and erect and align small machine	30.1 Understand and interpret repair procedure as per manual of machine and select appropriate tools & equipment for undertaking job.
	30.2 Understand and interpret construction, alignment and assembly of different parts of a simple machine.
	30.3 Plan to carry out the repair task with appropriate accuracy.
	30.4 Demonstrate possible solutions and agree tasks within the team.
	30.5 Assembly and disassembly of sub-assemblies and repair of parts using mechanical processing.
	30.6 Put the machine in operation
	30.7 Comply with Standard operating procedure when operating the machine.
	30.8 Check for proper functioning of repaired machine
	30.9 Conduct Trouble shooting of machine
	30.10 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
	30.11 Plan for appropriate erection of simple machine
	30.12 Select appropriate tools & equipment for erection
	30.13 Erect simple machine as per layout plan
	30.14 Check alignment and other parameters of simple machine as per manual after erection.

## 10. SYLLABUS CONTENT WITH TIME STRUCTURE

### 10.1 SYLLABUS CONTENT FOR PROFESSIONAL SKILL & KNOWLEDGE

**First Semester**  
**(Semester Code no. FTR - 01)**  
**Duration: Six Month**

#### **LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Prepare profile with an appropriate accuracy as per drawing
5. Manufacture different hand tools by forging and heat treat the same
6. Manufacture simple sheet metal items and join by soldering & brazing
7. Join MS sheet by riveting

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1.	<p>Importance of trade training, List of tools &amp; Machinery used in the trade. Health &amp; Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains.</p> <p><b>Occupational Safety &amp; Health</b> <b>Importance of housekeeping &amp; good shop floor practices.</b> Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipment's(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message. Preventive measures for electrical accidents &amp; steps to be taken in such accidents. Use of Fire extinguishers.</p>	<p>Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. <b>Soft Skills: its importance and Job area after completion of training.</b> Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application. Response to emergencies e.g.; power failure, fire, and system failure.</p>

2.	<p>Identification of tools &amp; equipments as per desired specifications for marking &amp; sawing.</p> <p>Selection of material as per application</p> <p>Visual inspection of raw material for rusting, scaling, corrosion etc., Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.</p>	<p>Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table.</p>
3.	<p>Filing Channel, Parallel. Filing- Flat and square (Rough finish).</p> <p>Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule, marking practice with dividers, odd leg calipers and steel rule (circles, ARCs, parallel lines).</p>	<p>Bench vice construction, types, uses, care &amp; maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws.</p> <p>Files- specifications, description, materials, grades, cuts, file elements, uses. Measuring standards (English, Metric Units), angular measurements, subdivisions, try square, ordinary depth gauge, protractor- description, uses and cares.</p>
4.	<p>Marking off straight lines and ARCs using scribing block and dividers, chipping flat surfaces along a marked line.</p>	<p>Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care &amp; maintenance.</p>
5.	<p>Marking, filing, filing square, use of tri-square.</p>	<p>Calipers- types, material, constructional details, uses, care &amp; maintenance of cold chisels- materials, types, cutting angles.</p>
6&7	<p>Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools, finding center of round bar with the help of 'V' block and marking block.</p> <p>Joining straight line to an ARC.</p>	<p>Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block.</p>
8.	<p>Chipping, Chip slots &amp; oils grooves (Straight).</p> <p>Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out, key ways at various angles &amp; cut key ways.</p>	<p>Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types and uses, workshop surface plate- their uses, accuracy, care and maintenance.</p> <p>Types of files- convexing, taper, needle, care and maintenance of files, various types of keys, allowable clearances &amp; tapers, types, uses of key pullers.</p>
9.	<p>File thin metal to an accuracy of 0.5 mm.</p> <p>Chip &amp; chamfer, grooving and slotting</p>	<p>Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity.</p> <p>Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.</p>
10.	<p>Saw along a straight line, curved line, on</p>	<p>Power Saw ,band saw, Circular saw</p>

	different sections of metal. Straight saw on thick section, M.S. angle and pipes.	machines used for metal sections cutting
11.	File steps and finish with smooth file accuracy $\pm 0.25$ mm. File and saw on M.S. Square and pipe.	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
12.	File radius along a marked line (Convex & concave) & match. Chip sheet metal (shearing). Chip step and file.	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital vernier caliper.
13.	Mark off and drill through holes, drill and tap on M.S. flat, Punch letter and number (letter punch and number punch), use of different punches.	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
14.	<b>Revision &amp; Test</b> (Two days) Prepare forge. Fire for heating metals. Forge a square rod from round stock. Judge the forging temperature of various metals.	<b>Revision &amp; Test</b> Safety precautions to be observed in a smith shop, forge - necessity, description uses, fuel used for heating, bellows blowers, description and uses
15.	Forge M.S. round rod to square Forge flat chisel, grind.	Anvil and swage blocks. Description and uses. Forging tools- hammers- band and sledge, description and uses. Chisels, set hammers, flatters, hardier, fuller swage & uses. Measuring and checking tools- steel rule, brass rule, calipers, try square, description and uses. General idea about the main operations performed in a forging shop such as upsetting drawing, twisting, bending, punching, drilling, and welding.
16.	Forge – punches, screw drivers, chisels, grind them to shape and heat treat to requirement, bending metals to angles, curves & twisting, Preparation of brackets.	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening, case hardening and tempering. Power hammer – construction, features, method of operating and uses.
17.	Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development, marking out for flaps for soldering and sweating.	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications.
18-19.	Make various joints: wiring, hemming, soldering and brazing, form locked,	Marking and measuring tools, wing compass, Prick punch, tin man's square



	grooved and knocked up single hem straight and curved edges form double hemming,. Punch holes-using hollow and solid punches. Do lap and butt joints.	tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.
20.	Bend sheet metal into various curvature form, wired edges- straight and curves, fold sheet metal at angle using stakes. Bend sheet metal to various curvatures. Make simple Square, container with wired edge and fix handle.	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges -
21.	Make square tray with square soldered corner Practice in soft soldering and silver soldering.	Solders-composition of various types of solders, and their heating media of soldering iron, fluxes types, selection and application-joints
22.	Make riveted lap and butt joint. Make funnel as per development and solder joints. Drilling for riveting. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, shearing machine- description, parts and uses.
23-25	<b>Revision</b>	
26	<b>Examination</b>	

**Second Semester**  
**(Semester Code no. FTR - 02)**

**Duration: Six Month**

**LEARNING OBJECTIVES OF 2<sup>ND</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Join mechanical components/metal parts by ARC welding
5. Cut and join MS parts with gas welding
6. Make and match male-female threaded components using hand tools
7. Fasten mechanical components/sub-assemblies together with different fastener using hand tools.
8. Make sliding fit of components to appropriate accuracy and assemble them
9. Repair and assemble simple machine parts from blue print and rectify faults of assembly

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	Welding - Striking and maintaining ARC, laying Straight-line bead.	Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators.
2	Making square, butt joint and 'T' fillet joint-gas and ARC. Do setting up of flames, fusion runs with and without filler rod, and gas.	Hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses.
3	Make butt weld and corner, fillet in ARC welding	Setting up parameters for ARC welding machines-selection of Welding electrodes
4	Gas cutting of MS plates	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
5	Mark off and drill through holes, drill on M.S. flat, file radius and profile to suit gauge.	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed.

