Industrial Training Institute
FITTER

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

COMPETENCY BASED CURRICULUM

FITTER

(Revised in 2017)

CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL- 5

SECTOR – PRODUCTION & MANUFACTURING

कौशल बलम्

Industrial Training Institute

Skill India
कौशल भारत-कुशल भारत

FITTER

(Revised in 2017)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

ACKNOWLEDGEMENT

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

List of Expert members participated for finalizing the course curricula of Fitter trade held on 12.01.17 at CSTARI, Kolkata

Sl. No.	Name & Designation Shri/Mr./Ms.	Organization	Remarks
1.	DEEPANKAR MALLICK, DDG (Trg.)	DGT, MSDE, New Delhi	Chairman
2.	H. V. SAMVATSAR, Director	CSTARI, Kolkata	Secretary (Trade Committee)
3.	NIRMALYA NATH Asst. Director of Trg.	CSTARI, Kolkata	Member cum Co-coordinator
4.	RAJENDRA PRASAD Director	DTE, Uttar Pradesh	Member
5.	R. N. BANDYOPADHAYA OSD	Paschim Banga Society For Skill Development, Kolkata	Member
6.	SUMANTA MODAK, General Manager (Works)	EVEREADY Industries Pvt. Ltd. (Representative of ***CII***)	Member
7.	S. D. SATISH CHANDRA, Manager (HR), Trg.	HAL – Koraput Division, Koraput, Odisha	Member
8.	SUMANTA CHATTERJEE Addl. General Manager	BHEL, Power Sector ER	Member
9.	P. C. BHANDARI Technical Advisor	J K Cement Ltd. Kanpur	Member
10.	SANJIT BHOWMICK Asst. General Manager	Hindalco Industries Ltd., Belur Math, Howrah	Member
11.	DEBASHIS BHATTACHARYYA, JWM,/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
12.	SATYABADI SATAPATHY Training Officer	HAL – Koraput Division, Koraput, Odisha	Member
13.	PRABHAT SAMIR PAL	GRSE Ltd., Kolkata	Member

	Jr. Manager		
14.	JOYDEEP PAL MAJUMDER Asst. Work Manager	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
15.	BHABANI PROSAD MONDAL CM/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
16.	SUNIRMAL BASU, Asst. Inspecting Officer	Railway Workshop, Kanchrapara	Member
17.	K. L. KULI Joint Director of Trg.	CSTARI, Kolkata	Member
18.	M. THAMIZHARASAN, Joint Director of Trg.	CSTARI, Kolkata	Member
19.	SANJAY KUMAR Joint Director of Trg.	CSTARI, Kolkata	Member
20.	L. K. MUKHERJEE Dy. Director of Trg.	CSTARI, Kolkata	Member
21.	U. K. MALLICK, Dy. Director	DTE&T, Odisha	Member
22.	N. R. PATTANAIK Principal	Govt. ITI Balasore, Odisha	Member
23.	DEEPAK KUMAR, SSE/Drg./C&W	Railway Workshop, Kanchrapara	Member
24.	D. W. PATNE, Secretary	Association of Non Govt. ITI, Maharastra	Member
25.	VIVEK CHAUDHARI Principal	Ujjwal ITI Nashirabad, Dist-Jalgoan, Maharastra	Member
26.	Fr. JOSE PADAMATTAM Principal	Don Bosco Technical Institute, Park Circus	Member
27.	SWAMI GUNINDRANANDA Superintendent	R. K. Mission Shilpayatan Belurmath, Howrah	Member
28.	TAPAS SENGUPTA, Instructor	ITI Howrah Homes	Member
29.	DEBIPROSHAD SARKAR, Instructor	ITI Howrah Homes	Member
30.	G. B. KOLAPATE, Instructor	Govt. ITI Andhari, Mumbai, Maharastra	Member
31.	H. B. KOSHTI, Craft Instructor	Govt. ITI Byculla, Mumbai - 400011	Member
32.	NAGESH BALAKRISHNA NARKAR,	ITI Ambernath, Thane, Maharastra	Member

	Craft Instructor		
33.	PARTHA SARKAR, Jr. Engineer/Drawing (Mech.)	Railway Workshop, Kanchrapara	Member
34.	SWAPAN K. BHATTACHARYA Instructor	STC/KPA, Eastern Railways, Kanchrapara	Member
35.	BIKASH CHAUDHURI, Instructor	Ramakrishna Mission Shilpayatan, Belur, Howah	Member
36.	SACHIN M. LAMSE Instructor	ITI Aundh, Pune, Maharastra	Member
37.	SOMNATH B. SAPKAL, Instructor	ITI Anudh, Pune, Maharastra	Member
38.	K. K. PANIGRAHI Instructor	Gun Shell Factory, Cossipore	Member
39.	R. N. MANNA, Training Officer	CSTARI, Kolkata	Member
40.	HARADHAN DAS, Training Officer	CSTARI, Kolkata	Member
41.	TARAKNATH GARAI Instructor	ITI Howrah Homes	Member
42.	SUDHANGSHU MUKHERJEE, Sr. Tech./Dy. CEE/KPN	Eastern Railway, Kanchrapara	Member
43.	S. N. TAMBATKAR, Craft Instructor	Govt. ITI, Adheri, Mumbai	Member

Sl. No.	Name & Designation Shri/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
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
21.	M. K. Verma, Sr. Manager Trg. Capability Development	SNTI, TATA Steel Ltd., Jamshedpur	Member
22.	N.K Thakur, DGM-Trg.	L&T, Construction and Mining Machinery, Kanchipuram.	Member
23.	Vijayan K T,	Volkswagen Academy, Pune	Member
Mentor			
24.	Sunil Kumar Gupta, Director	DGET HQ, New Delhi.	Mentor
Members of Core Group			
25.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
26.	H.Charles (TO)	NIMI, Chennai.	Member
27.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
28.	Ravi Pandey (V.I)	ATI Kanpur	Member
29.	A.K. Nasakar (T.O)	ATI Kolkata	Member

30.	Samir Sarkar (T.O)	ATI Kolkata	Member
31.	J. Ram EswaraRao (T.O)	RDAT Hyderabad	Member
32.	T.G. Kadam (T.O)	ATI Mumbai	Member
33.	K. Mahendar (DDT)	ATI Chennai	Member
34.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
35.	K. Nagasrinivas(DDT)	ATI Hyderabad	Member
36.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
37.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
38.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
39.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
40.	N.M. Kajale, Principal	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
41.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
42.	Vinod Kumar R Sr.Instructor	Govt.ITI Dhanuvachapuram Trivandrum, Dist., Kerala	Member
43.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
44.	L.K.Mukherjee, DDT	CSTARI, Kolkata	Member
45.	R. N. Manna, TO	CSTARI, Kolkata	Member
Other industry representatives			
46.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
47.	Venkata Dasari	Skill Sonics, Bangalore	Member
48.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
49.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
50.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member
51.	P. Joji, Ex-JDT	DGT, MSDE, New Delhi	Member
52.	K. Lakshmi Narayanan	Skill Development Centre, JBM Auto System Pvt. Ltd., Kancheepuram	Member

CONTENTS

1. COURSE INFORMATION

During the 02 years duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The practical part starts with basic fitting with tolerance level ± 0.5mm and finally to ± 0.02mm and angular tolerance from 1° to 10′ at the end of the course. The broad components covered under Professional Skill subject are as below:

1st **Semester -** The practical part starts with basic fitting in the beginning and the candidate also imparted training on allied trades viz., Sheet Metal, Welding (Gas & Arc) which leads to multi-skilling. In the basic fitting the skills imparted are sawing, filing, marking, chipping, measurement, riveting, soldering, brazing, drilling and observation of all safety aspects is mandatory. The accuracy achieved is of±0.25 mm. The safety aspects covers components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught.

2nd Semester - Different drilling operations (through, blind, angular), reaming, offhand grinding, tapping, dieing, different fits viz., sliding fit, etc., scraping, fastening (nuts & bolts, riveting, studs, screws, etc.,). The accuracy achieved is of± 0.04 mm and angular accuracy to 30minutes. Different turning operations on lathe (step, grooving, chamfering, drilling, boring, knurling & threading), simple repair, overhauling and lubrication work on machine are being taught in the practical.

3rd Semester – Power tool operation, different complex assembling and fitting, fastening, lapping, making gauges, pipe works and pipe joints, Dismantling, overhauling& assembling valves are covered. The accuracy achieved is of an accuracy of ± 0.02 mm & 10 minutes.

