

Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"



Course Contents / Lesson Plan

Course Title: Heavy Machine Mechanic

Duration: 6 Months

Revised Edition

Trainer Name	
Course Title	HEAVY MACHINE MECHANIC
Objectives and Expectations	<p>Employable skills and hands-on practice for Heavy Machine Mechanic</p> <p>This course is intended to provide sufficient theoretical knowledge and comprehensive skillset to build a great career in the field of Heavy Machine Mechanic in diagnosing, repairing and maintaining a variety of mechanical, hydraulic and electrical systems on City light and heavy gasoline and diesel power-driven vehicles and equipment; to perform preventive maintenance duties; and to perform a variety of technical tasks relative to assigned area of responsibility.</p> <p><u>Main Expectations:</u></p> <p>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.</p> <p>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 trainee to prepare them for such market roles during/after the training.</p> <ol style="list-style-type: none"> i. Specially designed practical tasks to be performed by the trainees 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. To materialize the main expectations, a special module on <u>Job Search & Entrepreneurial Skills</u> has been included in the latter part of this course (5th & 6th 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 form 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 in the workplace 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 the Pakistani workforce would undergo a positive transformation in the local as well as international job markets.

To maintain interest and motivation of the trainees throughout the 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 a 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 the 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.

The 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 a longer time without boredom and loss of interest because they can 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.

Course-related motivational lectures online link is available in **Annexure-II**.

(ii) Success Stories

Another effective way of motivating the trainees is using 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 using 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 comprehensible words. Moreover, it is helpful if it is assumed that the reader/listener knows nothing of what is being revealed. The 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 in **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 the classroom 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 be presented to the trainees. The trainer may adopt a PowerPoint presentation or video format for such case studies whichever is deemed suitable but only those cases must be selected that are relevant and of a learning value.

The Trainees should be required and supervised to carefully analyze the cases.

For this purpose, they must be encouraged to inquire and collect specific information/data, actively participate in the discussions, and intended solutions to the problem/situation.

Case studies can be implemented in the following ways: -

- i. A good quality trade-specific documentary (At least 2-3

	<p>documentaries must be arranged by the training institute)</p> <p>ii. Health & Safety case studies (2 cases regarding safety and industrial accidents must be arranged by the training institute)</p> <p>iii. Field visits(At least one visit to a trade-specific major industry/ site must be arranged by the training institute)</p>
Entry-level of trainees	Intermediate
Learning Outcomes of the course	<p>At the end of the course, the trainee must have attained the following competencies</p> <ul style="list-style-type: none"> • diagnose repair, and maintain by skills and knowledge gained through training and experience any of the working parts of diesel engines as well as the various components of mobile industrial equipment • use, competently, both hand and power tools in order to carry out repairs according to manufacturer's specifications • read and understand work orders, prepare estimates, and interpret technical manuals • write service reports, diagnose the cause of failures and keep service analysis records • when fully competent in all phases of general repairs, a Heavy Equipment Technician may specialize in any one of several areas of the trade such as, fuel pumps and injectors, track equipment, engine overhaul, hydraulic controls, power shift transmissions and allied equipment • outstanding individuals may advance to service representatives or supervisory positions • be familiar with the work in related trades such as Machinist and Welder • understand the fundamentals of operating a small business. • perform assigned tasks in accordance with quality and production standards required by industry.
Course Execution Plan	<p>The total duration of the course: 6 months (26 Weeks)</p> <p>Class hours: 4 hours per day</p> <p>Theory: 20%</p> <p>Practical: 80%</p> <p>Weekly hours: 20 hours per week</p> <p>Total contact hours: 520 hours</p>
Companies offering jobs in the respective trade	All national & multinational industries
Job Opportunities	A Heavy Machine Mechanic is a tradesperson who possesses the full range of knowledge, abilities and skills required to diagnose, repair, adjust, overhaul, maintain, operate and test the mobile, heavy duty machinery used in the construction, forestry, mining, petrochemical, material handling, landscaping, land clearing, transportation, road building and farming sectors. They can

	become: <ul style="list-style-type: none"> • construction equipment mechanic • diesel mechanic • farm equipment mechanic • heavy mobile logging equipment mechanic • heavy mobile mining equipment mechanic • heavy-duty equipment technician • tractor mechanic
No of Students	25
Learning Place	Classroom / Lab
Instructional Resources	<ul style="list-style-type: none"> • Multimedia, • White board • Board marker