		R.P.M. for different materials. Drill holding devices- material, construction and their uses.
6	Counter sink, counter bore and ream split fit (three piece fitting). Form internal threads with taps to standard size (through holes and blind holes) – Drill through hole and tap drill blind hole and tap, prepare studs and bolt.	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge). Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor).
7	Form external threads with dies to standard size. Prepare nuts and match with bolts.	Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
8	Step fit, angular fit, file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits.	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.
9	Enlarge hole and increase internal dia. File cylindrical surfaces. Make open fitting of curved profiles.	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts function and metric, different dimensions, convex and concave uses care and maintenance.
10	Make the circles by binding previously drilled hole. Test angular match up.	Radius gauge, feeler gauge, hole gauge, and their uses.
11	Inside square fit, make combined open and sliding fit, straight sides 'T' fit.	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system
12	File fit- combined, open angular and sliding sides. File internal angles 30minutes accuracy open, angular fit.	Method of expressing tolerance as per BIS Fits : Definition, types description of each with sketch .Vernier height gauge : material construction, parts, graduations (English & Metric) uses, care and maintenance, Pig Iron : manufacturing process ( by using)Blast furnace types, of pig Iron , properties and uses.

13	Make sliding fit with angles other than 90°. sliding fit with an angle.	Cast Iron: manufacturing process by using (cupola furnace) types, properties and uses. Wrought iron- : manufacturing process (Fuddling and Astor process ) properties and uses. Steel: manufacturing process plain carbon steels, types, properties and uses.
14	Make simple bracket by bending and twisting of non-ferrous metal. Drill small holes (2mm) Drill holes on sheet metal, bend short for round bracket.	Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.
15	Counter sink, counter bore and ream split fit (three piece fitting).	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.
16	Scrap on flat surfaces, scrap on curved surfaces and scrap surface parallels and test. Make & assemble, sliding flats, plain surfaces. Check for blue math of bearing surfaces- both flat and curved surfaces by witworth method.	Simple scraper- cir., flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces)
17	File and fit combined radius and angular surface (accuracy $\pm 0.5$ mm), angular and radius fit. Locate accurate holes. Make accurate hole for stud fit. Fasten mechanical components / sub assemblies together using screws, bolts and collars using hand tools.	Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.
18	Cutting threads using dies. Make sliding fits assembly with parallel and angular mating surface. ( $\pm 0.04$ mm)	Dial test indicator, construction, parts, material, graduation, Method of use,. Care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores.
19 & 20	Simple repair work, simple assembly of machine parts from blue prints. Rectify possible assembly faults during assembly.	Preventive maintenance-objective and function of P.M., section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies.
21	Assemble simple fitting using dowel pins and tap screw assembly using torque wrench.	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
22-23	<b>Implant training / Project work (work in a team)</b>	
24-25	<b>Revision</b>	
26	<b>Examination</b>	

**Third Semester**  
**(Semester Code no. FTR - 03)**

**Duration: Six Month**

**LEARNING OBJECTIVES OF 3<sup>RD</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Make facing, plane turning, step turning, chamfering, grooving, knurling, drilling and boring
5. Turn standard tappers and check with gauge
6. Make different gauges and lap finish the same as per drawing
7. Make dowel pin assemble and lap surfaces for appropriate accuracy

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
01	True job on four jaw chuck using knife tool, face both the ends for holding between centers, Using roughing tool parallel turn $\pm 0.1$ mm. Measure the diameter using outside caliper and steel rule.	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.
02	Lathe operations- the facing, parting and form tools, plain turn, step turn, holding job in three jaw chuck- deburr, chamfer-corner, round, the ends, Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled.	Lathe cutting tools- Brief study of the nomenclature of Lathe cutting tools and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.
03	Cut grooves- square, round 'V' groove, Make a mandrel-turn diameter to sizes. Knurl the job.	Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.

04	Bore holes –spot face, pilot drill, enlarge hole, using boring tools, make a bush step bore-cut recess, turn hole diameter to sizes. Turn taper (internal and external). Turn taper pins. Turn standard tapers to suit with gauge.	General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations morse taper.
05	Threading practice by using cut threads using taps, dies on lathe by hand, ‘V’ thread – external. Prepare a nut and match with the bolt.	Screw thread definition – uses and application. Terminology of screw threads, square, worm, buttress, acme ( non standard-screw threads),Principle of cutting screw thread in centre lathe –principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.
06	Assembly sliding for using keys and dowel pin and screw, $\pm 0.02$ mm accuracy on plain surface. Testing of sliding fitting job, scrap on two flat surfaces and curved surfaces.	Screws: material, different types (inch & metric), uses Testing scraped surfaces: ordinary surfaces without a master plate.
07	File & fit angular mating surface plain within an accuracy of $\pm 0.02$ mm & angular 15 minutes angular fitting.	Special files: types (pillar, Dread naught, Barrow, warding) description.
08	Drill through and blind holes at an angle, using swivel table of drilling machine, Precision drilling, reaming and tapping. Test- Job..	System of drill size, Fractional size: number, letter and metric. Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.
09	Dovetailed fitting, radius fitting.	Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge)
10	File and fit, combined fit with straight, angular surface with $\pm 0.02$ mm accuracy, hexagonal fitting. Check adherence to specification and quality standards using equipments like Vernier calipers, micrometers etc.,	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
11	Drilling and reaming, small dia. holes to accuracy correct location for fitting Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.

