Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"

Course Contents/ Lesson Plan

Course Title: Sheet Metal Technology

Duration: 6 Months

Course Details / Description & Preliminaries

Course Title	Sheet Metal Technology
Objectives and Expectations	**Employable skills through an intensive course on Sheet Metal Technology** This is a special course designed to address unemployment in the youth. The course aims to achieve the above objective through hands on practical training delivery by a team of dedicated professionals having rich market/work experience. This course is therefore not just for developing a theoretical understanding/back ground of the trainees. Contrary to that it is primarily aimed at equipping the trainees to perform commercially in a market space in independent capacity or as a member of a team. The course therefore is designed to impart not only technical skills but also soft skills (i.e. interpersonal/communication skills; personal grooming of the trainees etc.) as well as entrepreneurial skills (i.e. marketing skills; free lancing etc.). The course also seeks to inculcate work ethics to foster better citizenship in general and improve the image of Pakistani work force in particular. **Main Expectations:** In short, the course under reference should be delivered by professional instructors in such a robust hands- on manner that the trainees are comfortably able to employ their skills for earning money (through wage/self-employment) at its conclusion. This course thus clearly goes beyond the domain of the traditional training practices in vogue and underscores an expectation that a market centric approach will be adopted as the main driving force while delivering it. The instructors should therefore be experienced enough to be able to identify the training needs for the possible market roles available out there. Moreover, they should also know the strengths and weaknesses of each individual trainee to prepare them for such market roles during/after the training. **i.** Specially designed practical tasks to be performed by the trainees

Key Features of Training& Special Modules	have been included in the Annexure-I to this document. The record of all tasks performed individually or in groups must be preserved by the management of the training Institute clearly labeling name, trade, session etc so that these are ready to be physically inspected/verified through monitoring visits from time to time. The weekly distribution of tasks has also been indicated in the weekly lesson plan given in this document. **ii.** In order to materialize the main expectations, a special module on **Job Search & Entrepreneurial Skills** has been included in the later part of this course (5^{th} & 6^{th} month) through which, the trainees will be made aware of the Job search techniques in the local as well as international job markets (Gulf countries). Awareness around the visa process and immigration laws of the most favored labor destination countries also forms a part of this module. Moreover, the trainees would also be encouraged to venture into self-employment and exposed to the main requirements in this regard. It is also expected that a sense of civic duties/roles and responsibilities will also be inculcated in the trainees to make them responsible citizens of the country. **iii.** A module on **Work Place Ethics** has also been included to highlight the importance of good and positive behavior at work place in the line with the best practices elsewhere in the world. An outline of such qualities has been given in the Appendix to this document. Its importance should be conveyed in a format that is attractive and interesting for the trainees such as through PPT slides +short video documentaries. Needless to say that if the training provider puts his heart and soul into these otherwise non-technical components, the image of Pakistani workforce would undergo a positive transformation in the local as well as international job markets. In order to maintain interest and motivation of the trainees throughout the

Training Tools/ Methodology	course, modern techniques such as: • Motivational lectures • Success stories • Case studies These techniques would be employed as an additional training tool wherever possible (these are explained in the subsequent section on Training Methodology). Lastly, evaluation of the competencies acquired by the trainees will be done objectively at various stages of the training and proper record of the same will be maintained. Suffice to say that for such evaluations, practical tasks would be designed by the training providers to gauge the problem solving abilities of the trainees. **(i) Motivational Lectures** The proposed methodology for the training under reference employs motivation as a tool. Hence besides the purely technical content, a trainer is required to include elements of motivation in his/her lecture to inspire the trainees to utilize the training opportunity to the full and strive towards professional excellence. Motivational lectures may also include general topics such as the importance of moral values and civic role & responsibilities as a Pakistani. A motivational lecture should be delivered with enough zeal to produce a deep impact on the trainees. It may comprise of the following: • Clear Purpose to convey message to trainees effectively. • Personal Story to quote as an example to follow. • Trainees fit so that the situation is actionable by trainees and not represent a just idealism. • Ending Points to persuade the trainees on changing themselves. A good motivational lecture should help drive creativity, curiosity and spark the desire needed for trainees to want to learn more. Impact of a successful motivational strategy is amongst others commonly visible in increased class participation ratios. It increases the trainees' willingness to be engaged on the practical tasks for longer time without boredom and loss of

interest because they can clearly see in their mind's eye where their hard work would take them in short (1-3 years); medium (3 -10 years) and long term (more than 10 years).

As this tool is expected that the training providers would make arrangements for regular well planned motivational lectures as part of a coordinated strategy interspersed throughout the training period as suggested in the weekly lesson plans in this document.

(ii) Success Stories

Another effective way of motivating the trainees is by means of Success Stories. Its inclusion in the weekly lesson plan at regular intervals has been recommended till the end of the training.