MODULES

Scheduled Weeks	Module Title	Learning Units	Remarks
Week 1	Introduction	<p>Motivational Lecture (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Course Introduction • Job market • Course Applications • Institute/work ethics • Introduction to machinist • Safety Measures • Safety Signs • Hazard at Workplace • Various machining processes 	<p style="text-align: center;">Home Assignment</p> <ul style="list-style-type: none"> • Task 1 • Task 2 • Task 3 <p style="text-align: center;"><i>Details may be seen at Annexure-I</i></p>
Week 2	SUSPENSIONS, WHEELS AND SYSTEMS	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Frame and Suspension Fundamentals • Frame and Suspension Service • Bearings and Seals • Wheels, Tires, and Hubs • Trailer Systems and Components • Coupling Units Fundamentals and Service • Landing Gear Fundamentals and Service • Orientation to Trailer Inspection • Preventive Maintenance 	<ul style="list-style-type: none"> • Task 4 • Task 5 • Task 6 • Task 7 • Task 8 • Task 9 • Task 10 • Task 11 • Task 12 • Task 13 • Task 14 <p style="text-align: center;"><i>Details may be seen at Annexure-I</i></p>
Week 3	HYDRAULICS 1 AND HYDRAULIC BRAKE SYSTEMS	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Hydraulic Brake System Fundamentals • Hydraulic Brake System (Drum and Disc) • Hydraulic Brake System Diagnosis and Service • Hydraulic Brake Booster System Fundamentals and Service • Parking Brake System Fundamentals and Service • Electric Brake Fundamentals and Service • Hydraulic Fundamentals • Hydraulic System Components: Reservoir, Filters, Hoses and Coolers 	<ul style="list-style-type: none"> • Task 15 • Task 16 • Task 17 • Task 18 • Task 19 • Task 20 • Task 21 • Task 22 • Task 23 • Task 24 <p style="text-align: center;"><i>Details may be seen at Annexure-I</i></p>

		<ul style="list-style-type: none"> Hydraulic System Components: Pumps, Valves and Cylinders 	
Week 4	ELECTRICAL I AND ELECTRONICS I	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> Electrical Theory Electrical Circuits Magnetism Test Equipment Battery Fundamentals and Service Electrical Wiring, Lighting Circuits and Circuit Protection Basic Electronics Electronic Control Systems 	<ul style="list-style-type: none"> Task 25 Task 26 Task 27 Task 28 Task 29 Task 30 Task 31 Task 32 Task 33 Task 34 Task 35 Task 36 Task 37 <p><u>Details may be seen at Annexure-I</u></p> <p>Monthly Test 1</p>
Week 5	AIR BRAKES	<p>Motivational Lecture(For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> Air Brake System Fundamentals Air Brake System Mechanical Components Truck/Tractor Air Brake System Components Trailer Air Brake System Components Air Brake Testing and Service Air Antilock Brake System Fundamentals 	<ul style="list-style-type: none"> Task 38 Task 39 Task 40 Task 41 Task 42 Task 43 Task 44 Task 45 Task 46 <p><u>Details may be seen at Annexure-I</u></p>
Week 6	ENGINE FUNDAMENTAL, SERVICE AND REPAIR	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> Engine Fundamentals Engine Block and Cylinder Liner Fundamentals 	<ul style="list-style-type: none"> Task 47 Task 48 Task 49 Task 50 Task 51 Task 52 Task 53 Task 54