12	Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.
13	Stepped keyed fitting-test job. Lapping holes and cylindrical surfaces.	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
14	Making a snap gauge for checking a dia of $10 \pm 0.02$ mm.	. Manufacture: The name and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization
15	Scrape angular mating surface, scrape on internal surface.	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.
16	Practice in dovetail fitting assembly and dowel pins and cap screws assembly. <b>Industrial visit.</b>	Roller and needle bearings: Types of roller bearing. Description & use of each <b>Industrial visit.</b>
17	Preparation of gap gauges.	Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
18	Dovetail and Dowel pin assembly, scraps cylindrical bore.	Method of fitting ball and roller bearings
19	Scrapping cylindrical bore and to make a fit-make a cotter jib assembly.	Bearing metals – types, composition and uses, lubricants purpose of using different types, description and uses of each type
20	Scrapping cylindrical taper bore, check taper angle with sine bar, check in per angle (flat) with sine bar.	Hardening and tempering, purpose of each method, tempering colour chart.
21	Preparation of centre, squares, drills gauges. File and fit straight and angular surfaces internally Identify different ferrous metals by spark test	Annealing and normalising, purpose of each method.
22-23	<b>Implant training</b> / Project work (work in a team)	
24-25	<b>Revision</b>	
26	<b>Examination</b>	

**Fourth Semester**  
**(Semester Code no. FTR - 04)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 4<sup>TH</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Make simple jigs and fixture for drilling
5. Dismantle and assemble valves and fittings in pipes and test for leakage
6. Repair and assemble damaged mechanical components used for power transmission
7. Make dovetail slide fitting and scrape and lap surfaces for appropriate accuracy
8. Test accuracy of machine tools
9. Perform simple repair of machineries and erect and align small machine

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
01.	'H' fitting-	Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
02.	Exercises on lapping of gauges (hand lapping only) Hand reams and fit taper pin, drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Solder and soldering: Introduction-types of solder and flux. Method of soldering, Hard solder- Introduction, types and method of brazing. Production of gauges, templates and jigs. The objective of importance for preparing interchangeable components.
03.	Simple jigs and fixtures for drilling. Prepare a 'V' block and a clamp. Marking out as per Blue print, drilling, straight and curve filing. Threading with die, cutting slot, and cutting internal threads with taps, making an adjustable spanner.	Drilling jig-constructural features, types and uses. Fixtures-Constructural features, types and uses.
04.	Flaring of pipes and pipe joints, Cutting & Threading of pipe length. Fitting of pipes as per sketch. Conditions used for pipe work to be followed. Bending of pipes- cold and hot.	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads-Std. Pipe threads Die and Tap, pipe vices.
05.	Practice-dismantling & assembling – globe valves sluice valves, stop cocks, seat valves and non-return valve, fitting of pipes and testing for leakage.	Standard pipefitting-. Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.



06.	Practice in handling Fire extinguishers of different types, refilling of extinguishers.	Fire precautions-causes and types of fires, precautions against out break of fire. Fire Extinguishers-types and use.
07.	Marking detail includes male & female screw cutting, male and female fitting parts. Making and tempering springs.	Working material with finished surface as aluminium, duralumin, stainless steel, the importance of keeping the work free from rust and corrosion. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as chromium silver plating and nickel plating, and galvanising.
08.	Exercises on finished material as aluminium and stainless steel, marking out, cutting to size, drilling etc. without damage to surface of finished articles.	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel.
09.	Marking out for angular outlines, filing and fitting the inserts into gaps. Making a simple drilling jig, Marking out, filing to line, drilling and tapping brass and copper jobs.	Tapers on keys and cotters permissible by various standards. Discuss non-ferrous metals as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes where and why used, advantages for specific purposes, surface wearing properties of bronze and brass.
10.	Complete exercises covering the assembly of parts working to detail and arrangement – Drawings, Dismantling and mounting of pulleys. Making replacing damaged keys. Repairing damaged gears and mounting. Repair & replacement of belts.	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation.
11.	Complete exercises covering the assembly of parts working to details and arrangements as per drawings. Dismantling and mounting of pulleys. Making, replacing damaged keys. Repairing damaged gears and mounting them on shafts.	Power transmissions, coupling types-flange coupling,- Hooks coupling-universal coupling and their different uses.
12.	More difficult work in marking out including tangents, templates involving use of vernier protractor.	Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.
13.	Fitting of dovetail slides.	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ration of worm gearing. Repair to gear teeth by building up and dovetail method.
14.	Male and female dovetail fitting	Method or fixing geared wheels for various purpose

	repairs to geared teeth. Repair of broken gear tooth by stud. Repair broker gear teeth by dovetail.	drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.
15 - 16	Marking out on the round sections for geometrical shaped fittings. Finishing and fitting to size, checking up the faces for universality.	Lubrication and lubricants- Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal. Bearings, method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Chains, wire ropes and clutches for power transmission. Their types and brief description. Discuss the various rivets shape and form of heads, riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
17	Prepare different types of documentation as per industrial need by different methods of recording information.	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.
18 & 19	Inspection of Machine tools. Accuracy testing of Machine tools.	Installation, maintenance and overhaul of machinery and engineering equipment and Hydraulics & pneumatic symbols & exercise. Hydraulics pneumatic circuits. Clutch: Type, positive clutch (straight tooth type, angular tooth type) .
20.	Study of power transmission system in machine tools.	Washers-Types and calculation of washer sizes. The making of joints and fitting packing. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.
21.	Simple repair of machinery, making of packing gaskets, use of hollow punches, extractor ,drifts, various types of hammers and spanners, etc. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. Erect sample machines.	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, pipe 2 X 4', wire rope, manila rope, wooden block.
22-23	<b>Implant training / Project work (work in a team)</b>	
24-25	<b>Revision</b>	
26	<b>Examination</b>	

## 10.2 SYLLABUS CONTENT OF CORE SKILLS

**First Semester**  
**(Semester Code no. FTR - 01)**  
**Duration: Six Month**

### LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER

1. Apply basic arithmetic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b><u>Unit</u></b> : Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> <li>- Relationship to other technical drawing types</li> <li>- Conventions</li> <li>- Viewing of engineering drawing sheets.</li> <li>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2.	<b><u>Fractions</u></b> : Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses <ul style="list-style-type: none"> <li>- 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.</li> </ul>
3.	<b><u>Square Root</u></b> : Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : <ul style="list-style-type: none"> <li>- Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)</li> <li>- Drawing lines of given length (Straight, curved)</li> <li>- Drawing of parallel lines, perpendicular line</li> <li>- Methods of Division of line segment</li> </ul>
4.	<b><u>Ratio &amp; Proportion</u></b> : Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of <ul style="list-style-type: none"> <li>- Angle: Measurement and its types, method of bisecting.</li> <li>- Triangle -different types</li> </ul>