4th Semester – Making & using drill jigs, making of critical components, repair & maintenance of power transmission system, making of template &complex gauges, identify different Pneumatic & hydraulic components and circuit construction, repair & maintenance of machinery like lathe, drill, grinding, bench drilling,

Inspection of Machine tools, Accuracy testing of Machine tools and erection of simple machines are being performed as part of practical training.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like Physical properties of engineering materials, Interchangeability, Method of expressing tolerance as per BIS Fits, different types of iron, properties and uses, special files, honing, Metallurgical and metal working processes such as Heat treatment, the various coatings used to protect metals, different bearing, working material with finished surface as aluminium, duralumin and stainless steel, topics related to non-ferrous metals, Method of lubrication are also covered under theory part.

Total three projects need to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

Fitter trade under CTS is one of the most popular courses delivered nationwide through network of ITIs. The course is of two years (04 semester) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Trade Certificate (NTC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

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

2.2 CAREER PROGRESSION PATHWAYS:

- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (04 semesters) : -

Sl. No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2209
2	Professional Knowledge (Trade Theory)	510
3	Workshop Calculation & Science	170
4	Engineering Drawing	255
5	Employability Skills	110
6	Library & Extracurricular activities	146
7	Project work	240
8	Revision & Examination	520
	Total	**4160**

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – I).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while

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

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• 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/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weightage in the range of above75% - 90% to be allotted during assessment	
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.	• 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/set standards. • 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	
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.	• 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/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

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 assembles to be made and their functions. They select materials, appropriate tool and equipments to carry out their work. Holds the work in Vice, Cuts and shapes required parts to dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., using hand tools for making specimens or finished components. Measures object while working using foot rules, calipers, micrometer, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scriber, vernier, height gauges, vee-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 calipers, micrometer, vernier, gauges etc, makes holes with drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with dial indicator, micrometer, vernier, height gauges, screw gauges, plug gauges, sine bar, slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those with screws, rivets, pins, etc. as specified so as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them by repaired or new ones. Performs repairing and maintenance work (including preventive maintenance) of simple machines, dismantles and replaces different components to construct circuit of Pneumatics and Hydraulics. Tests completed article/ assembly to ensure correct performance. May do simple turning of parts on machines and perform welding, brazing, and like operations. May explain heat treatment processes viz., annealing, hardening, tempering etc. May specialize in particular type of machine or product and be designated accordingly. May suggest alterations.

In addition Fitter have the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

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.

May be designated as FITTER General according to nature of work done.

Reference NCO:

i) NCO-2015: 7233.0100
ii) NCO-2015: 7233.0200

4. NSQF LEVEL COMPLIANCE

NSQF level for Fitter trade under CTS: **Level 5**

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- 5.

The NSQF level-5 descriptor is given below:

LEVEL	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	knowledge of facts, principles, processes and general concepts, in a field of work or study	a range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	FITTER
NCO - 2015	7233.0100 7233.0200
NSQF Level	Level – 5
Duration of Craftsmen Training	Two years (Four semesters each of six months duration).
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Unit Strength (No. Of Student)	16 (Max. supernumeraries seats: 5)
Space Norms	88 Sq.m
Power Norms	3.51 KW
Instructors Qualification for	
1. Fitter Trade	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 10th Class Pass + NTC/NAC in the Trade of "Fitter" With 3 years post qualification experience in the relevant field. **Desirable: -** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Fitter trade. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience. Desirable: Craft Instructor Certificate in RoD & A course under NCVT.
3. Engineering Drawing	Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience. OR NCVT / NAC in the Draughtsman (Mechanical) with three years experience.

	Desirable: Craft Instructor Certificate in RoD & A course under NCVT.
4. Employability Skill	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 12th / Diploma level and above. **OR** **Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes**
List of Tools and Equipment	As per Annexure – I

Distribution of training on Hourly basis: (Indicative only)

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. LEARNING/ ASSESSABLE OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Fitter course of 02 years duration:

1. Recognize & comply safe working practices, environment regulation and housekeeping.

2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*

3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*

4. Select and ascertain measuring instrument and measure dimension of components and record data.

5. 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. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Semester – I

9. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy. *[Basic fitting operation – marking, Hack-sawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]*

10. Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting.
11. Join metal components by riveting observing standard procedure.
12. Join metal component by arc welding observing standard procedure.
13. Cut and join metal component by gas (oxy-acetylene)

Semester – II

14. Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*

15. Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*

16. Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]*

17. Plan & perform simple repair, overhauling of different machines and check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]*

Semester – III

18. Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[Different Mating Surfaces – Dovetail fitting, Radious fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*

19. Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]*

20. Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*

Semester – IV

21 Make drill jig & produce components on drill machine by using jigs and check for correctness.

22 Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]*

23 Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*

24 Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.

25 Plan & perform basic day to day preventive maintenance, repairing and check functionality.*[Simple Machines – Drill Machine, Power Saw and Lathe]*

26 Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]*

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING/ ASSESSABLE OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	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/unsalvageable 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 Productive 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.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation &earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.

available resources.	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.

SPECIFIC OUTCOME	
Semester-I	
LEARNING/ ASSESSABLE OUTCOMES	**ASSESSMENT CRITERIA**
9. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy. *[Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]*	9. 1 Plan & Identify tools, instruments and equipments for marking and make this available for use in a timely manner.
	9. 2 Select raw material and visual inspect for defects.
	9. 3 Mark as per specification applying desired mathematical calculation and observing standard procedure.
	9. 4 Measure all dimensions in accordance with standard specifications and tolerances.
	9. 5 Identify Hand Tools for different fitting operations and make these available for use in a timely manner.
	9. 6 Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	9. 7 Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job.
	9. 8 Observe safety procedure during above operation as per standard norms and company guidelines.
	9. 9 Check for dimensional accuracy as per standard procedure.
	9. 10 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
10. Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting.	10. 1 Identify Hand Tools for Sheet Metal work, Soldering, Brazing & riveting and make these available for use in a timely manner.
	10. 2 Mark and develop various forms as per drawing using sheet metals.
	10. 3 Make of simple items with sheet metal as per drawing.
	10. 4 Prepare the job for Soldering, Brazing &riveting .
	10. 5 Identify different type of rivets and use as per requirement.
	10. 6 Identify tools for drilling and use these tools.
	10. 7 Mark according to drawing.
	10. 8 Drill through holes on the job.
	10. 9 Solder, Braze and Rivet to prepare a job as per given drawing / sample following standard practices.
	10. 10 Observe safety procedure during riveting as per standard norms and company guidelines.
11. Join metal components by	11.1 Identify Tools and equipments for riveting and make

riveting observing standard procedure.	these available for use in a timely manner.
	11.2 Prepare the job for lap and butt joint.
	11.3 Identify different type of rivets and use as per requirement.
	11.4 Identify tools for drilling and use these tools.
	11.5 Mark according to drawing.
	11.6 Drill through holes on the job.
	11.7 Rivet to prepare a job as per given drawing / sample following standard practices.
	11.8 Observe safety procedure during riveting as per standard norms and company guidelines.
12. Join metal component by arc welding observing standard procedure.	12. 1. Identify different components/parts of arc welding machine, collect desired information and set each components/parts as per standard procedure.
	12. 2. Observe safety/ precaution during operation.
	12. 3. Select appropriate material & plan for arc welding.
	12. 4. Weld metal parts / mechanical components as per specification observing standard procedure.
	12. 5. Check joined part portion to ascertain proper welding.
13. Cut and join metal component by gas (oxy-acetylene)	13.1 Identify different components/parts of Gas (oxy-acetylene) machine, collect desired information and set each components/parts as per standard procedure.
	13.2 Observe safety/ precaution during operation.
	13.3 Select appropriate material & plan for gas cutting & joining operation.
	13.4 Cut & join metal parts / mechanical components as per specification observing standard procedure.
	13.5 Check cut portion/ joined part to ascertain proper welding.

Semester-II

LEARNING/ ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
14. Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	14.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	14.2 Plan work in compliance with standard safety norms.
	14.3 Produce component by observing standard procedure.
	14.4 Check the dimensions of the produced components to ensure dimensions are within prescribed limit.
	14.5 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.

15. Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*	15.1 Recognize general concept of Limits, Fits and tolerance necessary for fitting applications and functional application of these parameters.
	15.2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	15.3 Set up workplace/ assembly location with due consideration to operational stipulation
	15.4 Plan work in compliance with standard safety norms and collecting desired information.
	15.5 Demonstrate possible solutions and agree tasks within the team.
	15.6 Make components according to the specification for different fit using a range of practical skills and ensuring interchangeability of different parts.
	15.7 Assemble components applying a range of skills to ensure proper fit.
	15.8 Check functionality of components.
16. Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]*	16.1 Ascertain basic working principles and safety aspect of lathe machine.
	16.2 Understand functional application of different levers, stoppers, adjustment etc.
	16.3 Identify different lubrication points and lubricants, their usage for application in lathe machine as per machine manual.
	16.4 Identify different work and tool holding devices and collect information for functional application of each device.
	16.5 Mount the work and tool holding devices with required alignment and check for its functional usage to perform lathe operations.
	16.6 Solve problem by applying basic methods, tools, materials and information during setting.
	16.7 Observe safety procedure during mounting as per standard norms.
	16.8 Produce components observing standard procedure.
	16.9 Check accuracy/ correctness of job using appropriate equipment/gauge.
	16.10 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
17. Plan&perform simple repair, overhauling of different machines and check for functionality. *[Different*	17.1 Ascertain and select tools and materials for the repair, overhauling and make this available for use in a timely manner.

Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]	17.2 Plan work in compliance with standard safety norms.
	17.3 Demonstrate possible solutions and agree tasks within the team.
	17.4 Select specific parts to be repaired and ascertain for appropriate material and estimated time.
	17.5 Repair, overhaul and assemble the parts in the machine with the help of blue print.
	17.6 Check for functionality of part and ascertain faults of the part/ machine in case of improper function.
	17.7 Rectify faults of assembly.

Semester-III

LEARNING/ ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
18. Make &assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[Different Mating Surfaces – Dovetail fitting, Radious fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*	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 and collecting necessary information.
	18. 3 Set up workplace/ assembly location with due consideration to operational stipulation
	18. 4 Demonstrate possible solutions and agree tasks within the team.
	18. 5 Produce different components with appropriate accuracy by observing standard procedure& method as per specification using appropriate tools & machines.
	18. 6 Perform scraping and lapping of components to obtain required surface finish of different mating surface.
	18. 7 Comply with safety rules when performing the above operations.
	18. 8 Check tolerance and accuracy of components as defined with appropriate instruments observing standard procedure.
	18. 9 Assemble different components using different fastening components, tools and check the functionality.
19. Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap*	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 Produce gauge by observing appropriate method and as per specification of drawing.

gauge; Specified Accuracy - ±0.02mm]	19.4 Perform Lapping of gauge to obtain required finish as per drawing.
	19.5 Check tolerance and specified accuracy of gauge with appropriate measuring instruments as per drawing.
	19.6 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
20. Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*	20.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	20.2 Plan to Dismantle and assemble valves and pipe fittings.
	20.3 Dismantle valves and fittings in pipes applying range of skills andcheck for defect as per standard procedure.
	20.4 Demonstrate possible solutions in case of defect and agree tasks within the team for repair or replacement.
	20.5 Assemble valves and various pipe fittings using range of skills and observing standard procedure.
	20.6 Test for leakage and appropriate functioning of valves.
	20.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.

Semester-IV

LEARNING/ ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
21 Make drill jig & produce components on drill machine by using jigs and check for correctness.	21. 1 Set up workplace/ assembly location with due consideration to operational stipulation
	21. 2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	21. 3 Collect information related to standard procedure, methods and tools to make drill jigs.
	21. 4 Mark the components as per drawing.
	21. 5 Make drill jigs by turning, drilling, reaming, filing, taping, etc.
	21. 6 Test the functionality of jig.
	21. 7 Select suitable jigs for drilling considering desired result and collecting necessary information.
	21. 8 Produce component by using jig observing standard procedure and check the correctness of the job.
	21. 9 Comply with safety rules when performing the above operations.
22 Plan, dismantle, repair and assemble different damaged mechanical components used	24.1 Select and ascertain tools and materials for the job and make this available for use in a timely manner.

for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]*	24.2 Plan to dismantle, repair and assemble mechanical components used for power transmission as per drawing and collecting necessary information.
	24.3 Perform dismantling and appropriate repairing of mechanical components with accuracy applying range of skills and appropriate repairing processes.
	24.4 Check the accuracy of the repaired components with appropriate gauge & instruments.
	24.5 Assemble the repaired mechanical components observing standard procedure.
	24.6 Comply with safety rules when performing the above operations.
	24.7 Check different parameters of power transmission e.g. R.P.M, slackness of belts, matching of gears/ clutches, loss of RPM etc.
	24.8 Check for functionality of power transmission system or any assembly as per standard parameters.
23 Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	22.1 Select and ascertain tools for the job and make this available for use in a timely manner.
	22.2 Identify different pneumatics and hydraulics components.
	22.3 Plan to dismantle and replace pneumatics & hydraulics circuit as per drawing and collecting necessary information.
	22.4 Perform dismantling and replacing of different components with accuracy applying range of skills and standard operating procedure.
	22.5 Assemble different components.
	22.6 Check functionality of the components.
24 Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	23.1 Select and ascertain tools for the job and make this available for use in a timely manner.
	23.2 Plan to construct pneumatics & hydraulics circuit as per drawing and collecting necessary information.
	23.3 Demonstrate possible solutions and agree tasks within the team for constructing circuit.
	23.4 Construct circuit of pneumatics and hydraulics observing standard procedure.
	23.5 Comply with safety rules when performing the above operations.
	23.6 Check different parameters and functionality of the system.
25. Plan & perform basic day to day preventive maintenance,	25.1 Ascertain preventive maintenance/repair procedure as per manual of machine and select appropriate tools &

repairing and check functionality. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	equipment for undertaking job.
	25.2 Interpret construction, alignment and assembly of different parts of machine.
	25.3 Plan to carry out the preventive maintenance/repair task with appropriate accuracy of simple machine by collecting necessary information.
	25.4 Demonstrate possible solutions and agree tasks within the team.
	25.5 Perform preventive maintenance/dismantle, repair parts and assemble sub-assemblies of simple machine as per layout plan and standard procedure.
	25.6 Put the machine in operation complying Standard operating procedure.
	25.7 Check for proper functioning of repaired machine and other parameters of simple machine as per manual after erection.
	25.8 Dispose unsalvageable materials as per standard procedures.
26. Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	26.1 Ascertain erection procedure as per manual of machine and select appropriate tools & equipment for undertaking job.
	26.2 Interpret construction, alignment and assembly of different parts of machine.
	26.3 Set up workplace/ assembly location with due consideration to operational stipulation
	26.4 Plan to carry out the erection of simple machine by collecting necessary information.
	26.5 Demonstrate possible solutions and agree tasks within the team.
	26.6 Erect simple machine as per layout plan and standard procedure.
	26.7 Put the machine in operation complying Standard operating procedure.
	26.8 Check alignment of erected machine and other parameters of simple machine as per manual after erection.
	26.9 Dispose unsalvageable materials as per standard procedures.

8. SYLLABUS

First Semester
Duration: Six Month

Week No.	Ref. Learning Outcome	Professional Skills with Indicative hrs.	Professional Knowledge
1.	Recognize & comply safe working practices, environment regulation and housekeeping.	1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.) 3. First Aid Method and basic training.(2 hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.) 5. Hazard identification and avoidance. (2 hrs.) 6. Safety signs for Danger, Warning, caution & personal safety message.(1 hrs.) 7. Preventive measures for electrical accidents & steps to be taken in such accidents.(2 hrs.) 8. Use of Fire extinguishers.(7 hrs.) 9. Practice and understand precautions to be followed while working in fitting jobs. (2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hrs.)	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations & regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment.
2.	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy. *[Basic fitting operation – marking, Hacksawing,*	11. Identification of tools &equipments as per desired specifications for marking & sawing. (5 hrs.) 12. Selection of material as per application.(1 hrs.) 13. Visual inspection of raw material for rusting, scaling, corrosion etc.(1 hrs.) 14. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions. (10 hrs.) 15. Sawing different types of metals of different sections. (8 hrs.)	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.

	Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]		
3.	-do-	16. Filing Channel, Parallel. (5 hrs.) 17. Filing- Flat and square (Rough finish), (10 hrs.) 18. Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule. (5 hrs.) 19. Marking practice with dividers, odd leg calipers and steel rule (circles, ARCs, parallel lines). (5 hrs.)	Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements.
4.	-do-	20. Marking off straight lines and ARCs using scribing block and dividers. (5 hrs.) 21. Chipping flat surfaces along a marked line. (10 hrs.) 22. Marking, filing, filing square and check using tri-square.(10 hrs.)	Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.
5 & 6	-do-	23. Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools. (20 hrs.) 24. Finding center of round bar with the help of 'V' block and marking block. (5 hrs.) 25. Joining straight line to an ARC.(25 hrs.)	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.