A success story may be disseminated orally, through a presentation or by means of a video/documentary of someone that has risen to fortune, acclaim, or brilliant achievement. A success story shows how a person achieved his goal through hard work, dedication and devotion. An inspiring success story contains compelling and significant facts articulated clearly and easily comprehendible words. Moreover, it is helpful if it is assumed that the reader/listener knows nothing of what is being revealed. Optimum impact is created when the story is revealed in the form of:-

- Directly in person (At least 2-3 cases must be arranged by the training institute)
- Through an audio/ videotaped message (2-3 high quality videos must be arranged by the training institute)

It is expected that the training provider would collect relevant high quality success stories for inclusion in the training as suggested in the weekly lesson plan given in this document.

Suggestive structure and sequence of a sample success story and its various shapes can be seen at annexure III.

(iii) Case Studies

Where a situation allows, case studies can also be presented to the trainees to

	widen their understanding of the real life specific problem/situation and to explore the solutions. In simple terms, the case study method of teaching uses a real life case example/a typical case to demonstrate a phenomenon in action and explain theoretical as well as practical aspects of the knowledge related to the same. It is an effective way to help the trainees comprehend in depth both the theoretical and practical aspects of the complex phenomenon in depth with ease. Case teaching can also stimulate the trainees to participate in discussions and thereby boost their confidence. It also makes class room atmosphere interesting thus maintaining the trainee interest in training till the end of the course. Depending on suitability to the trade, the weekly lesson plan in this document may suggest case studies to be presented to the trainees. The trainer may adopt a power point presentation or video format for such case studies whichever is deemed suitable but it's important that only those cases are selected that are relevant and of a learning value. The Trainees should be required and supervised to carefully analyze the cases. For the purpose they must be encouraged to inquire and collect specific information / data, actively participate in the discussions and intended solutions of the problem / situation. **Case studies can be implemented in the following ways:-** i. A good quality trade specific documentary(At least 2-3 documentaries must be arranged by the training institute) ii. Health & Safety case studies(2 cases regarding safety and domestic accidents must be arranged by the training institute) iii. Field visits(At least one visit to a trade specific major industry/ site must be arranged by the training institute)
Learning Outcome of the Course	By the end of the course the trainees will be able to have following competencies and skills. • Supervise, train and coach apprentices. • Use and maintain hand and power tools to the standards of competency and safety required in the trade. • Apply the correct principles of sheet metal pattern development using

	triangulation, parallel line, and radial line development. • Read and use blueprints and specifications to estimate, fabricate and install sheet metal items. • Fabricate and install, safely and efficiently, fume and dust exhaust systems, ventilation, heating and air-conditioning systems and equipment for restaurants, hospitals, dairies, breweries, etc. • Know, and be able to apply their knowledge of the advantages and limitations of various types of sheet metal used in the trade including non-metallic materials such as plastics. • Know, and be able to apply their knowledge of the installation, and service of gas piping systems, HVAC appliances and equipment in accordance with local, provincial and national standards for the industry. • Apply standards and regulations of propane and natural gas in order to provide the maximum of safety. • Co-ordinate sheet metal work with other trades on the job site. • Perform all sheet metal related tasks expected of a certified journeyperson.
Course Execution Plan	Total duration of course: **6 months (26 Weeks)** Class hours: **4 hours per day** Theory: **20%** Practical: **80%** Weekly hours: **20 hours per week** Total contact hours: **520hours**
Companies Offering Jobs in the respective trade	National and international scope in food, agriculture, aviation, marine etc.
Job Opportunities	A sheet metal technician interprets drawings, develops suitable patterns, cuts and forms sheet materials into complex shapes and assemblies both manually and by machine. He or she works in a range of materials including ferrous and non-ferrous materials and therefore needs to understand the joining and fastening of all of these materials. Sheet metal technician work in factories and workshops specifically equipped with a range of hand tools, power tools and

	specialist machines capable of forming and assembling sheet metal into simple and complex shapes. Sheet metal workers interpret drawings and transfer dimensions to sheet materials and sections to meet the required specification. Sheet metal workers develop patterns both manually and using CAD to allow materials to be formed into the correct shapes. Formed panels are sometimes connected to box section frameworks to form assemblies to suit the required purpose. Sheet metal workers may be required to programme forming and shaping machinery and operate this machinery to fabricate accurately shaped panels and assemblies. A sheet metal worker will need to be proficient in a range of joining and fastening processes including metal active gas, Tungsten Inert Gas and resistance spot welding processes. Assemblies can be arranged using hot work processes or cold fixings such as riveting, screwing and bonding. A sheet metal worker will manually assemble, dress and finish sheet metal panels and assemblies using a range of hand and bench tools. A sheet metal worker will be able to operate all types of welding equipment, manual and CNC forming equipment, sheet metal hand fabrication and dressing tools as well as a range of power operated tools. A sheet metal worker will use a computer to develop patterns for machine use as well as manually developing simple patterns on a drawing board. Sheet metal workers serve a wide range of sectors including the marine, aviation, food with title • Sheet metal mechanic • Sheet metal installer • Sheet metal fabricator • Sheet metal production worker • Journeyman Sheet Metal Commercial HVAC Installation Tech • Aircraft Sheet Metal Technician • Shop worker • Sheet metal worker
No of Students	25