		<ul style="list-style-type: none"> <li>- Rectangle, Square, Rhombus, Parallelogram.</li> <li>- Circle and its elements.</li> </ul>
5.	<b>Percentage</b> : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: <ul style="list-style-type: none"> <li>- Single Stroke, Double Stroke, inclined, Upper case and Lower case.</li> </ul>
6.	<b>Material Science</b> : 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 metals, Non-Ferrous Alloys.	Dimensioning: <ul style="list-style-type: none"> <li>- Definition, types and methods of dimensioning (functional, non-functional and auxiliary)</li> <li>- Types of arrowhead</li> <li>- Leader Line with text</li> </ul>
7.	<b>Mass, Weight and Density</b> : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of <ul style="list-style-type: none"> <li>- Lines, polygons, ellipse, etc.</li> <li>- geometrical figures and blocks with dimension</li> <li>- Transferring measurement from the given object to the free hand sketches.</li> </ul>
8.	<b>Speed and Velocity</b> : Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> <li>- Basic principle of Sheet Size</li> <li>- Designation of sizes</li> <li>- Selection of sizes</li> <li>- Title Block, its position and content</li> <li>- Borders and Frames (Orientation marks and graduations)</li> <li>- Grid Reference</li> <li>- Item Reference on Drawing Sheet (Item List)</li> </ul>
9.	<b>Work, Power and Energy</b> : 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.	Method of presentation of Engineering Drawing <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : <ul style="list-style-type: none"> <li>- Fastener (Rivets, Bolts and Nuts)</li> <li>- Bars and profile sections</li> <li>- Weld, brazed and soldered joints.</li> <li>- Electrical and electronics element</li> <li>- Piping joints and fittings</li> </ul>

**Second Semester**  
**(Semester Code no. FTR - 02)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 2<sup>ND</sup> SEMESTER**

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Algebra</b> : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	<b>Mensuration</b> : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle,  Volume of solids – cube, cuboids, cylinder and Sphere.  Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	<b>Trigonometry</b> : Trigonometrical ratios, measurement of angles.  Trigonometric tables	Dimensioning practice:  - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
4.	<b>Heat &amp; Temperature</b> : 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.	Construction of Geometrical Drawing Figures:  - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse & Parabola)

5.	<p><b>Basic Electricity:</b> 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.</p>	<p>Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.</p>
6.	<p><b>Levers and Simple Machines:</b> levers and its types.</p> <p>Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.</p>	<p>Free Hand sketch of hand tools and measuring tools used in respective trades.</p>
7.		<p>Projections:</p> <ul style="list-style-type: none"> <li>- Concept of axes plane and quadrant.</li> <li>- Orthographic projections</li> <li>- Method of first angle and third angle projections (definition and difference)</li> <li>- Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection as per IS specification.</li> </ul>
8.		<p>Drawing of Orthographic projection from isometric/3D view of blocks</p>
9.		<p>Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts &amp; Screw)</p>
10.		<p>Drawing details of two simple mating blocks and assembled view.</p>

**Third Semester**  
**(Semester Code no. FTR - 03)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 3<sup>RD</sup> SEMESTER**

1. Demonstrate & apply calculation of area of cut-out regular & irregular surfaces, Volume of geometrical shapes and their cut section in related shop floor problems.
2. Calculate value of unknown sides and angles of geometrical shapes by trigonometrical methods and apply in shop floor problems.
3. Understand & apply concept of forces, stress & strain, factor of safety for practical application.
4. Factual knowledge of thermal conductivity, temperature measuring instruments, average velocity and circular motion for day to day application.
5. Understanding drawing of machined components & related symbols for use in manufacturing purpose.
6. Draw free hand sketches for fasteners, hand tools and components.
7. Prepare simple assembly drawings & their details.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	- Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle.	- Revision of first year topics.
2.	- Area of cut-out regular surfaces: circle and segment and sector of circle.	- Machined components; concept of fillet & chamfer; surface finish symbols.
3.	- Area of irregular surfaces. - Application related to shop problems.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
4.	- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks.	- Free hand Sketches for bolts, nuts, screws and other screwed members.
5.	- Material weight and cost problems related to trade.	- Free hand Sketching of foundation bolts and types of washers.
6.	- Finding the value of unknown sides and angles of a triangle by Trigonometrical method.	- Standard rivet forms as per BIS (Six types).
7.	- Finding height and distance by trigonometry.	- Riveted joints-Butt & Lap (Drawing one for each type).
8.	- Application of trigonometry in shop problems. (viz. taper angle calculation).	- Orthogonal views of keys of different types

<b>9.</b>	<ul style="list-style-type: none"> <li>- Forces definition.</li> <li>- Compressive, tensile, shear forces and simple problems.</li> <li>-Stress, strain, ultimate strength, factor of safety.</li> <li>-Basic study of stress-strain curve for MS.</li> </ul>	<ul style="list-style-type: none"> <li>- Free hand Sketches for simple pipe, unions with simple pipe line drawings.</li> </ul>
<b>10.</b>	<ul style="list-style-type: none"> <li>- Temperature measuring instruments.</li> <li>Specific heats of solids &amp; liquids.</li> </ul>	<ul style="list-style-type: none"> <li>- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies &amp; their details of trade related tools/job/exercises with the dimensions from the given sample or models.</li> </ul>
<b>11.</b>	<ul style="list-style-type: none"> <li>- Thermal Conductivity, Heat loss and heat gain.</li> </ul>	<ul style="list-style-type: none"> <li>-Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.)</li> </ul>
<b>12.</b>	<ul style="list-style-type: none"> <li>- Average Velocity, Acceleration &amp; Retardation.</li> <li>- Related problems.</li> </ul>	<ul style="list-style-type: none"> <li>- Study of assembled views of Vee-blocks with clamps.</li> </ul>
<b>13.</b>	<ul style="list-style-type: none"> <li>- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force</li> </ul>	<ul style="list-style-type: none"> <li>- Study of assembled views of shaft and pulley.</li> </ul>
<b>14.</b>		<ul style="list-style-type: none"> <li>- Study of assembled views of bush bearing.</li> </ul>
<b>15.</b>		<ul style="list-style-type: none"> <li>- Study of assembled views of a simple coupling.</li> </ul>
<b>16.</b>		<ul style="list-style-type: none"> <li>- Free hand Sketching of different gear wheels and nomenclature.</li> </ul>



**Fourth Semester**  
**(Semester Code no. FTR - 04)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 4<sup>TH</sup> SEMESTER**

1. Read & interpret different types graphs.
2. Solve simple statistical problem and apply sampling method for inspection purpose.
3. Factual knowledge of friction, magnetism and their application and affects.
4. Understand the application of electrical insulating materials & concept of earthing.
5. Understand & apply transmission of power, heat treatment & their advantages.
6. Factual knowledge of pressure, its units and measuring system and understand basic concept of pneumatics & hydraulic system.
7. Draw free hand sketches of bench vice and bearing.
8. Understand & identify missing lines, symbols & views.
9. Estimate material required as per drawing.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<p><b><u>Graph:</u></b></p> <ul style="list-style-type: none"> <li>- Read images, graphs, diagrams</li> <li>- bar chart, pie chart.</li> <li>- Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.</li> </ul>	- Free hand Details and assembly of simple bench vice.
2.	<p>Simple problem on Statistics:</p> <ul style="list-style-type: none"> <li>- Frequency distribution table</li> <li>- Calculation of Mean value.</li> <li>- Examples on mass scale productions.</li> <li>- Cumulative frequency</li> <li>- Arithmetic mean</li> </ul>	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
3.	Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples).	<ul style="list-style-type: none"> <li>- Simple exercises relating missing symbols.</li> <li>- Missing views</li> </ul>
4.	<ul style="list-style-type: none"> <li>- Friction- co-efficient of friction, application and effects of friction in Workshop practice.</li> </ul> <p><b>Centre of gravity</b> and its practical application.</p>	- Simple exercises related to missing section.
5.	<ul style="list-style-type: none"> <li>- Magnetic substances- natural and artificial magnets.</li> <li>- Method of magnetization. Use of magnets.</li> </ul>	- Free hand sketching of different types of bearings and its conventional representation.