		<ul style="list-style-type: none"> • Engine Block and Cylinder Liner Service • Piston, Piston Rings and Connecting Rod Fundamentals • Piston, Piston Rings and Connecting Rod Service • Crankshaft, Bearings and Related Component Fundamentals • Crankshaft, Bearings and Related Component Service. • Camshaft and Follower Fundamentals • Camshaft and Follower Service • Cylinder Head Fundamentals • Cylinder Head Service • Engine Braking System Fundamentals and Service 	<ul style="list-style-type: none"> • Task 55 • Task 56 • Task 57 • Task 58 • Task 59 • Task 60 • Task 61 • Task 62 • Task 63 • Task 64 <p><u>Details may be seen at Annexure-I</u></p>
Week 7	ENGINE SYSTEMS	<p>Motivational Lecture (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Air Induction and Exhaust Systems • Turbo Charged Air Systems • Lubrication Systems and Crankcase Ventilation • Cooling Systems (Liquid and Air) 	<ul style="list-style-type: none"> • Task 65 • Task 66 • Task 67 • Task 68 • Task 69 <p><u>Details may be seen at Annexure-I</u></p>
Week 8	DIESEL FUEL INJECTION SYSTEMS	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Diesel Fuel and Storage Tanks (Machine and Bulk Storage) • Combustion Process and Starting Aids • Fuel System Service • Mechanical Fuel Injection System • Advanced Mechanical Fuel Injection System • Basic Diesel Engine and Fuel System Testing and Adjusting Emergency 	<ul style="list-style-type: none"> • Task 70 • Task 71 • Task 72 • Task 73 • Task 74 • Task 75 • Task 76 • Task 77 <p><u>Details may be seen at Annexure-I</u></p>

		Shutdown Systems	
Week 9	ELECTRONICS FUEL MANAGEMENT	<p>Motivational Lecture (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Electronic Fuel System Fundamentals • Electronic Controlled Fuel Injection Systems • Electronic Fuel System Diagnosis • Emission Control / After Treatment 	<ul style="list-style-type: none"> • Task 78 • Task 79 • Task 80 • Task 81 • Task 82 • Task 83 • Task 84 • Task 85 • Task 86 • Task 87 • Task 88 <p><u>Details may be seen at Annexure-I</u></p> <p>Monthly Test 2</p>
Week 10	HEAVY DUTY CHARGING AND CRANKING SYSTEMS	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Charging System and Control Circuit Fundamentals. • Charging System Testing and Service • Cranking System Fundamentals and Motor Drives • Cranking System Control Circuits • Cranking System Testing and Service • Non-Electric Cranking Systems 	<ul style="list-style-type: none"> • Task 89 • Task 90 • Task 91 • Task 92 • Task 93 • Task 94 • Task 95 • Task 96 • Task 97 • Task 98 • Task 99 • Task 100 • Task 101 <p><u>Details may be seen at Annexure-I</u></p>

<p>Week 11 Week 12</p>	<p>HYDRAULICS II</p>	<p>Motivational Lecture (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Hydraulic Principles • Hydraulic Pump Fundamentals • Hydraulic Pump Service • Hydraulic Actuator Fundamentals • Hydraulic Actuator Service • Hydraulic Valve II • Hydraulic System Types • Hydraulic System Testing and Service • Electro hydraulics 	<ul style="list-style-type: none"> • Task 102 • Task 103 • Task 104 • Task 105 • Task 106 • Task 107 • Task 108 • Task 109 • Task 110 • Task 111 • Task 112 • Task 113 • Task 114 • Task 115 • Task 116 • Task 117 • Task 118 • Task 119 • Task 120 <p><u>Details may be seen at Annexure-I</u></p>
<p>Week 13</p>	<p>STEERING AND SUSPENSION SYSTEMS AND ACCESSORIES (SPECIFIC TO OFF-ROAD) AND APPRENTICESHIP</p>	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Wheeled Equipment Steering Fundamentals and Service. • Suspension System Fundamentals and Service • Off-Road Equipment Accessories and Attachments • Off-Road Electrical Circuit Fundamentals • Off-Road Electrical Circuit Service 	<ul style="list-style-type: none"> • Task 121 • Task 122 • Task 123 • Task 124 • Task 125 • Task 126 • Task 127 • Task 128 • Task 129 • Task 130 • Task 131 • Task 132 <p><u>Details may be seen at Annexure-I</u></p>
<p>Week 14</p>	<p style="text-align: center;">Midterm</p>		