Learning Place	Classroom / Lab / Workshop
Instructional Resources	https://tradesecrets.alberta.ca/SOURCES/PDFS/course_outlines/011_outline.pdf https://www.collegeoftrades.ca/wp-content/uploads/Curriculum-Sheet-Metal-Worker-Level-1-2-3-ENG.km-.pdf https://www.collegeoftrades.ca/wp-content/uploads/M_Sheet-Metal-Worker-308A-EN-TS.pdf Guidelines for course outline development

WEEKLY SCHEDULE OF TRAINING

Scheduled Week	Module Title	Learning Units	Remarks
Week 1	**Introduction of training related to Sheet metal work technology**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* ● Course Introduction ● Job market ● Course Applications ● Institute/work ethics ● Survey career opportunities ● Survey industry requirements for each career path ● Discuss how metal worker trade works with other mechanical trades ● Various specialties within the industry of metal worker trade ● An understanding of metal worker role in industries ● See real-time examples of metal worker trade	**Task-1** **Task-2** (Details may be seen at Annexure-I)
Week 2	**Basic safety related to trade**	**Success stories (***For further detail please see Page No: 3& 4)* ● Safety Legislation, Regulations & Industry Policy in the Trades ● OHS standards ● Hazardous Materials & Fire Protection ● Types of PPE ● Electrical safety ● Sheet Metal handling Safety ● Use of ladders, scaffold and lifts ● Welding safety ● Climbing, Lifting, Rigging and Hoisting ● Emergency situation	**Task-3** (Details may be seen at Annexure-I)

Week 3	**Basic Measurement**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* • Basic units • Unit system • Units conversion • Standard size of different sheets	**Task-4** (Details may be seen at Annexure-I) **Home Assignment-1** (Details may be seen at Annexure-II)
Week 4	**Tool & equipment for fabrication**	**Success stories (***For further detail please see Page No: 3& 4)* Students are introduced to learn: • Hand and Power Tools • Marking and cutting tools • Precision tools • Bench Machines • Floor, Portable and Power Shop Equipment • Materials, Valves, Welded Pipe and Fittings • Joints, Seams, Fasteners, Sealants and Insulation • Plastic Pipe and Tube	**Task-5** (Details may be seen at Annexure-I) **Monthly Test 1**
Week 5	**Introduction to Technical Drawing**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to use the • Importance of Technical Drawing. • Symbols of engineering terminology. • Uses of technical Drawing tools • Type of Drawing • Application of Technical drawing • Rules for lettering system • Types of lines • Circle and its parts • Different triangles • Introduction to sketching techniques. • Different engineering curves(Parabola, hyperbola, ellipse, spiral	**Task-6** **Task-7** (Details may be seen at Annexure-I)

		curve, cycloid etc.) • Multiview drawing(orthographic projection, oblique, isometric, prism, cone and pyramid)	
Week 6	**Basic workshop**	**Success stories (***For further detail please see Page No: 3& 4)* Students are introduced to learn: • Perform metal/bench work • Perform cutting operations with common methods and machines for sheet metal trade • Perform Grinding operation	**Task-8** (Details may be seen at Annexure-I)
Week 7	**Drill and drill machine operations**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to learn: • Safety precautions. • Procedure of setting up of drilling machine. • Safe procedure for operating drilling machines. • Types of drilling machines. • Selecting and adjusting speed and feed of drilling machine. • Importance of coolants in drilling operations. • Methods and techniques of quality checks. • Different types of drilling tools and their implications. • Importance of selecting right drilling tool for the job specifications. • Methods and techniques for positioning the work-piece in the drill to ensure proper alignment and stability during drilling.	**Task-9** (Details may be seen at Annexure-I) **Home Assignment-2** (Details may be seen at Annexure-II)
Week 8	**Basic Welding operations**	**Success stories (***For further detail please see Page No: 3& 4)* • Explain various types of welding processes • Explain various welding positions • Demonstrate the method to correctly wear PPE	**Task-10** **Task-11** **Task-12** (Details may