7 & 8.	-do-	26. Chipping, Chamfering, Chip slots & oils grooves (Straight).(10 hrs.) 27. Filing flat, square, and parallel to an accuracy of 0.5mm. (10 hrs.) 28. Chip curve along a line-mark out, key ways at various angles & cut key ways.(15 hrs.) 29. Sharpening of Chisel.(5 hrs.) 30. File thin metal to an accuracy of 0.5 mm.(10 hrs.)	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.
9.	-do-	31. Saw along a straight line, curved line, on different sections of metal.(15 hrs.) 32. Straight saw on thick section, M.S. angle and pipes.(10 hrs.)	Power Saw, band saw, Circular saw machines used for metal cutting.
10.	-do-	33. File steps and finish with smooth file to accuracy of ± 0.25 mm. (10 hrs.) 34. File and saw on M.S. Square and pipe. (5 hrs.)	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
11.	-do-	35. File radius along a marked line (Convex & concave) & match. (15 hrs.) 36. Chip sheet metal (shearing). (5 hrs.) 37. Chip step and file. (5 hrs.)	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital verniercaliper.
12.	-do-	38. Mark off and drill through holes. (5 hrs.) 39. Drill and tap on M.S. flat. (10 hrs.) 40. Punch letter and number (letter punch and number punch) (5 hrs.) 41. Practice use of different punches.(5 hrs.)	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
13.	Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting.	42. Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. (15 hrs.) 43. Marking out of simple development (5 hrs.) 44. Marking out for flaps for soldering	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. Shearing machine- description, parts and uses.

		and sweating.(5 hrs.)	
14 & 15.	-do-	45. Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming,.(15 hrs.) 46. Punch holes-using hollow and solid punches. (2 hrs.) 47. Do lap and butt joints.(8 hrs.)	Marking and measuring tools, wing compass, Prick punch, tin man's square 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.
16.	-do-	48. Bend sheet metal into various curvature form, wired edges-straight and curves. Fold sheet metal at angle using stakes. (8 hrs.) 49. Make simple Square container with wired edge and fix handle.(17 hrs.)	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges.
17.	-do-	50. Make square tray with square soldered corner.(15 hrs.) 51. Practice in soft soldering and silver soldering. (10 hrs.)	Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method of soldering, selection and application-joints. Hard solder- Introduction, types and method of brazing.
18.	Join metal component by arc welding observing standard procedure.	52. Make riveted lap and butt joint.(9 hrs.) 53. Make funnel as per development and solder joints.(10 hrs.) 54. Drill for riveting. (1 hrs.) 55. Riveting with as many types of rivet as available, use of counter sunk head rivets. (5 hrs.)	Various rivets shape and form of heads, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
19.	Cut and join metal component by gas (oxy-acetylene)	56. Welding - Striking and maintaining ARC, laying Straight-line bead.(25 hrs.)	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.
20.	Cut and join metal component by gas (oxy-acetylene) &	57. Making square, butt joint and 'T' fillet joint-gas and ARC. (15 hrs.) 58. Do setting up of flames, fusion runs with and without filler rod, and gas.(10 hrs.)	Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle,

	Join metal components by riveting observing standard procedure.		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.
21.	Cut and join metal component by gas (oxy-acetylene)	59. Make butt weld and corner, fillet in ARC welding(25 hrs.)	Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode.
22.	Join metal components by riveting observing standard procedure.	60. Gas cutting of MS plates(25 hrs.)	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
23-25		**Revision**	
26		**Examination**	

NOTE: -

1. More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of industry on machine fitting, alignment of pump-motor, fitting of pipes & tubes, assembling jobs, maintenance work, etc., may be shown to the trainees to give a feel of Industry and their future assignment.

Second Semester
Duration: Six Month

Week No.	Learning Outcome	Professional Skills with Indicative hrs.	Professional Knowledge
27.	Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	61. Mark off and drill through holes. (5 hrs.) 62. Drill on M.S. flat. (1 hrs.) 63. File radius and profile to suit gauge.(13 hrs.) 64. Sharpening of Drills.(1 hrs.) 65. Practice use of angular measuring instrument. (5 hrs.)	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.
28.	-do-	66. Counter sink, counter bore and ream split fit (three piece fitting).(5 hrs.) 67. Drill through hole and blind holes.(2 hrs.) 68. Form internal threads with taps to standard size (through holes and blind holes).(3 hrs.) 69. Prepare studs and bolt.(15 hrs.)	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).
29.	-do-	70. Form external threads with dies to standard size. (10 hrs.) 71. Prepare nuts and match with bolts.(15 hrs.)	Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
30.	-do-	72. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree).(15 hrs.) 73. Make simple open and sliding fits.(10 hrs.)	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.

31.	-do-	74. Enlarge hole and increase internal dia. (2 hrs.) 75. File cylindrical surfaces.(5 hrs.) 76. Make open fitting of curved profiles.(18 hrs.)	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.
32.	-do-	77. Correction of drill location by binding previously drilled hole.(5 hrs.) 78. Make inside square fit. (20 hrs.)	Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and uses.
33.	Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*	79. Make sliding 'T' fit.(25 hrs.)	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
34.	-do-	80. File fit- combined, open angular and sliding sides. (10 hrs.) 81. File internal angles 30minutes accuracy open, angular fit.(15 hrs.)	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.
35-36.	-do-	82. Make sliding fit with angles other than 90^{o}.(25 hrs.)	Wrought iron- : properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.

37.	-do-	83. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. (5 hrs.) 84. Make & assemble, sliding flats, plain surfaces. (15 hrs.) 85. Check for blue math of bearing surfaces- both flat and curved surfaces by wit worth method.(5 hrs.)	Simple scraper- circular, flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces)
38.	-do-	86. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. (18 hrs.) 87. Locate accurate holes & make accurate hole for stud fit.(2 hrs.) 88. Fasten mechanical components / sub-assemblies together using screws, bolts and collars using hand tools.(5 hrs.)	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.
39.	-do-	89. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)(25 hrs.)	Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores.
40.	Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]*	90. Lathe operations- 91. True job on four jaw chuck using knife tool.(5 hrs.) 92. Face both the ends for holding between centers. (9 hrs.) 93. Using roughing tool parallel turn ± 0.1 mm. (10 hrs.) 94. Measure the diameter using outside caliper and steel rule.(1 hrs.)	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.
41.	-do-	95. Holding job in three jaw chuck.(2 hrs.) 96. Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, round the ends, and use	Lathe cutting tools- Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away

		form tools. (11 hrs.) 97. Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled.(11 hrs.) 98. Sharpening of -Single point Tools.(1 hrs.)	type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.
42.	-do-	99. Cut grooves- square, round, 'V' groove. (10 hrs.) 100. Make a mandrel-turn diameter to sizes. (5 hrs.) 101. Knurl the job.(1 hrs.) 102. Bore holes –spot face, pilot drill, enlarge hole using boring tools. (9 hrs.)	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.
43.	-do-	103. Make a bush step bore-cut recess, turn hole diameter to sizes.(5 hrs.) 104. Turn taper (internal and external).(10 hrs.) 105. Turn taper pins. (5 hrs.) 106. Turn standard tapers to suit with gauge.(5 hrs.)	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.
44.	-do-	107. Practice threading using taps, dies on lathe by hand. (2 hrs.) 108. Make external 'V' thread.(8 hrs.) 109. Prepare a nut and match with the bolt.(15 hrs.)	Screw thread definition – uses and application. 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.
45–46.	Plan & perform simple repair, overhauling of different machines and check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]*	110. Simple repair work: Simple assembly of machine parts from blue prints. (15 hrs.) 111. Rectify possible assembly faults during assembly.(19 hrs.) 112. Perform the routine maintenance with check list (10 hrs.) 113. Monitor machine as per routine checklist (3 hrs.) 114. Read pressure gauge, temperature gauge, oil level (1 hrs.)	**Maintenance** -Total productive maintenance -Autonomous maintenance -Routine maintenance -Maintenance schedule -Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks

		115. Set pressure in pneumatic system (2 hrs.)	and reference table. Possible causes for assembly failures and remedies.
47.	-do-	116. Assemble simple fitting using dowel pins and tap screw assembly using torque wrench. (25 hrs.)	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
48-49		**In-plant training / Project work** 1. Pipe Fixture 2. Adjustable Clamp 3. Hermaphrodite/ Inside Caliper 4. Chuck Key	
50-51.		**Revision**	
52.		**Examination**	