<b>6.</b>	- Electrical insulating materials. - Basic concept of earthing.	- Free hand sketching of different gear wheels and nomenclature/ Simple duct (for RAC). Free hand sketch of Reciprocating compressor – open type (for RAC)
<b>7.</b>	- Transmission of power by belt, pulleys & gear drive. - Calculation of Transmission of power by belt pulley and gear drive.	- Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols
<b>8.</b>	- Heat treatment and advantages.	- Study of drawing & Estimation of materials.
<b>9.</b>	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure	- Solution of NCVT test papers.
<b>10.</b>	Introduction to pneumatics & hydraulics systems.	

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# **11. Employability Skills**

## 11.1 GENERAL INFORMATION

1. **Name of the subject** : **EMPLOYABILITY SKILLS**
2. **Applicability** :
  - CTS- Mandatory for all trades
  - ATS- Mandatory for fresher only
3. **Hours of Instruction** : 110 Hrs.
4. **Examination** : The examination will be held at the end of semesters.
5. **Instructor Qualification** :

**MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGET institutes**

**AND**

**Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above**

**OR**

**Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes**

6. **Instructor** :
  - One full time instructor is required for 1000 seats and above
  - For seats less than 1000, the instructor may be out sourced/ hired on contract basis.

## 11.2 DISTRIBUTION OF TOPICS BETWEEN SEMESTERS FOR EMPLOYABILITY SKILL

Course Duration	Semester1	Semester2	Examination
	Topics	Topics	
01 Year (Two semesters)	<ol style="list-style-type: none"> <li>1. English Literacy</li> <li>2. I.T. Literacy</li> <li>3. Communication Skills</li> </ol>	<ol style="list-style-type: none"> <li>4. Entrepreneurship Skills</li> <li>5. Productivity</li> <li>6. Occupational safety , Health and Environment Education</li> <li>7. Labour Welfare Legislation</li> <li>8. Quality Tools</li> </ol>	Final examination at the end of second semester
02 Years (Four Semesters)	<ol style="list-style-type: none"> <li>1. English Literacy</li> <li>2. I.T. Literacy</li> <li>3. Communication Skills</li> </ol>	<ol style="list-style-type: none"> <li>4. Entrepreneurship Skills</li> <li>5. Productivity</li> <li>6. Occupational safety , Health and Environment Education</li> <li>7. Labour Welfare Legislation</li> <li>8. Quality Tools</li> </ol>	Final examination at the end of second semester

## 11.3 SYLLABUS CONTENT OF EMPLOYABILITY SKILL

### SEMESTER-I

#### LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

<b>1. English Literacy</b>	
<b>Hours of Instruction: 20 Hrs.</b>	
<b>Marks Allotted: 09</b>	
<b>Pronunciation</b>	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
<b>Functional Grammar</b>	Transformation of sentences, Voice change, Change of tense, Spellings.
<b>Reading</b>	Reading and understanding simple sentences about self, work and environment
<b>Writing</b>	Construction of simple sentences Writing simple English
<b>Speaking / Spoken English</b>	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.
<b>2. I.T. Literacy</b>	
<b>Hours of Instruction: 20 Hrs.</b>	
<b>Marks Allotted: 09</b>	
<b>Basics of Computer</b>	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
<b>Computer Operating System</b>	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.
<b>Word processing and Worksheet</b>	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

<b>Computer Networking and INTERNET</b>	<p>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),</p> <p>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.</p> <p>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT – ACT, types of cyber crimes.</p>
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### 3. Communication Skills

**Hour of Instruction: 15 Hrs.Marks Allotted: 07**

Topic	Contents
<b>Introduction to Communication Skills</b>	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on phone.
	Nonverbal communication –characteristics, components-Para-language
	Body – language
	Barriers to communication and dealing with barriers.
	Handling nervousness/ discomfort.
<b>Listening Skills</b>	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.
	Triple- A Listening – Attitude, Attention & Adjustment.
	Active Listening Skills.
<b>Motivational Training</b>	
	Characteristics Essential to Achieving Success
	The Power of Positive Attitude
	Self-awareness
	Importance of Commitment
	Ethics and Values
<b>Facing Interviews</b>	Ways to Motivate Oneself
	Personal Goal setting and Employability Planning.
<b>Behavioral Skills</b>	Manners, Etiquettes, Dress code for an interview
	Do's & Don'ts for an interview
	Problem Solving Confidence Building Attitude

## SEMESTER-II

### LEARNING OBJECTIVES OF 2<sup>ND</sup> SEMESTER

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

<b>4. Entrepreneurship skill</b> <b>Hour of Instruction: 15 Hrs.Marks Allotted: 06</b>	
<b>Topic</b>	<b>Content</b>
<b>Business &amp; Consumer:</b>	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
<b>Self Employment:</b>	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis
<b>Govt Institutions :</b>	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
<b>Initiation Formalities :</b>	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
<b>5. Productivity</b> <b>Hour of Instruction: 10Hrs.Marks Allotted: 05</b>	
Productivity	Definition, Necessity, Meaning of GDP.
Benefits	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.

Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
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.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
<b>6. Occupational Safety, Health &amp; Environment</b> <b>Hour of Instruction: 15 Hrs.Marks Allotted: 06</b>	
<b>Safety &amp; Health :</b>	Introduction to Occupational Safety and Health and its importance at workplace
<b>Occupational Hazards :</b>	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
<b>Accident &amp; safety :</b>	Accident prevention techniques- control of accidents and safety measures
<b>First Aid :</b>	Care of injured & Sick at the workplaces, First-aid & Transportation of sick person
<b>Basic Provisions :</b>	Idea of basic provisions of safety, health, welfare under legislation of India
<b>7.Labour Welfare Legislation</b> <b>Hour of Instruction: 05 Hrs.Marks Allotted: 03</b>	
<b>Labour Welfare Legislation</b>	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
<b>8.Quality Tools</b> <b>Hour of Instruction: 10Hrs.Marks Allotted: 05</b>	
<b>Quality Consciousness :</b>	Meaning of quality, Quality Characteristic
<b>Quality Circles :</b>	Definition, Advantage of small group activity, objectives of Quality Circle, Roles and Functions of Quality Circles in organisation, Operation of Quality Circle, Approaches to Starting Quality Circles, Steps for Continuation Quality Circles
<b>Quality Management System:</b>	Idea of ISO 9000 and BIS systems and its importance in



	maintaining qualities.
<b>House Keeping :</b>	Purpose of Housekeeping, Practice of good Housekeeping.5S Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

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## 12. INFRASTRUCTURE

1. INSTRUCTORS' QUALIFICATION : Degree in Mechanical Engineering from recognized Engineering College / university with one year experience in the relevant field.  
OR  
Diploma in Mechanical Engineering from recognized board of technical education with two years experience in the relevant field.  
OR  
10<sup>th</sup> Class Pass + NTC/NAC in the Trade of "Fitter" With 3 years post qualification experience in the relevant field.
2. DESIRABLE QUALIFICATION : Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Fitter trade.
3. SPACE NORMS : 88 Sq.m
4. POWER NORMS : 3.51 KW
5. TOOLS, EQUIPMENT & GENERAL MACHINERY : (AS PER ANNEXURE-II)

**Note:**

- (i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.
- (iii) The list of Tools, Equipment & General Machinery listed in Annexure – II are for a particular trade (FITTER) comprising of four semesters and not for single semester.

## **13. ASSESSMENT STANDARD**

### **13.1 Assessment guideline:**

The trainer/assessor should ensure appropriate arrangements are for assessment and appropriate resources are available for undertaking such assessment. The nature of special needs should be taken into account while undertaking assessment.

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 performance in 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:

- demonstration of good skill in the use of hand tools, machine tools and workshop equipment
- below 70% tolerance dimension/accuracy achieved while undertaking different work 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 above 75%- 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
- 70-80% tolerance dimension/accuracy achieved while undertaking different work 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
- above 80% tolerance dimension/accuracy achieved while undertaking different work 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

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### 13.2 INTERNALASSESSMENTS (FORMATIVE ASSESSMENT)

ASSESSABLE OUTCOME NO.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT MARKS
<b>GENERIC</b>		
1.	Apply safe working practices.	
2.	Comply environment regulation and housekeeping	
3.	Interpret & use Company terminology and technical communication	
4.	Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.	
5.	Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	
6.	Read and apply engineering drawing for different application in the field of work.	
7.	Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	
8.	Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	
9.	Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	
10.	Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.	
<b>SPECIFIC</b>		
11.	Prepare profile with an appropriate accuracy as per drawing.	
12.	Manufacture different hand tools by forging and heat treat the same.	
13.	Manufacture simple sheet metal items and join by soldering.	

14.	Join MS sheet by riveting.	
	<b>Sub-Total of Internal assessment for Semester- I</b>	100
15.	Join mechanical components/metal parts by arc welding.	
16.	Cut and join MS parts with gas welding.	
17.	Make and match male-female threaded components using hand tools.	
18.	Fasten mechanical components/sub-assemblies together with different fastener using hand tools.	
19.	Make sliding fit of components to appropriate accuracy and assemble them.	
20.	Repair and assemble simple machine parts from blue print and rectify faults of assembly.	
	<b>Sub-Total of Internal assessment for Semester- II</b>	100
21.	Make facing, plane turning, step turning, chamfering, grooving, knurling, drilling and boring	
22.	Turn standard tapers and check with gauge.	
23.	Make different gauges and lap finish the same as per drawing.	
24.	Make dowel pin assemble and lap surfaces for appropriate accuracy.	
	<b>Sub-Total of Internal assessment for Semester- III</b>	100
25.	Make simple jigs and fixture for drilling.	
26.	Dismantle and assemble valves and fittings in pipes and test for leakage.	
27.	Repair and assemble damaged mechanical components used for power transmission.	
28.	Make dovetail slide fitting and scrape and lap surfaces for appropriate accuracy.	
29.	Test accuracy of machine tools.	
30.	Perform simple repair of machineries and erect and align small machine.	
	<b>Sub-Total of Internal assessment for Semester- IV</b>	100
	<b>Total of Internal assessment</b>	400

### 13.3 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

- a) There will be a single objective type Examination paper for the subjects Engineering drawing and Workshop Calculation & Science.
- b) There will be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- c) The two objective type Examination papers as mentioned above will be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical will be conducted by the State Government. NCVT shall supply the Question Paper for the subject Trade Practical.

<b>Marking Pattern</b>		
<b>Sl. No.</b>	<b>Subject for the trade test</b>	<b>Maximum marks for the each subject</b>
a)	Practical	<b>300</b>
b)	Trade Theory	<b>200</b> Objective type Written test of 200 marks (Trade Theory 150 marks & Employability Skills 50 marks)
c)	Employability Skills	
d)	Work shop Calculation and Science.	<b>100</b> Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Work shop Calculation and Science 50 marks)
e)	Engineering Drawing	
f)	Internal assessment	<b>100</b>
<b>TOTAL:</b>		<b>700</b>

## 14. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
<b>Members of Sector Mentor council</b>			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen &Tourbo 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.	UdayApte	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



<b>Mentor</b>			
<b>21.</b>	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
<b>Members of Core Group</b>			
<b>22.</b>	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
<b>23.</b>	H.Charles (TO)	NIMI, Chennai.	Member
<b>24.</b>	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
<b>25.</b>	Ravi Pandey (V.I)	ATI Kanpur	Member
<b>26.</b>	A.K. Nasakar (T.O)	ATI Kolkata	Member
<b>27.</b>	Samir Sarkar (T.O)	ATI Kolkata	Member
<b>28.</b>	J. Ram EswaraRao (T.O)	RDAT Hyderabad	Member
<b>29.</b>	T.G. Kadam (T.O)	ATI Mumbai	Member
<b>30.</b>	K. Mahendar (DDT)	ATI Chennai	Member
<b>31.</b>	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
<b>32.</b>	K. Nagasrinivas(DDT)	ATI Hyderabad	Member
<b>33.</b>	G.N. Eswarappa (DDT)	FTI Bangalore	Member
<b>34.</b>	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
<b>35.</b>	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
<b>36.</b>	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
<b>37.</b>	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
<b>38.</b>	SubrataPolley, Instructor	ITI Howrah Homes, West Bengal	Member
<b>39.</b>	VINOD KUMAR.R Sr.Instructor	Govt.ITIDhanuvachapuram Trivandrum, Dist., Kerala	Member
<b>40.</b>	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
<b>41.</b>	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
<b>42.</b>	L.K.Mukherjee, DDT	CSTARI, Kolkata	Member
<b>43.</b>	R. N. Manna, TO	CSTARI, Kolkata	Member
<b>Other industry representatives</b>			
<b>44.</b>	VenugopalParvatikar	Skill Sonics, Bangalore	Member
<b>45.</b>	VenkataDasari	Skill Sonics, Bangalore	Member
<b>46.</b>	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
<b>47.</b>	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
<b>48.</b>	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member