		• Explain Specifications/ classification of electrode/s required for the job • Define Electrical parameters like (voltage, current etc.) and their effects on weld • Explain Welding techniques as per WPS/instruction sheet • Describe Welding procedure specifications (WPS) • Describe Method of Pre- heating of base metal • Define types of flame (carburizing flame, neutral flame and oxidizing flame etc.) • Describe types of joint lap joint, Tee joint, Corner joint and Butt joint) • Explain Polarity setting according to standard specifications • Define Visual welding defects • Describe Welding codes and standards • Identify various gases/combination of gases for shielding	be seen at Annexure-I) **Monthly Test 2**
Week 9	**Soldering and brazing operations**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* • Difference between soldering and brazing • Purpose of soldering and brazing • Soldering operations and techniques • Brazing operations and techniques	**Task-13** (Details may be seen at Annexure-I)
Week 10	**DUCT CONSTRUCTION USING SIMPLE AND CONICAL LINE PATTERN DEVELOPMENT**	**Success stories (***For further detail please see Page No: 3& 4)* Students are introduced to: • Use geometry and calculations • Develop simple patterns for sheet metal projects • Fabricate conical items • Use welding and cutting processes in sheet metal fabrication • Use soldering processes in sheet metal fabrication. • Learn fabrication of rectangular	**Task-14** (Details may be seen at Annexure-I)

		HVAC duct line using simple layout	
Week 11	**RESIDENTIAL HVAC DRAWINGS**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to: • Develop orthographic drawings for sheet metal fabrication. • Develop pictorial drawings for sheet metal and gas line fabrication • Interpret Drawing Components and symbols • HVAC Drawings(mechanical drawings) • Residential HVAC Components and Material Takeoff	**Task-15** (Details may be seen at Annexure-I)
Week 12	**RESIDENTIAL HVAC INSTALLATION**	**Success stories (***For further detail please see Page No: 3& 4)* Students are introduced to: • Residential Heating Systems and Equipment • Interpret codes and regulations that apply to sheet metal and gas line installations. • Principles of Indoor Air Quality • Indoor Air Quality Equipment	**Task-16** **Task-17** (Details may be seen at Annexure-I)
	Build your CV	Download professional CV template from any good site (https://www.coolfreecv.com or relevant) • Add Personal Information • Add Educational details • Add Experience/Portfolio • Add contact details/profile links	
Week 13	**Overview of the previous weeks & Mid Term Examination**		
Week 14	**FABRICATION USING PARALLEL LINE PATTERN**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to: • Define terms used in parallel line development.	**Task-18** **Task-19** **Task-20** (Details may

	DEVELOPMENT	• Describe principles of parallel line development. • Identify items that can be laid out using parallel line pattern development. • Transitional Fitting Fabrication • Round Fitting Fabrication • Mild Steel GMAW Welding	be seen at Annexure-I)
Week 15	**LIGHT COMMERCIAL HVAC**	**Success stories (***For further detail please see Page No: 3& 4)* Students are introduced to: • Multi Equipment Systems • Smoke and Fire Containment • Roofing and Building Envelope Penetrations • Types of pumps and their applications • Describe the operation of boiler controls. • List the sequencing process of the boiler controls. •	**Task-21** **Task-22** **Task-23** **Task-24** (Details may be seen at Annexure-I) **Home Assignment-3** (Details may be seen at Annexure-II)
	Create an account profile on Fiverr (at least two gigs) and Upwork	Create an account by following these steps: Step 1: Personal Info Step 2: Professional Info Step 3: Linked Accounts Step 4: Account Security	
Week 16		**Motivational Lecture (For** *further detail please see Page No: 3& 4)* • Describe principles of natural ventilation. • Describe natural ventilation devices. • Describe natural ventilation openings and exhaust outlets. • Energy Efficient Buildings	

Week 17	**HVAC HEATING APPLIANCE INSTALLATION-I**	**Success stories (***For further detail please see Page No: 3& 4)* ● Explain electron flow. ● Describe various electrical circuits. ● Calculate Ohm's law. ● Use electrical measuring equipment. ● Identify types of test equipment. ● Describe settings for electrical testing equipment. ● Use test equipment to service appliances. ● Pilots, Thermocouples and Thermopile ● Wiring Diagrams	**Task-25** **Task-26** **Task-27** (Details may be seen at Annexure-I)
Week 18		**Motivational Lecture (For** *further detail please see Page No: 3& 4)* ● Matter, Density and Relative Density ● Pressure and Atmosphere ● Properties of Gas ● Temperature and Heat ● Gas System Components ● Pipe Sizing and gas piping ● Pipe Installation and Pressure Testing	**Monthly Test 3**
Week 19	**HVAC HEATING APPLIANCE INSTALLATION-II**	**Success stories (***For further detail please see Page No: 3& 4)* ● Appliance Venting and Installer Responsibilities ● Furnace Commissioning and Maintenance ● Propane Storage and Handling Systems	**Task-28** **Task-29** **Task-30** (Details may be seen at Annexure-I) **Home Assignment-4** (Details may be seen at Annexure-II)