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of industry on machine fitting, alignment of pump-motor, fitting of pipes & tubes, assembling jobs, maintenance work, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

Third Semester
Duration: Six Month

Week No.	Ref. Learning Outcome	Professional Skills with Indicative hrs.	Professional Knowledge
53.	Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[Different Mating Surfaces – Dovetail fitting, Radious fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*	117. Make 'H' fitting.(17 hrs.) 118. Power tools: Practice operation of power tool for fastening.(5 hrs.) 119. Tightening of bolt/ screw with specified torque.(2 hrs.) 120. Selection of right tool as for Tightening or loosening of screw/bolt as per accessibility (1 hrs.)	Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance.
54	-do-	121. Assembly sliding for using keys, dowel pin and screw, ± 0.02 mm accuracy on plain surface and testing of sliding fitting job. (25 hrs.)	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.
55	-do-	122. File & fit angular mating surface within an accuracy of ± 0.02 mm & 10 minutes angular fitting.(25 hrs.)	Various types of keys, allowable clearances & tapers, types, uses of key pullers.
56	-do-	123. Drill through and blind holes at	Special files: types (pillar, Dread naught,

		an angle using swivel table of drilling machine.(10 hrs.) 124. Precision drilling, reaming and tapping and Test- Job.(15 hrs.)	Barrow, warding) description & their uses. Testing scraped surfaces: ordinary surfaces without a master plate.
57	-do-	125. Make Dovetailed fitting and radius fitting.(25 hrs.)	Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge)
58	-do-	126. File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy and check adherence to specification and quality standards using equipment like Vernier calipers, micrometers etc.(25 hrs.)	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.
59	-do-	127. Drilling and reaming, small dia. holes to accuracy & correct location for fitting.(4 hrs.) 128. Perform drilling using 'V' block and a clamp.(1 hrs.) 129. Make male and female fitting parts, drill and ream holes not less than 12.7 mm.(20 hrs.)	Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
60	-do-	130. Make Sliding Diamond fitting.(20 hrs.) 131. Lap flat surfaces using lapping plate. (5 hrs.)	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.
61	-do-	132. Prepare Stepped keyed fitting and test job. (20 hrs.) 133. Lapping holes and cylindrical surfaces.(5 hrs.)	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
62	-do-	134. Dovetail and Dowel pin assembly.(20 hrs.) 135. Scrape cylindrical bore.(5 hrs.)	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart.
63	-do-	136. Scrapping cylindrical bore and to	Annealing and normalizing, Case

		make a fit-(15 hrs.) 137. Scrapping cylindrical taper bore and check taper angle with sine bar.(10 hrs.)	hardening and carburising and its methods, process of carburising (solid, liquid and gas).
64	-do-	138. Make a cotter jib assembly.(25 hrs.)	Tapers on keys and cotters permissible by various standards.
65	-do-	139. Hand reams and fit taper pin. (15 hrs.) 140. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.(10 hrs.)	The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing.
66	Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]*	141. Making a snap gauge for checking a dia of 10 ± 0.02 mm.(25 hrs.)	Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization.
67	-do-	142. Scrape external angular mating surface and check angle with sine bar.(15 hrs.) 143. Scrape on internal surface and check.(10 hrs.)	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.
68	-do-	144. Practice in dovetail fitting assembly and dowel pins and cap screws assembly.(20 hrs.) 145. Industrial visit.(5 hrs.)	Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings Industrial visit.
69	-do-	146. Preparation of gap gauges.(15	Bearing metals – types, composition and

		hrs.) 147. Perform lapping of gauges (hand lapping only)(10 hrs.)	uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
70	-do-	148. Preparation of drill gauges. (10 hrs.) 149. File and fit straight and angular surfaces internally.(13 hrs.) 150. Identify different ferrous metals by spark test(2 hrs.)	, the importance of keeping the work free from rust and corrosion.
71	Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*	151. Flaring of pipes and pipe joints. (3 hrs.) 152. Cutting & Threading of pipe length.(3 hrs.) 153. Fitting of pipes as per sketch observing conditions used for pipe work. (12 hrs.) 154. Bending of pipes- cold and hot.(7 hrs.)	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.
72	-do-	155. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve. (25 hrs.)	Use of tools such as pipe cutters, pipe wrenches, pipe dies , and tap, pipe bending machine etc.
73	-do-	156. Fit & assemble pipes, valves and test for leakage & functionality of valves.(22 hrs.) 157. Visual inspection for visual defects e.g. dents, surface finish.(1 hrs.) 158. Measuring, checking and	Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Inspection & Quality control -Basic SPC

		recording in control chart.(2 hrs.)	-Visual Inspection
74-75		**In-plant training / Project work** 1. Key Way Fitting 2. Lathe Dog 3. Different Test Piece For Fitter 4. Radious Form Gauge/ Form Gauge/ Snap Gauge 5. Square Fitting Alignment 6. Universal Fitting 7. Hand Press 8. Setup assembly of pipes and valves and test for leakage/ functionality	
76--77		**Revision**	
78.		**Examination**	

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of industry on machine fitting, alignment of pump-motor, fitting of pipes & tubes, assembling jobs, maintenance work, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

Fourth Semester
Duration: Six Month

Week No.	Learning Outcome	Professional Skills with Indicative hrs.	Professional Knowledge
79.	Make drill jig & produce components on drill machine by using jigs and check for correctness.	159. Make a simple drilling jig. (20 hrs.) 160. Use simple jigs and fixtures for drilling. (5 hrs.)	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses.
80.	Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]*	161. Marking out for angular outlines, filing and fitting the inserts into gaps. (10 hrs.) 162. Exercises on finished material such as aluminium/ brass/ copper / stainless steel, marking out, cutting to size, drilling, tapping etc. without damage to surface of finished articles. (15 hrs.)	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such 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.
81.	-do-	163. Making an adjustable spanner: - Marking out as per Blue print, drilling, cutting, straight and curve filing, threading, cutting slot and cutting internal threads with taps. (25 hrs.)	Installation, maintenance and overhaul of machinery and engineering equipment. 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.
82-84	-do-	164. Dismantling and mounting of pulleys. (10 hrs.) 165. Making & replacing damaged keys. (15 hrs.) 166. Dismounting, repairing damaged gears and mounting and check for workability. (15 hrs.) 167. Repair & replacement of belts and check for workability. (10 hrs.)	Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions- coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses. 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.
85.	-do-	168. Making of template/gauge to check involute profile. (25 hrs.)	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.
86.	-do-	169. Repair of broken gear tooth by stud and repair broker gear teeth by dovetail. (25 hrs.)	Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method.
87.	-do-	170. Make hexagonal slide fitting. (20 hrs.) 171. Prepare different types of documentation as per industrial need by different methods of recording information. (5 hrs.)	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.
88.	-do-	172. Marking out on the round sections for geometrical shaped fittings such as spline with 3 or 4 teeth. Finishing and fitting to size, checking up the faces for universality. (25 hrs.)	Fluid power, Pneumatics, Hydraulics, and their comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law.
89.	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	173. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs.) 174. Dismantle, replace, and assemble FRL unit(5 hrs.) 175. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE)(2 hrs.) 176. Identify the parts of a pneumatic cylinder (1 hrs.) 177. Dismantle and assemble a pneumatic cylinder (8 hrs.) 178. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder(7 hrs.)	Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems. Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders.
90.	Construct circuit of pneumatics and hydraulics observing	179. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input	Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO & NC types) (manually-

	standard operating procedure& safety aspect.	signals(5 hrs.) 180. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve(10 hrs.) 181. Dismantling &Assembling of solenoid valves(10 hrs.)	actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control valve Pneumatic valves: Roller valve, Shuttle valve, Two-pressure valve Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls
91.	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	182. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) (5 hrs.) 183. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses (5 hrs.) 184. Inspect fluid levels, service reservoirs, clean/replace filters(5 hrs.) 185. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings(5 hrs.) 186. Identify internal parts of hydraulic cylinders, pumps/motors(5 hrs.)	- Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses
92.	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	187. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2 & 4/3 way valves. (10 hrs.) 188. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video) (15 hrs.)	- Hydraulic cylinders –Types - Hydraulic motors –Types - Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves - Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves - Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function - Flow control valves: Types, Speed control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic &

			hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils
93.	Plan & perform basic day to day preventive maintenance, repairing and check functionality.*[Simple Machines – Drill Machine, Power Saw and Lathe]*	189. Dismantle, overhauling & assemble cross-slide & hand-slide of lathe carriage. (25 hrs.)	Method or fixing geared wheels for various purpose 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.
94-96.	-do-	190. Simple repair of machinery: - Making of packing gaskets. (5 hrs.) 191. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. (5 hrs.) 192. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. (15 hrs.) 193. Dismantling, assembling of different types of bearing and check for functionality. (15 hrs.) 194. Perform routine check of machine and do replenish as per requirement. (10 hrs.)	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. Clutch: Type, positive clutch (straight tooth type, angular tooth type) . Washers-Types and calculation of washer sizes. The making of joints and fitting packing. Chains, wire ropes and clutches for power transmission. Their types and brief description.
97.	Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	195. Inspection of Machine tools such as alignment, levelling. (10 hrs.) 196. Accuracy testing of Machine tools such as geometrical parameters. (15 hrs.)	Lubrication and lubricants- purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings.
98-99.	-do-	197. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. (5 hrs.) 198. Erect simple machines. (45 hrs.)	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, wire rope, manila rope, wooden block. 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.
100-101		**In-plant training/ Project work** 1. Pulley Extractor 2. Cam Vice 3. Link Mechanism 4. Adjustable Fixture 5. Slider Crank 6. Hand Lever Punch 7. Setup hydraulic and pneumatic circuit and test the functioning of piston movement.	
102-103		**Revision**	
104		**Examination**	