<p>Week 15</p>	<p>POWERTRAIN (SPECIFIC TO OFF-ROAD)</p>	<p>Motivational Lecture (<i>For further detail please see Page No: 3& 4</i>)</p> <ul style="list-style-type: none"> • Gearing Principles • Torque Converter Fundamentals and Service • Powershift and Automatic Transmission Mechanical/Electronic Components • Powershift and Automatic Transmission Control and Shifting • Hydraulic Retarder Fundamentals • Powershift and Automatic Transmission Testing and Service • Tracked Equipment Steering Fundamentals and Service • Undercarriage Systems Fundamentals and Service • Final Drive Fundamentals and Service (Off-Road) • Drive Axle and Carrier Fundamentals and Service (Off-Road) • Clutch Fundamentals and Service 	<p>Home Assignment</p> <ul style="list-style-type: none"> • Task 133 • Task 134 • Task 135 • Task 136 • Task 137 • Task 138 • Task 139 • Task 140 • Task 141 • Task 142 • Task 143 • Task 144 • Task 145 • Task 146 • Task 147 • Task 148 • Task 149 <p><u>Details may be seen at Annexure-I</u></p>
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<p>Week 16 Week 17</p>	<p>POWERTRAIN (SPECIFIC TO TRUCK AND TRANSPORT)</p>	<p>Success stories (For further detail please see Page No: 3& 4)</p> <ul style="list-style-type: none"> • Clutch Fundamentals and Service • Driveline Fundamentals and Service • Gearing Principles • Transmission Fundamentals • Transmission Shifting • Transmission Service • Transfer Case and Auxiliary Drives • Drive Axle Assembly Fundamentals (On Road) • Drive Axle Assembly Service (On Road) 	<ul style="list-style-type: none"> • Task 150 • Task 151 • Task 152 • Task 153 • Task 154 • Task 155 • Task 156 • Task 157 • Task 158 • Task 159 • Task 160 • Task 161 • Task 162 • Task 163 • Task 164 • Task 165 <p><u>Details may be seen at Annexure-I</u></p>
<p>Week 18</p>	<p>STEERING AND ANTILOCK BRAKE SYSTEMS</p>	<p>Motivational Lecture(For further detail please see Page No: 3& 4)</p> <p>Perform CNC Lathe Operations</p> <ul style="list-style-type: none"> • Steering Fundamentals • Steering Service • Steering Angles and Alignment • Air Antilock Brake Systems • Air Antilock Brake System Diagnosis • Hydraulic Antilock Brake Systems 	<ul style="list-style-type: none"> • Task 166 • Task 167 • Task 168 • Task 169 • Task 170 • Task 171 • Task 172 • Task 173 • Task 174 • Task 175 • Task 176 • Task 177 <p><u>Details may be seen at Annexure-I</u></p> <p>Monthly Test</p>
<p>Week 19</p>	<p>AIR</p>	<p>Success stories (For further detail please</p>	<ul style="list-style-type: none"> • Task 178