Week 20	**GTAW WELDING AND PLASMA CUTTING**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to: ● Computerized Layouts and Plasma Cutting ● Gas Tungsten Arc Welding (GTAW) ● Aluminum Fabrication ● Stainless Steel Fabrication	**Task-31** **Task-32** **Task-33** (Details may be seen at Annexure-I) **Monthly Test 4**
Week 21	**DUCT CONSTRUCTION USING TRIANGULATION PATTERN DEVELOPMENT**	**Success stories (***For further detail please see Page No: 3& 4)* ● Triangulation Pattern Development ● Medium Pressure Duct Fabrication	**Task-34** (Details may be seen at Annexure-I)
Week 22	**COMMERCIAL HVAC-I**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* Students are introduced to: ● Air Flow techniques ● Heat Loss and Heat Gain calculations ● Residential HVAC Design ● Commercial Duct Designs ● Multi Zone Equipment ● List all parts of an HVAC installation.	**Task-35** (Details may be seen at Annexure-I)
	How to search and apply for jobs in at least two labor marketplace countries (KSA, UAE, etc.)	● Browse the following website and create an account on each website. ▪ Bayt.com – The Middle East Leading Job Site ▪ Monster Gulf – The International Job Portal ▪ Gulf Talent – Jobs in Dubai and the Middle East ● Find the handy 'search' option at the top of your homepage to search for the	

		jobs that best suit your skills. • Select the job type from the first 'Job Type' drop-down menu, next, select the location from the second drop-down menu. • Enter any keywords you want to use to find suitable job vacancies. • On the results page you can search for part-time jobs only, full-time jobs only, employers only, or agencies only. Tick the boxes as appropriate to your search. • Search for jobs by: ▪ Company ▪ Category ▪ Location ▪ All jobs ▪ Agency Industry	
Week 23	**COMMERCIAL HVAC-II**	**Success stories (***For further detail please see Page No: 3& 4)* ● Commercial Installation ● Mechanical Air Movement and Control ● Describe the operation of commercial heating systems. ● Describe the operation of commercial cooling systems. ● Describe the operation of make-up air systems. ● Describe the operation of exhaust systems. ● Describe the operation of ventilation systems. ● Describe sound attenuation and the methods used in reducing sound transmission. ● Describe materials used in sound attenuation and their application. ● Describe the effects of sound attenuation on air flow. ● Describe the purpose and types of various air filtering devices. ● Describe air cleaning techniques. ● Identify air cleaning equipment.	**Task-3**6 (Details may be seen at Annexure-I)

		● Describe methods used to measure filter efficiency. ● Describe methods used to control humidity. ● Describe methods used to control bacteria, germ, and volatile organic compounds	
Week24	**ADVANCE FABRICATION**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* ● Radial Line Pattern Development ● Pattern Development Short Cuts ● Cladding and Lagging	**Task-37** (Details may be seen at Annexure-I)
Week25	**REFRIGERATION**	**Success stories (***For further detail please see Page No: 3& 4)* ● Refrigerant and Oil Handling ● Split Systems installation	**Task-38** (Details may be seen at Annexure-I)

Week 26	**Entrepreneurship and Final Assessment in project**	**Motivational Lecture (For** *further detail please see Page No: 3& 4)* • Job Market Searching • Self-employment • Introduction • Fundamentals of Business Development • Entrepreneurship • Startup Funding • Business Incubation and Acceleration • Business Value Statement • Business Model Canvas • Sales and Marketing Strategies • How to Reach Customers and Engage CxOs • Stakeholders Power Grid • RACI Model, SWOT Analysis, PEST Analysis • SMART Objectives • OKRs • Cost Management (OPEX, CAPEX, ROCE etc.)	
	Projects & Final Assessment		

Annexure-I

Note: The following tasks are required to be performed multiple times by each trainee/group until sufficient proficiency level is acquired. The trainer is required to determine the number of times, each task needs to be repeated by a trainee as per his/her low/medium/high level of skill and proficiency during any stage of the course.