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of industry on machine fitting, alignment of pump-motor, fitting of pipes & tubes, assembling jobs, maintenance work, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*
6. *The institute may arrange old/used pneumatic & hydraulic cylinders, FRL unit, hydraulic pump, filters, etc for dismantling and assembling.*
7. *Trainees are encouraged to download videos on (1) Hydraulic fundamentals, (2) Fluid contamination & its control, (3) Hydraulic pumps, and (4) Hydraulic applications from internet and watch them for the quick understanding of the concepts.*
8. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of industry on machine fitting, alignment of pump-motor, fitting of pipes & tubes, assembling jobs, maintenance work, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

First Semester		Duration: Six Month
Sl. No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions** : 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 - 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.
3.	**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Ratio &Proportion** : Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	**Percentage** : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Material Science** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron,	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary)

	Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	- Types of arrowhead - Leader Line with text
7.	**Mass, Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings

Second Semester		Duration: Six Month
Sl. No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	**Mensuration :** 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.	**Trigonometry:** 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.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)
5.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
6.	**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between	Free Hand sketch of hand tools and measuring tools used in respective trades.

	Efficiency, velocity ratio and Mechanical Advantage.	
7.		Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
8.		Drawing of Orthographic projection from isometric/3D view of blocks
9.		Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.		Drawing details of two simple mating blocks and assembled view.

Third Semester		Duration: Six Month
Sl. No.	**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
9.	- Forces definition. - Compressive, tensile, shear forces and simple problems. -Stress, strain, ultimate strength, factor of safety. -Basic study of stress-strain curve for MS.	- Free hand Sketches for simple pipe, unions with simple pipe line drawings.
10.	- Temperature measuring instruments. Specific heats of solids & liquids.	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models.
11.	- Thermal Conductivity, Heat loss and heat gain.	-Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.)
12.	- Average Velocity, Acceleration & Retardation. - Related problems.	- Study of assembled views of Vee-blocks with clamps.
13.	- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	- Study of assembled views of shaft and pulley.

14.		- Study of assembled views of bush bearing.
15.		- Study of assembled views of a simple coupling.
16.		- Free hand Sketching of different gear wheels and nomenclature.

Fourth Semester		Duration: Six Month
Sl. No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Graph:** - Read images, graphs, diagrams – bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	- Free hand Details and assembly of simple bench vice.
2.	Simple problem on Statistics: - Frequency distribution table - Calculation of Mean value. - Examples on mass scale productions. -Cumulative frequency -Arithmetic mean	- 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).	- Simple exercises relating missing symbols. - Missing views
4.	- Friction- co-efficient of friction, application and effects of friction in Workshop practice. **Centre of gravity** and its practical application.	- Simple exercises related to missing section.
5.	- Magnetic substances- natural and artificial magnets. - Method of magnetization. Use of magnets.	-Free hand sketching of different types of bearings and its conventional representation.
6.	- 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)
7.	- 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
8.	- Heat treatment and advantages.	- Study of drawing & Estimation of materials.
9.	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure	- Solution of NCVT test papers.

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

1st Semester **Duration – 55 hrs.**	
1. English Literacy Duration : 20 Hrs. Marks : 09	
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy Duration : 20 Hrs. Marks : 09	
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating

	simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills Duration : 15 Hrs. Marks : 07	
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
2nd Semester **Duration – 55 hrs.**	

4. Entrepreneurship Skills Duration : 15 Hrs. Marks : 06	
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
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.
6. Occupational Safety, Health and Environment Education Duration : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.

Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation Duration : 05 Hrs. Marks : 03	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools Duration : 10 Hrs. Marks : 05	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality

	Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

FITTER

LIST OF TOOLS AND EQUIPMENT (For batch of 16 candidates)

A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)

Sl. no.	Name of the Tool &Equipments	Specification	Quantity
1	Steel Rule with metric & British graduation	150 mm, Stainless steel	16 nos.
2	Try Square.	150 mm blade	16 nos.
3	Caliper inside spring type.	150 mm	16 nos.
4	Caliper hermaphrodite spring type	150 mm	16 nos.
5	Caliper outside spring type	150 mm	16 nos.
6	Divider spring type	150 mm	16 nos.
7	Scriber	150 mm	16 nos.
8	Centre Punch	10 mm and Length - 120 mm	16 nos.
9	Screw driver	150mm insulated flat type	16 nos.
10	Chisel cold flat	20 mm X 150 mm High carboon steel	16 nos.
11	Hammer ball peen With handle	450 grams (1 lb)	16 nos.
12	Hammer ball peen With handle.	220 grams (1/2 lb)	16 nos.
13	File flat - second cut	250 mm	16 nos.
14	File flat smooth	250 mm.	16 nos.
15	File half round second cut	150 mm.	16 nos.
16	Hacksaw frame fixed type	300 mm	16 nos.
17	Safety goggles.		16 nos.

18	Dot punch	100 mm	16 nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
INSTRUMENTS			
19.	Steel Rule Graduated both in Metric and English Unit	300 mm Stainless steel	4 nos.
20.	Straight edge steel	300 mm or above	2 nos.
21.	Spirit Level metal Type - 2	300 mm Basic Length Accuracy 0.1mm/Meter	1 no.
22.	Stud Extractor EZY - out	Set of 8	2 sets
23.	Combination Set	300 mm	2 nos.
24.	Micrometer outside.	0 - 25 mm	2 nos.
25.	Micrometer outside.	25 - 50 mm	2 nos.
26.	Micrometer outside.	50 - 75 mm	2 nos.
27.	Micrometer inside with extension rods.	Accuracy 0.01 mm with extension rods upto 150 mm	1 no.
28.	Vernier caliper	150 mm	4 nos.
29.	Vernier height gauges	0 - 300 mm with least count = 0.02 mm	1 no.
30.	Vernier bevel protractor Blade with Acute Angle Attachment	300 mm	1 no.
31.	Screw pitch gauge Metric	0.25 to 6 mm	1 no.
32.	Wire gauge, metric standard.		1 no.
GENERAL SHOP OUTFIT			
33.	Surface plate C.I/Granite with Stand and Cover	600 x 600 mm	1 nos.
34.	Marking table (Mild steel)	900X900X900 mm	1 no.
35.	Universal scribing block.	220 mm	2 nos.
36.	V-Block pair with clamps	150 x 100 x 100 mm	2 nos.
37.	Angle plate	150 X 150 X 250 mm	2 nos.
38.	Punch letter set.	3 mm	1 no.
39.	Punch number set.	3 mm	1 no.
40.	Portable hand drill (Electric)	0 to 13 mm Capacity	1 no.
41.	Drill twist straight shank	3 mm to 12 mm by 0.5 mm H.S.S.	2 sets
42.	Drill twist Taper shank	8 mm to 20 mm by 0.5 mm H.S.S.	2 sets
43.	Taps and dies complete set in box.	Wit-worth	1 no.
44.	Taps and dies complete set	5, 6, 8, 10 & 12 mm set of 5	2 Sets
45.	File knife edge smooth	150 mm	4 nos.