## TRADE: FITTER

**LIST OF TOOLS & EQUIPMENTS FOR 16 TRAINEES + 1****A: TRAINEES TOOL KIT:-**

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

**B:INSTRUMENTS& GENERAL SHOP OUTFIT: -**

<b>Sl. No.</b>	<b>Name of the items</b>	<b>Quantity</b>
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.	2 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.	2 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 hollow 6 mm to 19 set of 5	2 nos.
14.	Punch round 3mm x 4 mm set of 2	2 nos.
15.	Portable hand drill (Electric) 0 to 6 mm	2 nos.
16.	Drill twist straight shank 1.5 to 12 mm by 0.5 mm	1 Set
17.	Drill twist straight shank 8 mm to 15 mm by ½ mm	1 Set
18.	Taps and dies complete set in box B.A	1 no.
19.	Taps and dies complete set in box with-worth.	1 no.
20.	Taps and dies complete set in box 3-18 mm set of 10	1 no.
21.	File warding 15 cm smooth	4 nos.
22.	File knife edge 15 cm smooth	4 nos.
23.	File cut saw 15 cm smooth	4 nos.
24.	File feather edge 15 cm smooth	4 nos.
25.	File triangular 15 cm smooth	2 nos.
26.	File round 20 cm second cut	8 nos.
27.	File square 15 cm second cut	4 nos.
28.	File square 25 cm second cut	4 nos.
29.	Feeler gauge 10 blades	1 set
30.	File triangular 20 cm second cut.	8 nos.
31.	File flat 30 cm second cut.	8 nos.
32.	File flat 20 cm bastard	8 nos.
33.	File flat 30 cm bastard.	8 nos.
34.	File Swiss type needle set of 12.	2 sets
35.	File half round 25 cm second cut.	8 nos.
36.	File half round 25 cm bastard.	4 nos.
37.	File round 30 cm bastard.	4 nos.
38.	File hand 15 cm second cut.	8 nos.
39.	Card file.	8 nos.

40.	Oil Stone 15 cm x 5 cm x 2.5 cm	4 nos.
41.	Stone carborandum 15 cm x 5 cm x 5 cm x 4 cm.	2 nos.
42.	Oil Can 0.25 liters.	2 nos.
43.	Pliers combination 15 cm	2 nos.
44.	Soldering Iron 350 gm.	2 nos.
45.	Blow Lamp 0.50 liters.	2 nos.
46.	Spanner D.E. 6 -26 mm set of 10 pcs.	8 nos.
47.	Spanner adjustable 15 cm	2 nos.
48.	Interchangeable ratchet socket set with a 12 mm driver, sized 10-32 mm set of 18 socket & attachments.	1 set
49.	Box spanner set 6-25 mm set of 8 with Tommy bar.	1 set
50.	Glass magnifying 7 cm	2 nos.
51.	Clamp toolmaker 5 cm and 7.5 cm set of 2.	2 nos.
52.	Clamp "C" 5 cm	2 nos.
53.	Clamp "C" 10 cm	2 nos.
54.	Hand Reamer adjustable cover max 9 ,12,18mm – set of 3	1 set
55.	Hand Reamer taper 4 -9mm set of 6 OR 4 -7 mm set of 4.	1 set
56.	Reamer parallel 12 - 16mm set of 5.	1 no.
57.	Scraper flat 15 cm.	8 nos.
58.	Scraper triangular 15 cm	8 nos.
59.	Scraper half round 15cm	8 nos.
60.	Chisel cold 9 mm cross cut 9 mm diamond.	8 each
61.	Chisel cold 19 mm flat	8 nos.
62.	Chisel cold 9 mm round noze.	8 nos.
63.	Stud Extractor EZY – out	2 nos.
64.	Combination Set 30 cm.	2 nos.
65.	Micrometer 0 – 25 mm outside.	2 nos.
66.	Micrometer 25 – 50 mm outside.	3 nos.
67.	Micrometer 50 –75 mm outside.	2 nos.
68.	Micrometer inside 25 - 50 mm with extension rods.	1 no.
69.	Vernier caliper 15 cm	1 no.
70.	Vernier height gauges 30 cm.	1 no.
71.	Vernier bevel protractor.	1 no.
72.	Screw pitch gauge.	1 no.
73.	Wire gauge, metric standard.	1 no.
74.	Drill twist Taper Shank 12 mm to 25 mm x 1.5.	1 no.
75.	Drill chuck 12 mm.	1 no.
76.	Pipe wrench 40 cm	1 no.
77.	Pipe vice 100mm	1 no.
78.	Adjustable pipe tap set BSP with die set cover pipe size 15, 20, 25,32,38,50 mm.	1 no.

79.	Wheel dresser (One for 4 units).	1 no.
80.	Machine vice 10 cm.	1 no.
81.	Machine vice 15 cm	1 no.
82.	Sleeve drill Morse 0 - 1, 1 - 2, 2 - 3.	1 Set
83.	Vice bench 12 cm jaws.	16 nos.
84.	Vice leg 10 cm jaw.	2 nos.
85.	Bench working 240 x 120 x 90 cm.	4 nos.
86.	Almirah 180 x 90 x 45 cm.	2 nos.
87.	Lockers with 6 drawers (standard size).	2 nos.
88.	Metal rack 182 x 182 x 45 cm	1 no.
89.	Instructor Table	1 no.
90.	Instructor Chair	1 no.
91.	Black board with easel.	1 no.
92.	Fire extinguisher (For 4 Units)	2 nos.
93.	Fire buckets.	2 nos.
94.	Machine vice 100mm.	2 nos.
95.	Wing compass 25.4 cm or 30 cm.	2 nos.
96.	Hand hammer 1 kg. with handle.	2 nos.
97.	Torque wrench (14 to 68 Nm)	1 no.