TASKS FOR ADVANCE ELECTRONICS AND POWER SYSTEM

Task No.	Task	Description	Week
1.	**Find the career path**	Prepare a career path related to your course and also highlight the emerging trends in the local as well as international market	**Week-1**
2.	**Work Ethics**	Generate a report on Institute work ethics and professionalism related to your course	
3.	**Safety**	Describe hazards associated with sheet metal tooling and equipment. Use PPE for climbing, lifting and load moving equipment.	**Week-2**
4.	**Measurements**	Covert different unit system into each other.	**Week-3**
5.	**Tools and equipment handling**	Perform joining, seaming, fastening, sealing and insulation processes. Calculate bend allowance and mean diameters for various thicknesses of metal.	**Week-4**
6.	**Construct different engineering curves**	Construct inscribe and circumscribe figures. Construct Tangents of circles (Inside & Outside) Construct a Archimedean Spiral curve Construct a ellipse,hyperbola and parabola https://www.slideshare.net/vagallasuresh/unit-1-engineering-curves-15901367	**Week 5**

		Teaching Material for help	
7.	**Construct Multiview drawings**	Sketch Orthographic projection in 1st angle of Projection Sketch Orthographic projection 3rd angle of Projection Sketch Oblique Drawing of given shape Sketch isometric Drawing of any given sample http://www.mhhe.com/engcs/drawgr/bertolinetgc/etext/chapt08.pdf Teaching Material for help	
8.	**Basic workshop**	Give a small project which includes bench work, cutting and grinding operation at basic level	**Week 6**
9.	**Drilling**	Perfrom drilling technique on any given part of different material and note down the difference.	**Week 7**
10.	**Oxy Acetylene Welding**	Perform oxy acetylene welding techniques to make tee, lap and butt joint.	**Week 8**
11.	**GAS welding**	Perform Gas Welding On Mild Steel Plates (1F)	
12.	**SMAW welding**	Make Fillet Welds on Carbon Steel Plate by using SMAW	
13.	**Soldering and brazing**	Perform soldering and brazing on given parts	**Week 9**
14.	**Fabricate a rectangular HVAC duct line using simple layout.**	• Fabricate rectangular duct fittings. • Fabricate rectangular flex connectors. • Assemble fittings to form duct lines. • Apply installation codes and standards to residential construction. • Install a rectangular duct line. • Install supplied round fittings to a rectangular duct line.	**Week 10**
15.	**Install residential duct systems.**	• Install supply air components of an HVAC system. • Install return air components of an HVAC system. • Install components of an under slab heating	**Week 11**

		system. • Install components used to exhaust and support combustion. • Install components used to ventilate residential buildings. 6. Identify how system components effect air movement in low pressure duct systems. • Install zoning components related to low pressure duct systems. • Understand process for developing a material takeoff list. • Develop a material takeoff list from a drawing.	
16.	**Calculate properties related to Indoor air quality**	• Measure temperature and relative humidity and apply the effects on indoor air quality.	
17.	**Install residential indoor air quality equipment**	• Describe the operation of air filtering methods and equipment. Describe the operation of air ventilation methods and equipment. • Describe the operation of air circulation methods and equipment. • Describe the maintenance of IAQ equipment. • Install residential ventilator. • Commission a ventilator.	**Week 12**
18.	**Develop parallel net development**	• Develop net patterns using parallel line development. • Develop net patterns for right and oblique cylinders.	
19.	**Transitional and round fitting fabrication**	• Fabricate a transitional fitting with a minimum one flat side from an appliance to plenum. • Fabricate round fittings using parallel line pattern development.	**Week 14**
20.	**Mild steel GMAW welding**	• Perform GMAW on a round fitting. • Identify weld faults. • Repair weld faults.	
21.	**Interpret multifamily and multi equipment system drawings.**	• Identify components of a multi equipment system. • Identify components of a multi equipment system from a drawing. • Produce a material take off complete with shop drawings.	
22.	**Install smoke and fire containment.**	• Identify codes and regulations pertaining to smoke and fire containment devices.	**Week 15**

		• Install fire dampers. • Install fire stop flaps	**&**
23.	**Boiler control**	• Apply standards from CSA B149.1, ASME and CSA B51. • List the sequencing process of the boiler controls. • Sketch wiring diagrams for a gas fired boiler. • Troubleshoot a gas fired boiler.	**Week 16**
24.	**Natural ventilation system**	• Design natural ventilation systems used in agricultural and industrial building designs.	
25.	**Calculate basic properties related to HVAC heating installation**	• Use test equipment to service appliances. • Troubleshoot pilots, thermocouples and thermopiles. • Interpret millivolt wiring diagrams. • Interpret 24 volt wiring diagrams. • Calculate mass and density using relative densities. • Perform pressure and force calculations in both imperial and metric units. • Perform calculations to convert absolute, gauge and mercury pressures. • Calculate combustion air requirements for heating appliances.	**Week 17** **&** **Week 18**
26.	**Install and service gas line components.**	• Calculate vent sizing of reliefs. • Clock a meter at low pressure. • Clock a meter at high pressure. • Troubleshoot a regulator.	
27.	**Install and test a gas line system.**	• Compile a materials list for a gas line. • Apply standards for CSA B149.1. • Install a gas line. • Test a gas line	
28.	**Venting**	• *Install appliance venting*	**Week 19**
29.	**Furnace commissioning**	• *Perform furnace commissioning.*	
30.	**Propane storage**	• *Install and service propane storage and handling systems.*	
31.	**Use computerized plasma cutting equipment.**	Input duct fitting information to a plasma cutting machine. Operate a plasma cutting machine. Cut a medium pressure duct project on a plasma table.	**Week 20**