46.	File feather edge smooth	150 mm	4 nos.
47.	File triangular smooth	200 mm	8 nos.
48.	File round second cut	200 mm	8 nos.
49.	File square second cut	250 mm	8 nos.
50.	Feeler gauge	Gauge Feeler / Thickness - 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm - 13 leaves	1 set
51.	File triangular second cut.	200 mm	8 nos.
52.	File flat second cut safe edge.	300 mm	8 nos.
53.	File flat bastard	200 mm	10 nos.
54.	File flat bastard.	300 mm	10 nos.
55.	File Swiss type needle	Set of 12, Length = 150 mm	2 sets
56.	File half round second cut.	250 mm	10 nos.
57.	File half round bastard.	250 mm	10 nos.
58.	File round bastard.	250 mm	10 nos.
59.	File hand second cut.	150 mm	8 nos.
60.	File card.	3"x5" size, brass or steel wire	8 nos.
61.	Oil Can	250 ml	2 nos.
62.	Pliers combination insulated	150 mm	2 nos.
63.	Wooden handle forged Soldering Iron copper bit.	230V, 250 W, 350 gm	2 nos.
64.	Blow Lamp	0.5 litre	2 nos.
65.	Spanner- Double Ended	6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22	1 set each
66.	Spanner adjustable	150 mm	2 nos.
67.	Interchangeable ratchet socket set	12 mm driver, sized10-32 mm set of 18 socket & attachments.	1 set
68.	Double Ended tubular Box spanner set with Tommy bar.	A/F 6-25 mm set of 10 Tommy Bar Dia 6, 8, 10, 12, 14, 16	1 set
69.	Glass magnifying	75 mm	2 nos.
70.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	2 nos.
71.	Clamp "C"	100 mm	2 nos.
72.	Clamp "C"	200 mm	2 nos.
73.	Hand Reamer set (Tapar pin straight flute)	Nominal Dia 6, 8, 10, 12, 16mm	1 set

74.	Machine Reamer parallel (Helical flute)	12 - 16mm set of 5.	1 no.
75.	Scraper flat	150 mm	8 nos.
76.	Scraper triangular	150 mm	8 nos.
77.	Scraper half round	150 mm	8 nos.
78.	Chisel cold cross cut & diamond point.	9 mm X 150 mm	8 each
79.	Chisel cold flat	9 mm X 100 mm	8 nos.
80.	Chisel cold round noze.	9 mm X 100 mm	8 nos.
81.	Drill chuck with key	12 mm.	1 no.
82.	Pipe wrench	400 mm	1 no.
83.	Pipe vice	100 mm	1 no.
84.	Adjustable pipe die set BSP	cover pipe size 1" or 3/4"	1 Set
85.	Wheel dresser (One for 4 units) Star/Dresser with Holder	Length 150 mm, diamond point	1 no.
86.	Machine vice - Swivel Base	100 mm	1 no.
87.	Machine vice - Swivel Base	125 mm	1 no.
88.	Sleeve drill Morse	No. 0 - 1, 1 - 2, 2 - 3, 3 - 4, 4 - 5	1 Set
89.	Vice bench	150 mm	20 nos.
90.	Bench working.	2400 x 1200 x 900 mm	4 nos.
91.	Almirah.	1800 x 900 x 450 mm	2 nos.
92.	Lockers with 8 drawers (standard size).	One locker for each trainee	3 nos.
93.	Metal rack	1820 x 1820 x 450 cm	1 no.
94.	Instructor Table		
95.	Instructor Chair		
96.	Black board with easel.		
97.	Fire extinguisher (For 4 Units)	CO2 type, 3 kg capacity	
98.	Fire buckets.		
99.	Machine vice.	100mm	2 nos.
100.	Wing compass.	254 mm or 300 mm	2 nos.
101.	Hand hammer with handle.	1000 gm	1 nos.
102.	Torque wrench (Standard/Ratchet type)	14 to 68 Nm	1 no.
103.	Power tools for fastening	Capacity 10-18mm	1 No.
104.	Different Profile gauges (Plate type) - For demonstration	Metric standard	4 nos
105.	Knurling tool (Diamond, straight & Diagonal)		1 each
106.	Indexable boring bar with inserts	1" shank	4 nos.

107.	Machine maintenance mannual for Lathe, Pedestal grinder, Drill machine, Power saw		1
108.	Temperature gauge	Range 0 - 150°C	1 each
109.	Dowel pin (straight)	Dia. -1" Length -4" (Mat: Stainless Steel)	1 each
110.	Standard Tap screws	M3, M4, M5, M6, M8, M10, M12, M14, M16	1 each
111.	Lapping plate	Dia. -6"	2 each
112.	Medium carbon Heat treated alloy steel Metric Studs and bolts along with nuts (for display) of standard length (May be manufactured in-house)	M6, M8, M10, M12, M14, M16 (Standard)	2 each
113.	Caps screws	M6, M8, M10, M12	2 each
114.	Drill gauges	Letter drill gauge (A to Z) , Number drill gauge (1 to 60) , Metric drill gauge (1.5mm to 12.5mm, 30 holes)	2 nos.
115.	Cast Iron Globe Valve (Flanged type)	150NB, Class# 150 Flange:ANSI125-B16.1	2 nos.
116.	C.I. Sluice / Gate valve (flanged type)	150NB, Class# 150 Flange:ANSI125-B16.1	2 nos.
117.	Stop cock	25NB (2-way, Threaded end)	2 nos.
118.	M.S. Pipe	150NB, Sch.40, ERW, IS:1239	as required
119.	G.I. Pipe	25mm, Sch.40, ERW	as required
120.	Slip-on Forged steel Flange	150NB, ANSI-B16.5, Class#150	4 nos.
121.	Bolt & Nut with washer (May be manufactured in-house)	M20x2.5x90Long (part thread - Hex. Head)	16 nos.
122.	Pipe threading die with handle	Ratchet type Die head of 1/2" , 3/4" and 1"	2 nos.
123.	Jigs & Fixture (sample)-For demonstration (May be manufactured in-house)		1 nos.
124.	M. S. Shaft (May be manufactured in-house)	Bright M.S. round bar □80mm, 600mm long, Stepped □□0mm on 300mm one end	2 nos.
125.	Pulleys (for V-belt or Flat belt)	to fit on 50mm dia. Shaft with key slot	1 no.
126.	Steel keys (May be manufactured in-house)	to fit with keyslot of shaft & pulley	2 nos.
127.	Damaged old spur gear	to fit 50mm dia. Shaft	2 nos.
128.	V-belt and Flat belt	to fit on pulley	1 each
129.	Packing gasket	PTFE gasket roll small size	1 no.

130.	Washer, clutch, keys, jib, cotter & circlip	minimum 25mm size, carbon steel material	2 each
131.	Hollow punch	Straight Shank Hollow Punch Sets 5-12mm	1 set
132.	Drill Drift (May be manufactured in-house)	200mm hardened and black finish	2 nos.
133.	Bearing different types	each type of diameter 25mm (min.)	1 each
134.	Lifting sling	8mm Nominal Dia. Single leg sling	2 nos.
135.	Bearing extractor	Universal gear puller 2 or 3 jaws adjustable	1 no.
136.	Pulley extractor	- do -	1 no.
C. TOOLS FOR ALLIED TRADE - SHEET METAL WORKER (Note: - Those additional items are to be provided for the Allied Trade Training where the Sheet Metal trade does not exist.)			
1.	Trammel	300 mm	1 no.
2.	Pocker.		2 nos.
3.	Prick punch	100 mm	2 nos.
4.	Mallet.	Dia 100 mm X 150 mm	2 nos.
5.	Aviation Snips straight Cut	300 mm	2 nos.
6.	Flat headed hammers with handle.		2 nos.
7.	Planishing hammer.		2 nos.
8.	Snip bent Left Cut	250 mm	2 nos.
9.	Stake hatchet with Leg.	300 X 200 X 20 mm	2 nos.
10.	Stake grooving.	100 X 100 X 300 mm	2 nos.
D. MODIFIED LIST OF TOOLS FOR THE 3RD AND 4TH SEMESTER FOR FITTER TRADE			
INSTRUMENT			
*1.	Slip Gauge as Johnson metric set.	87 Pieces Set	1 Set
*2.	Gauge snap Go and Not Go	25 to 50 mm by 5 mm, Set of 6 pieces	1 Set
*3.	Gauge plug	Single ended 5 to 55 by 5 mm. Set of 11 pcs.	1 Set
**4.	Gauge telescopic set.	8 - 150 mm	1 no.
5.	Dial test indicator on stand	0.01 mm least count	1 no.
6.	Sine bar	125 mm	1 no.
**7.	Dial vernier caliper. (Universal type)	0 - 300 mm, LC 0.05 mm	1 no.