	CONDITIONING	<p style="text-align: center;"><i>see Page No: 3& 4)</i></p> <ul style="list-style-type: none"> • Air Conditioning Fundamental • Heating, Ventilation and Air Conditioning (HVAC) Control Systems • Air Conditioning Testing and Service 	<ul style="list-style-type: none"> • Task 179 • Task 180 • Task 181 • Task 182 • Task 183 • Task 184 • Task 185 <p style="text-align: right;"><u>Details may be seen at Annexure-I</u></p>
Week 20	VEHICLE ELECTRICAL DIAGNOSIS, FAILURE ANALYSIS AND APPRENTICESHIP	<p>Motivational Lecture(<i>For further detail please see Page No: 3& 4)</i></p> <ul style="list-style-type: none"> • Truck Electrical Circuit Fundamentals • Truck Electrical Circuit Service • Failure and Fluid Analysis • Orientation to Vehicle Inspection • Workplace Coaching Skills • Advisory Network • Interprovincial Standards 	<ul style="list-style-type: none"> • Task 186 • Task 187 • Task 188 • Task 189 • Task 190 • Task 191 • Task 192 • Task 193 <p style="text-align: right;"><u>Details may be seen at Annexure-I</u></p>
Week 21	<p>Employable Project/Assignment (6 weeks i.e. 21-26) besides regular classes.</p> <p style="text-align: center;">OR</p> <p>On the job training (2 weeks)</p>	<ul style="list-style-type: none"> • Guidelines to the Trainees for selection of students employable project like final year project (FYP) • Assign Independent project to each Trainee • A project-based on trainee's aptitude and acquired skills. • Designed by keeping in view the emerging trends in the local market as well as across the globe. • The project idea may be based on Entrepreneur. • Leading to successful employment. • The duration of the project will be 6 weeks • Ideas may be generated via different sites such as: https://1000projects.org/ https://nevonprojects.com/ https://www.freestudentprojects.com/ https://technofizi.net/best-computer-science-and-engineering-cse-project-topics-ideas-for-students/ • Final viva/assessment will be conducted on project assignments. • At the end of the session, the project 	

		<p>will be presented in a skills competition</p> <ul style="list-style-type: none"> • The skill competition will be conducted on zonal, regional, and National levels. • The project will be presented in front of Industrialists for commercialization • The best business idea will be placed in the NAVTTC business incubation center for commercialization. <p>----- -----</p> <p style="text-align: center;">OR</p> <p>On the job training for 2 weeks:</p> <ul style="list-style-type: none"> • Aims to provide 2 weeks of industrial training to the Trainees as part of the overall training program • Ideal for the manufacturing trades • As an alternative to the projects that involve expensive equipment • Focuses on increasing Trainee’s motivation, productivity, efficiency, and quick learning approach. 	
Week 22	Capstone project	<p>Students are provided with details regarding a capstone project that they are required to complete to showcase their learning. The project should ideally consist of the following deliverables:</p> <ol style="list-style-type: none"> 1. Design brief/description outlining their project 2. Research collected during the project 3. Rough sketches, either hand-drawn or digitally created that showcase their design process 4. Professionally presented a main body of artwork at the end of the course <p>Notes for the Trainer/Teacher:</p> <ul style="list-style-type: none"> • Each student must receive a separate/independent project based on their strengths and interests. This will reinforce their motivation and determine their aptitude towards specific design fields. • Each project should be designed keeping future design trends as well as current market demands in mind • The duration for the completion of the project is 4 weeks 	Monthly Test 6

		<p>It's important to reiterate the value of these projects as each student will later be able to showcase their creative effort in the real world market, giving them leverage over others for better employment.</p> <p>Ideas for projects may be generated via different sites such as: https://1000projects.org/ https://benahce.com/ https://www.freestudentprojects.com/</p>	
Week 23	Introduction to freelancing	<ul style="list-style-type: none"> • Motivational Lecture (<i>For further detail please see Page No: 3& 4</i>) <p>Students are introduced to:</p> <ul style="list-style-type: none"> • the concept of freelancing • how to become freelance and create a sustainable income • pros and cons of freelancing • the ethical and professional way of becoming a productive freelancer • resources available for freelancing in the field of design • how to join freelancing sites • the process of creating a freelancing profile 	
Week 24	Professional practice methods& legal side of design	<ul style="list-style-type: none"> • Success stories (<i>For further detail please see Page No: 3& 4</i>) <p>Students are introduced to:</p> <ul style="list-style-type: none"> • the standards that define the expectations of a professional designer • the principles of integrity that demonstrate respect for the profession, for colleagues, for clients, for audiences or consumers, and society as a whole • the perspectives of the design profession i.e. understanding the profession, the meanings of environmental responsibility, copyright, and ethics • what legalities are involved in professional design projects • how to build strong professional proposals • copyrights, copyright infringement, plagiarism, crediting creators, 	