32.	**Join projects using Gas Tungsten Arc Welding equipment.**	Set-up and operate the equipment for GTAW. Produce GTAW welds on mild steel, aluminum and stainless steel. Troubleshoot welding problems associated with GTAW.	
33.	**Fabricate items using aluminum and stainless steel**	Fabricate an aluminum project with welded seams. Construct a stainless steel project with GTAW joints. Demonstrate finishing techniques on a stainless steel project	
34.	**DUCT CONSTRUCTION USING** **TRIANGULATION PATTERN DEVELOPMENT**	● **Medium Pressure Duct Fabrication** ● Develop patterns and fabricate two way Plenum Transitions for a medium pressure duct line. ● Develop patterns and fabricate Transition Change Elbows for a medium pressure duct line. ● Develop patterns and fabricate Rectangular Elbows with turning vanes for a medium pressure duct ● line. ● Develop patterns and fabricate Rectangular to Round Transition for a medium pressure duct line. ● Fabricate Pipe Tees and Conical Tees for a medium pressure duct line from plasma cut supplied ● patterns. ● Fabricate Round Pipe Reducers for a medium pressure duct line from plasma cut supplied ● patterns. ● Fabricate Round Y Branches for a medium pressure duct line from plasma cut supplied patterns. ● Fabricate Round Tapering Offsets for a medium pressure duct line from plasma cut supplied ● patterns. ● Fabricate fittings for a medium pressure duct system with welded joints and seams. ● Assemble a medium pressure duct line. ● Install a sealed medium pressure duct line. ● Perform a pressure test on a medium pressure duct line.	**Week 21**

35.	**COMMERCIAL HVAC INSTALLATION-I**	***Test systems for air flow.*** ***Perform heat loss and heat gain calculations.*** Design a residential air distribution system. Design a small commercial air distribution system using the Sheet Metal & Air Conditioning Contractors'' National Association (SMACNA) standards Generate a material list from a large commercial HVAC drawing. 2. Develop strategies to complete a mechanical room from drawings and onsite measurements.	**Week 22**
36.	**COMMERCIAL HVAC INSTALLATION-I**	Apply installation codes and standards to commercial construction. Generate a complete material list from a light commercial HVAC drawing. Install components of a commercial duct line from a drawing. Interpret fan performance graphs and curves.	**Week 23**
37.	**Advance fabrication**	Develop patterns using radial line pattern development. Describe the techniques necessary to calculate a mitre at a job site.	**Week 24**
38.	**Refrigeration**	Demonstrate recovery and disposal of refrigerants. Demonstrate recovery and disposal of refrigeration oils. Demonstrate leak testing methods and instruments used. Demonstrate the evacuation process of split systems. Demonstrate maintenance procedures of recovery and evacuation equipment. Install split air conditioning systems	**Week 25**

Annexure-II

Home Assignment

Designing Effective Homework

To achieve a positive impact on student learning, homework assignments must be well-designed and carefully constructed. Some specific research findings include:

- ► Homework is most effective when it covers material already taught.
- ► Homework is most effective when it is used to reinforce skills learned in previous weeks or months.
- ► Homework is less effective if it is used to teach complex skills.

Characteristics of Good Assignments

When teachers plan homework, they should consider the characteristics listed below:

- ► Provide clear instructions for students;
- ► Can be completed successfully;
- ► Are not too long;
- ► Can be completed within a flexible time frame;
- ► Use information and materials that are readily available;
- ► Reinforce and allow practice of previously taught skills;
- ► Must not be unfinished class work;
- ► Are interesting to students and lead to further exploration and study;
- ► Stimulate creativity and imagination in the application of skills;
- ► Stimulate home and class discussion

Homework Don'ts

Do not assign homework that:

- ► Is unfamiliar, boring or impossible to do
- ► Requires complex skills or requires unreasonable time frames
- ► Is a "time filler" to keep students busy or a punishment for not doing class work
- ► Do not wait until the last minute to organize and assign the *homework (You may give useless or impossible tasks and/or giving inadequate directions)*
- ► Do not assume that all homes have equal resources, that all parents have equal skills and talents to support their children as learners
- ► Do not collect any homework you do not intend to check, review or grade.
- ► Do not assign homework that is so difficult and unfamiliar to students that their parents are tempted to:
    - Do the work for them;
    - Accuse their children of being inattentive in class; or
    - Accuse their children of failing.