**C: TOOLS FOR ALLIED TRADE- BLACKSMITH & SHEET METAL WORK: -**

Sl. No.	Name of the items	Quantity
1.	Hammer smith 2 kg. With handle.	2 nos.
2.	Tongs roving 350mm.	2 nos.
3.	Tongs fiat 350mm.	2 nos.
4.	Smith's square 45 cm x 30 cm.	1 no.
5.	Cold set rodded 25X200mm.	2 nos.
6.	Hot set rodded 25X200mm.	1 no.
7.	Swages top & bottom 12 mm /19	1 Each
8.	Swage block 35 x 35 x 12 cm.	1 no.
9.	Flatters (rodded) 55 mm square.	2 nos.
10.	Fuller top & bottom 6 mm 9 mm (Pair).	2 nos.
11.	Anvil 50 kg.	2 nos.

12.	Anvil stand	2 nos.
13.	Shovel.	2 nos.
14.	Trammel 30cm.	1 no.
15.	Rake.	2 nos.
16.	Quenching tank (To be made in the Institute).	1 no.
17.	Pocker.	2 nos.
18.	Hardle.	2 nos.
19.	Leather apron.	2 nos.
20.	Prick punch	2 nos.
21.	Mallet.	2 nos.
22.	Snips straight 25 cm.	2 nos.
23.	Setting hammers with handle.	2 nos.
24.	Planishing hammer.	2 nos.
25.	Snip bent 25 cm.	2 nos.
26.	Stake hatchet.	2 nos.
27.	Stake grooving.	2 nos.
28.	Gauge imperial sheet.	1 no.

The specifications of the items in the above list have been given in Metric Units. The items which are available in the market nearest of the specification as mentioned above, if not available as prescribed should be procured Measuring instruments such as steel rule which are graduated both English and Metric Units may be procured, if available.

**D : MODIFIED LIST OF TOOLS FOR THE 3<sup>RD</sup> AND 4<sup>TH</sup> SEMESTER FOR FITTER TRADE: -**

Sl. No.	Name of the Tools & Equipment	Quantity
*1.	Slip Gauge as Johnson metric set.	1 Set
2.	Carbide Wear Block 1 mm – 2 mm.	2 each
*3.	Gauge snap Go and Not Go 25 to 50 mm by 5mm. Set of 6 pcs.	1 Set
*4.	Gauge plug single 3 ended 5 to 55 by 5 mm. Set of 11 pcs.	1 Set
**5.	Gauge telescopic upto 150 mm.	1 no.
6.	Dial test indicator .01 mm on stand	1 no.
7.	Sine bar 125 mm.	1 no.
8.	Sine bar 250 mm.	1 no.
9.	Lathe tools H.S.S. tipped set.	2 nos.
10.	Lathe tools bit 6 mm x 75 mm.	4 nos.
11.	Lathe tools bit 8 mm x 75 mm.	4 nos.
12.	Lathe tools bit 10 mm x 85mm.	4 nos.
13.	Arm strong type tool bit holder R.H.	2 nos.

14.	Arm strong type tool bit holder L.H.	2 nos.
15.	Arm strong type tool bit holder straight.	2 nos.
16.	Stilson wrenches 25 cm	2 nos.
17.	Pipe cutter 6 mm to 50 mm wheel type.	1 no.
18.	Pipe bender spool type up to 25 mm. with stand manually operated.	1 no.
19.	Adjustable pipe chain tonge to take pipes up to 300 mm.	1 no.
20.	Adjustable spanner 38 cm long.	1 no.
**21.	Dial vernier caliper 0 – 200 mm LCO 0.05 mm. (Universal type).	1 no.
**22.	Screw thread micrometer with interchangeable 0-25mm. Pitch anvils for checking metric threads 60.	1 no.
23.	Depth micrometer 0-25 mm. 0.01 mm.	1 no.
**24.	Vernier caliper 0-150 mm. L.C. 0.02 mm.	1 no.
**25.	Digital Micrometer 0 – 25 mm outside. L.C. 0.001 mm.	1 no.
**26.	Comparators stand with dial indicator LC 0.01mm.	1 no.
27.	Engineer's try square (knife-edge) 150 mm blade.	1 no.
**28.	Surface roughness comparison plates N1-N12 grade	1 Set
29.	Digital Vernier caliper 0-150 mm. L.C. 0.001 mm.(Optional)	1no.

**Note:** - (\*) No additional number of items are required to be provided up to four batches of trainees i.e. two batches in the first shift and two in the second shift.

(\*\*) Only one number need be provided in each I.T.I. irrespective of No. of Units.

#### **E : GENERAL MACHINERY INSTALLATIONS –**

<b>Sl. No.</b>	<b>Name &amp; Description of Machines</b>	<b>Quantity</b>
*1.	SS and SC centre lathe (all geared) with minimum specification as: Centre height 150 mm and centre distance 1000 mm along with 3 & 4 jaw chucks, auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement & standard accessories.	2 Nos.
2	Drilling machine pillar sensitive 0-20 mm cap with swivel table motorised with chuck & key.	1 no.
3	Drilling machine bench sensitive 0-12 mm cap motorised with chuck and key.	2 nos.
4	Forge portable hand blower 38 cm to 45 cm.	1 no.
5	D.E. pedestal Grinding machine with 200mm diameter wheels rough and smooth with twist drill grinding attachment.	1 no.

**Note:** - (\*) No additional number of items are required to be provided up to four batches of trainees i.e. two batches in the first shift and two in the second shift.

(\*\*) Only one number need be provided in each I.T.I. irrespective of No. of Units.

**F : LIST OF ADDITIONAL TOOLS FOR ALLIED TRADE IN WELDING: -**

Sl. No.	Name & Description of Machines	Quantity
1.	Transformer welding set 150 amps. – continuous welding current, with all accessories and electrode holder	1 Set
2.	Welder cable to carry 200 amps. With flexible rubber cover	20 Meter
3.	Lungs for cable	12 Nos.
4.	Earth clamps.	2 Nos.
5.	ARC welding table (all metal top) 122 cm X 12 cm X 60 cm with positioner.	1 No.
6.	Oxy – acetylene gas welding set equipment with hoses, regulator and other accessories.	1 Set.
7.	Gas welding table with positioner	1 No
8.	Welding torch tips of different sizes	1 Set
9.	Gas lighter.	2 Nos
10.	Trolley for gas cylinders.	1 No
11.	Chipping hammer.	2 Nos
12.	Gloves (Leather)	2 Pairs
13.	Leather apron.	2 Nos
14.	Spindle key for cylinder valve.	2 Nos.
15.	Welding torches 5 to 10 nozzles.	1 Set.
16.	Welding goggles	4 Pairs.
17.	Welding helmet with coloured glass	2 Nos.
18.	Tip cleaner	10 Sets.

**Note: -** Those additional items are to be provided for the Allied Trade Training where the welding trade does not exist.



**GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS**

1. All the questions of the theory paper for the trade will be in objective type format.
2. Due care to be taken for proper & inclusive delivery among the batch. Some of the following 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

3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.
4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.
5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in % age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.