		<p>purchasing online products, downloading 'free' content</p> <ul style="list-style-type: none"> the do's and don'ts of how to price their time, effort, and creativity 	
Week 25	Preparing your portfolio	<ul style="list-style-type: none"> Motivational Lecture(<i>For further detail please see Page No: 3& 4</i>) <p>Students are introduced to:</p> <ul style="list-style-type: none"> the concept of design portfolios the concept of present design work/projects in a professional manner websites that provide free portfolio hosting such as Behance and Dribbble creating a portfolio how to select work for presenting in your portfolio 	Final Assessment
Week 26	Entrepreneurship and Final Assessment in project	<ul style="list-style-type: none"> Success stories (<i>For further detail please see Page No: 3& 4</i>) 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.) Final Assessment 	

Tasks For Certificate in HEAVY MACHINE MECHANIC

Task No.	Description	Week
1.	Search any three freelancing sites(Fiverr, Upwork, Guru, etc.) and list down the top 5 profiles related to your course	Week 1
2.	Prepare a career path related to your course and also highlight the emerging trends in the local as well as international market	
3.	Generate a report on Institute work ethics and professionalism related to your course	
4.	Identify types, designs and components of frames commonly used in truck and trailer applications	Week 2
5.	Explain frame inspection and repair procedures	
6.	Diagnose common bearing and seal faults.	
7.	Perform bearing and seal service.	
8.	Perform wheel removal, inspection and installation.	
9.	Diagnose wheel and tire faults.	
10.	Describe types and configurations of on-highway trailers	
11.	Explain procedures and safety precautions required when coupling and uncoupling trailer systems.	
12.	Service common types of trailer landing gear	
13.	Outline trailer inspection regulations	
14.	Demonstrate basic preventive maintenance and service procedures	Week 3
15.	Explain braking principles with emphasis on heat, friction and hydraulic forces.	
16.	Explain the principles of operation of drum brake systems	
17.	Service a typical drum brake assembly.	
18.	Service a typical disc brake assembly	
19.	Describe the diagnosis and repair procedures for hydraulic-over-hydraulic brake booster systems	
20.	Explain the principles of operation for common parking brake systems	
21.	Identify basic electric braking system failures	
22.	Using mathematical calculations, explain the hydraulic principles of pressure, force, area.	
23.	Explain the properties of hydraulic fluid and the criteria for its selection.	
24.	Explain the principles of operation of the basic types of hydraulic control valves (direct acting pressure relief valve, open center directional control valve).	Week 4
25.	Explain the physical properties of conductors, semi-conductors and insulators.	

26.	Apply electrical laws and formulas to mathematically calculate circuit values		
27.	Explain the fundamental laws of magnetism		
28.	Explain the construction, operation and application of electromagnets		
29.	Measure voltage at various points on a circuit and interpret the results.		
30.	Measure current flow at various points on a circuit and interpret the results		
31.	Measure resistance using an ohmmeter		
32.	Identify hazards encountered with lead-acid storage batteries		
33.	List the safety precautions and procedures for charging batteries.		
34.	Trace electrical circuits using symbols that are common to the industry		
35.	Repair an electrical lighting circuit for a short circuit, ground fault, open circuit and high resistance		
36.	Compare and contrast solid state electronic and electrical circuitry		
37.	Identify electronic test equipment used for diagnosis of electronic systems		
38.	Develop a simple air brake system consisting of a compressor, dryer, reservoir, brake valve, steer axle and drive axle brake chambers, and connecting lines		Week 5
39.	Explain the operating principles of a typical cam-operated foundation brake		
40.	Explain the functions and principles of operation of common air brake supply circuit components		
41.	Explain the functions and principles of operation of pre-CMVSS 121 single trailer brake circuit components.		
42.	State the safety precautions that must be observed prior to performing air brake system testing and service.		
43.	Perform air brake system testing		
44.	Service cam-operated foundation brakes		
45.	Identify typical system layout and component locations on a vehicle equipped with an antilock air brake system		
46.	Describe antilock air brake system service precautions		
47.	Explain the stages of development of the internal combustion engine	Week 6	
48.	Explain the principles of operation for two and four stroke cycle engines.		
49.	State the functions of the engine cylinder block.		
50.	Describe the construction and design features of removable cylinder liners		
51.	Inspect engine blocks for cracks, thread, bearing bore and machined surface condition		
52.	Perform removable cylinder liner service		
53.	Explain the function, construction and design features of pistons and piston pins		
54.	Remove and disassemble piston and connecting rod assemblies		
55.	State the functions of crankshaft seals, gears and flywheels		