Annexure-III

PCB Design & Manufacturing

What is freelancing and how you can make money online - BBCURDU

https://www.youtube.com/watch?v=9jCJN3Ff0kA

What Is the Role of Good Manners in the Workplace? By Qasim Ali Shah | In Urdu

https://www.youtube.com/watch?v=Qi6Xn7yKIlQ

Hisham Sarwar Motivational Story | Pakistani Freelancer

https://www.youtube.com/watch?v=CHm_BH7xAXk

21 Yr Old Pakistani Fiverr Millionaire | 25-35 Lakhs a Month Income | Interview

https://www.youtube.com/watch?v=9WrmYYhr7S0

Failure to Millionaire - How to Make Money Online | Fiverr Superhero Aaliyaan Success Story

https://www.youtube.com/watch?v=d1hocXWSpus

Annexure-IV

Workplace/Institute Ethics Guide

Work ethic is a standard of conduct and values for job performance. The modern definition of what constitutes good work ethics often varies. Different businesses have different expectations. Work ethic is a belief that hard work and diligence have a moral benefit and an inherent ability, virtue or value to strengthen character and individual abilities. It is a set of values centered on importance of work and manifested by determination or desire to work hard.

The following ten work ethics are defined as essential for employee's success:

1. **Attendance:**
   Be at work every day possible, plan your absences don't abuse leave time. Be punctual every day.
2. **Character:**
   Honesty is the single most important factor having a direct bearing on the final success of an individual, corporation, or product. Complete assigned tasks correctly and promptly. Look to improve your skills.
3. **Team Work:**
   The ability to get along with others including those you don't necessarily like. The ability to carry your own weight and help others who are struggling. Recognize when to speak up with an ideas and when to compromise by blend ideas together.
4. **Appearance:**
   Dress for success, set your best foot forward, personal hygiene, good manner, remember that the first impression of who you are, can last a life time
5. **Attitude:**
   Listen to suggestions and be positive, accept responsibility. If you make a mistake, admit it. Values workplace safety rules and precautions for personal and co-worker safety. Avoids unnecessary risks. Willing to learn new processes, systems and procedures in light of changing responsibilities.
6. **Productivity:**
   Do the work correctly, quality and timelines are prized. Get along with fellows, cooperation is the key to productivity. Help out whenever asked, do extra without being asked. Take pride in your

work, do things the best you know how. Eagerly focuses energy on accomplishing tasks, also referred to as demonstrating ownership. Takes pride in work.

7. **Organizational Skills:**

   Make an effort to improve, learn ways to better yourself. Time management; utilize time and resources to get the most out of both. Takes an appropriate approach to social interactions at work. Maintains focus on work responsibilities.

8. **Communication:**

   Written communication, being able to correctly write reports and memos. **Verbal communications,** being able to communicate one on one or to a group.

9. **Cooperation:**

   Follow institute rules and regulations, learn and follow expectations. Get along with fellows, cooperation is the key to productivity. Able to welcome and adapt to changing workplace situations and the application of new or different skills.

10. **Respect:**

    Work hard, work to the best of your ability. Carry out orders, do what's asked the first time. Show respect, accept and acknowledge an individual's talents and knowledge. Respects diversity in the workplace, including showing due respect for different perspectives, opinions and suggestions.

Annexure-V

Suggestive Format and Sequence Order of Success Story

S. No	Key Information	Detail/Description
1.	**Self & Family background**	• Self-introduction • Family background and socio economic status, • Education level and activities involved in • Financial hardships etc
2.	**How he came on board NAVTTC Training/ or got trained through any other source**	• Information about course, apply and selection • Course duration, trade selection • Attendance, active participation, monthly tests, interest in lab work
3.	**Post training activities**	• How job / business (self-employment) was set up • How capital was managed (loan (if any) etc). • Detail of work to share i.e. where is job or business being done; how many people employed (in case of self-employment/ business) • Monthly income or earnings and support to family • Earning a happy life than before
4.	**Message to others (under training)**	• Take the training opportunity seriously • Impose self-discipline and ensure regularity • Make Hard work pays in the end so be always ready for the same.

Note: Success story is a source of motivation for the trainees and can be presented in a number of ways/forms in a NAVTTC skill development course as under: -

1. To call a passed out successful person of institute. He/she will narrate his/her success story to the trainees in his/her own words and meet trainees as well.
2. To see and listen to a recorded video/clip (5 to 7 minutes) showing a successful person Audio video recording that has to cover the above mentioned points.
3. The teacher displays the picture of a successful trainee (name, trade, institute, organization, job, earning per month etc) and narrates his/her story in teacher's own motivational words.