**8.	Screw thread micrometer with interchangeable. Pitch anvils for checking metric threads 60.	0 - 25 mm LC 0.01 mm	1 no.
9.	Depth micrometer. 0-25 mm	Accuracy 0.01 mm with standard set of extension rods upto 200 mm	1 no.
**10.	Vernier caliper.	0 - 150 mm with least count 0.02mm	1 no.
**11.	Digital Micrometer outside.	0 - 25 mm L.C. 0.001 mm.	1 no.
**12.	Comparators Gauge - Dial Indication with Stand and Bracket.	LC 0.01mm	1 no.
13.	Engineer's try square (knife-edge)	150 mm Blade	1 no.
**14.	Surface roughness comparison plates	N1 - N12 Grade	1 Set
15.	Digital Vernier caliper	0 - 200 mm L.C. 0.01 mm (Optional)	1no.
16.	Vernier Bevel protector	Range 360deg, LC. : 5min(150mm blade)	1no.
GENERAL SHOP OUTFIT			
17.	Carbide Wear Block.	1 mm - 2 mm	2 each
18.	Lathe tools H.S.S. tipped set.		2 nos.
19.	Lathe tools bit.	6 mm x 75 mm HSS/Carbide	4 nos.
20.	Lathe tools bit.	8 mm x 75 mm HSS/Carbide	4 nos.
21.	Lathe tools bit.	10 mm x 75 mm HSS/Carbide	4 nos.
22.	Arm strong type tool bit holder.	Right hand	2 nos.
23.	Arm strong type tool bit holder.	Left hand	2 nos.
24.	Arm strong type tool bit holder.	Straight	2 nos.
25.	Stillson wrenches	250 mm	2 nos.
26.	Pipe cutter wheel type.	6 mm to 25 mm	1 no.
27.	Pipe bender machine spool type with stand manually operated.	up to 25 mm cold bending	1 no.
28.	Adjustable pipe chain tonge to take pipes	up to 300 mm	1 no.
29.	Adjustable spanner.	380 mm long	1 no.
E. GENERAL MACHINERY INSTALLATION			

*1.	SS and SC centre lathe (all geared) with minimum specification	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	Pillar Type Drilling machine	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	D.E. pedestal Grinding machine with wheels rough and smooth	2 H.P.-3Phase-415V, 1500 rpm,250 Dia wheel	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 (Note: - Those additional items are to be provided for the Allied Trade Training where the Welder trade does not exist.)			
1	Transformer welding set - continuous welding current, with all accessories and electrode holder 60% Duty Cycle with Standard Accessories	300 A, OCV 60 - 100 V,	1 Set
2	Welder cable	Able to carry 300 amps. With flexible rubber cover	20 Meter
3	Lugs for cable		12 Nos.
4	Earth clamps.		2 Nos.
5	Arc welding table (all metal top) with positioner.	1200 X 1200 X 750 mm	1 No.
6	Oxy - acetylene gas welding set equipment with hoses, Oxygen & Acetylene cylenders, regulator and other accessories.		1 Set.
7	Gas welding table with positioner with Fire Bricks	900 X 600 X 750 mm	1 No

8	Welding torch tips of different sizes for Oxy - acetylene gas welding	To fit nozzel no. 1, 2, & 3	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.	Nozzles no. 1, 2, & 3	1 Set.
16	Welding goggles		4 Pairs.
17	Welding helmet with coloured flame retardent glass		2 Nos.
18	Tip cleaner		5 Sets.
#G. LIST OF TOOLS & ACCESSORIES FOR PNEUMATICS AND HYDRULICS			
1	Compressor unit	suitable for Pressure: 8 bar, Delivery: 50 lpm (or more), Reservoir capacity: 24 Litres (or more), 230V, 50 Hz, with pressure regulator and water separator	1 No.
2	Pneumatic Trainer Kit, each consisting of the following matching components and accessories:		01 sets
	I. Single acting cylinder	Max. stroke length 50 mm, Bore dia 20 mm	1 No
	II. Double acting cylinder	Max. stroke length 100 mm, Bore dia 20 mm, magnetic type	1 No
	III. 3/2-way valve	manually-actuated, Normally Closed	2 Nos
	IV. 3/2-way valve	pneumatically-actuated, spring return	1 No
	V. One-way flow control valve		2 Nos
	VI. 5/2-way valve	with manually-operated switch	1 No
	VII. 5/2-way valve	pneumatically-actuated, spring return	1 No
	VIII. 5/2-way pneumatic actuated valve	double pilot	1 No
	IX. 3/2-way roller lever valve	direct actuation Normally Closed	2 Nos
	X. Shuttle valve (OR)		1 No

	XI. Two-pressure valve (AND)		1 No
	XII. Pressure gauge	0-16 bar	1 Nos
	XIII. Manifold with self-closing	NRV, 6-way	1 No
	XIV. Pushbutton station for electrical signal input	with 3 illuminated momentary-contact switches (1 NO + 1 NC) and 1 illuminated maintained-contact switch (1 NO + 1 NC), Contact load 2A	1 No
	XV. Relay station	with 3 ralays each with 4 contact sets (3NO+1NC or Change-over type), 5 A	1 No
	XVI. 3/2-way single solenoid valve	with LED	1 No
	XVII. 5/2-way single solenoid valve	with manual override and LED	1 No
	VIII. 5/2-way double solenoid valve	with manual override and LED	1 No
	XIX. Power supply unit,	Input voltage 85 – 265 V AC, Output voltage: 24 V DC, Output current: max. 4.5 A, short-circuit-proof.	1 No
	XX. Profile plate, Anodised Aluminium	1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the pneumatic workstation)	1 sets
3	Pneumatic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide:	(1) Work Table – Size(Approx.) L1200mmXW900mmXH900mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) - L470mmxW495mmxH825mm and (3) Drawer slide height (Approx.) 85mm.	1 No
4	Carrier for mounting components, such as PB & relay boxes.		1 No
5	Cut section model for pneumatic components		1 set
6	Hydraulic Trainer Kit, each consisting of the following matching components and accessories:		01 set
	I. Hydraulic Power pack	with (1) external gear pump having a delivery rate of 2.5 lpm, (approx.) @ 1400 rpm operating pressure 60 bar, coupled to a single-phase AC motor (230 V AC) having start capacitor and	1 No.

			ON/OFF switch and overload protection, (2) pressure relief valve adjustable from 0 – 60 bar, (3) oil reservoir, ≥5 litres capacity having sight glass, drain screw, air filter, and P and T ports.	
	II.	Pressure relief valve	pilot-operated	1 No
	III.	Drip tray, steel	size 1160 mm x 760 mm.	1 No.
	IV.	Pressure Gauge	Glycerin-damped, Indication range of: 0 – 100 bar	1 No.
	V.	Four-Way distributor	with five ports, equipped with a pressure gauge	1 No.
	VI.	Double acting hydraulic cylinder	with a control cam, Piston diameter16 mm, Piston rod diameter10 mm, Stroke length 200 mm.	1 No.
	VII.	Suitable Weight	for vertical loading of hydraulic cylinder	1 No.
	VIII.	Mounting kit for weight	for realizing pulling and pushing load.	1 No.
	IX.	3/2-way directional control valve	with hand lever actuation.	1 No.
	X.	4/2-way directional control valve	with hand lever actuation.	1 No.
	XI.	4/3-way directional control valve	closed-centre position, with hand lever actuation.	1 No.
	XII.	Non-return valve.		1 No.
	XIII.	Pilot-operated check valve	pilot to open.	1 No.
	XIV.	One-way flow control valve	with integrated check valve.	1 No.
	XV.	T-Connector with self sealing coupling nipples (2 Nos.) and quick coupling socket (1 No.).		2 Nos.
	XVI.	Profile plate,	Anodised Aluminium, 1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the Hydraulic workstation)	1 set
7	Hydraulic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide:		(1) Work Table – Size(Approx.) L1200mmXW900mmXH900mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) - L470mmxW495mmxH825mm and	1 No

		(3) Drawer slide height (Approx.) 85mm.	
8	Cut-section models for hydraulic components		1 set

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *For items under #G (LIST OF TOOLS & ACCESSORIES FOR PNEUMATICS AND HYDRULICS), may be installed in the existing workshop for units upto 8(4+4). For units beyond 8(4+4), separate room (having area: 20sq. m) for installation of these items is essential.*

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - *Above Tools & Equipments not required, if Computer LAB is available in the institute.*		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :		**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :		**Date of Assessment :**
Name & Address of the Industry :		**Assessment location: Industry / ITI**
Trade Name :	**Semester:**	**Duration of the Trade/course:**
Learning Outcome:		

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														