56.	Remove crankshaft and bearings from an engine block		
57.	Explain the function and design features of camshafts, camshaft bearings and seals.		
58.	Remove camshaft and related components from an engine block		
59.	Inspect and measure camshafts and related components to determine serviceability.		
60.	Describe the construction and design features of engine valves and related components		
61.	Demonstrate cylinder head assembly and installation		
62.	Clean and inspect cylinder heads		
63.	Demonstrate cylinder head assembly and installation		
64.	Explain the functions and operation of an engine exhaust brake		
65.	Identify and state the function of air induction system components		Week 7
66.	Identify and explain the operation of exhaust system components.		
67.	Test, inspect and service a turbocharger		
68.	Perform lubrication system inspection and service		
69.	Perform engine liquid cooling system repair and maintenance		
70.	Identify construction requirements and design features of fuel storage and supply tanks	Week 8	
71.	Identify and state the purpose of common combustion chambers		
72.	Identify types and function of common diesel engine starting aids		
73.	Identify types and service procedures for common fuel filters		
74.	Identify the layout and components of a basic fuel injection system		
75.	Explain the operating principles of hydraulic fuel injection nozzles.		
76.	Explain engine performance testing and demonstrate diagnosis		
77.	Explain the operation of an engine emergency warning and shutdown systems that monitors oil pressure, coolant temperature, coolant level and engine over-speed		
78.	Explain the operation of a computer-controlled fuel injection system	Week 9	
79.	Demonstrate the use of a personal computer (PC) and other appropriate tools for electronic system interface		
80.	Demonstrate the adjustment of electronic fuel control system parameters		
81.	Explain the operation of an electronic unit fuel injection system		
82.	Explain the operation of a hydraulic electronic unit injection (HEUI) fuel injection system		
83.	Diagnose and repair an electronic fuel control system malfunction		
84.	Describe the theory of Exhaust Gas Recirculation (EGR)		
85.	Explain the purpose of Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPI).		
86.	Explain the purpose of a Selective Catalyst Reduction (SCR) and Diesel Exhaust Fluid (DEF).		

87.	Explain effect on other vehicle systems; fuel, oil, coolants, intake/turbo systems.	
88.	Discuss emerging technologies	
89.	Identify charging system components	Week 10
90.	Identify and state the function of common alternator components	
91.	Identify the variations to common alternator designs	
92.	Identify common regulator types and designs	
93.	Identify alternator defects	
94.	Demonstrate charging system maintenance procedures	
95.	Identify components of a typical cranking system	
96.	Identify cranking motor construction in regards to electrical design	
97.	Explain the operation of a cranking motor solenoid switch	
98.	Explain the operation of a magnetic switch	
99.	Diagnose possible cranking system failures from specific symptoms	
100.	State the function, system requirements and troubleshooting procedures required on air cranking systems.	Week 11 Week 12
101.	State the function, system requirements and troubleshooting procedures required on hydraulic motor cranking systems	
102.	Explain common hydraulic contamination control methods.	
103.	Explain common hydraulic pump configurations	
104.	Service a gear pump	
105.	Service a vane pump.	
106.	Service a piston pump	
107.	Explain the operating principles of hydraulic cylinders	
108.	Service hydraulic cylinders.	
109.	Service hydraulic motors	
110.	Explain the operation and service procedures of hydraulic pressure control valves	
111.	Explain the operation and service procedures of hydraulic flow control valves	
112.	Interpret common mobile equipment hydraulic system schematics	
113.	Explain the operation of a mobile hydrostatic transmission hydraulic system	
114.	Perform visual inspection and operational tests on common hydraulic systems	
115.	Perform pressure and flow testing on common hydraulic systems	
116.	Determine hydraulic system faults	
117.	Explain the operating principles of electrically controlled hydraulic system components	
118.	Explain the operating principles of electronically controlled hydraulic system components	

119.	Explain joystick and pulse width modulated control systems	
120.	Diagnose electrohydraulic system faults	
121.	Identify common off-road steering configurations and applications.	Week 13
122.	Identify full time power steering system components	
123.	Identify skid steering system components	
124.	Explain the operation of a skid steering system.	
125.	State the functions and applications of common off-road suspension systems.	
126.	Explain common haul truck suspension system diagnostic and repair procedures	
127.	Identify and explain the purpose of automatic fire suppression systems used on off-road equipment.	
128.	Identify and explain the functions of common ground engaging tools and tool mounting components	
129.	Explain the operation of off-road equipment lighting circuits	
130.	Explain multiplexing systems in off-road equipment	
131.	Perform basic test procedures on off-road equipment lighting circuits	
132.	Perform basic test procedures on off-road equipment accessory circuits	
133.	Identify common gear types and applications.	
134.	Describe the components and operation of torque converters	
135.	Compare functions and applications of powershift and automatic transmissions	
136.	Explain the operation of typical countershaft type powershift/automatic transmissions	
137.	Explain the operation of hydraulic shift control systems for powershift transmissions	
138.	Identify the components of a typical off-road equipment hydraulic retarder	
139.	Perform powershift and automatic transmission visual inspections and operational tests	
140.	Perform powershift and automatic transmission hydraulic shift control system testing.	
141.	Perform powershift and automatic transmission electronic shift control system testing	
142.	Explain the operation of a steering clutch and brake crawler tractor steering system.	
143.	Explain the operation of a differential type crawler tractor steering system	
144.	Describe the functions, applications and configurations of undercarriage systems	
145.	Describe the functions, applications, and configurations of final drive systems	
146.	Explain the operation of wheeled equipment final drive systems.	
147.	Identify single reduction drive axle components	
148.	Diagnose a drive axle and carrier assembly for operational faults	
149.	Explain the operation and maintenance of overcentre clutches	

150.	Explain the function and operating principles of spring-loaded clutch systems.	Week 16 Week 17
151.	Perform service procedures for spring-loaded clutches	
152.	Explain the function and operating principles of common driveline assemblies	
153.	Identify common gear types and applications	
154.	Explain vehicle powertrain requirements in relation to engine performance characteristics and vehicle applications	
155.	Explain the fundamentals of Hybrid drive systems	
156.	Explain the operation of the components of a mechanical air shift system	
157.	Explain the basic operation of mechanical transmission electronic shift controls	
158.	Perform failure analysis on the components of a typical constant mesh transmission	
159.	Perform air shift system diagnosis and troubleshooting	
160.	Explain how to service and maintain constant mesh transmissions	
161.	Explain the diagnosis and service of a typical transfer case	
162.	Identify drive axle configurations and components	
163.	Diagnose a drive axle assembly for operational faults	
164.	Overhaul a typical differential carrier assembly to manufacturer's specifications	
165.	Overhaul a typical inter-axle differential assembly	
166.	Identify the components of a truck power steering system	
167.	Diagnose power steering system faults	
168.	Service a power steering gear	
169.	List pre-alignment inspection procedures	
170.	Describe common methods of adjusting wheel alignment angles to achieve manufacturer's guidelines.	
171.	Explain the operation of an antilock brake systems (ABS).	
172.	Explain the operation of the individual ATC components	
173.	List ABS and ATC service precautions	
174.	Identify service tools for ABS diagnosis	
175.	Diagnose and repair ABS faults.	Week 19
176.	Identify the components of a hydraulic ABS.	
177.	Demonstrate the procedure to bleed a hydraulic ABS	
178.	Identify the basic components of an air conditioning system.	
179.	Identify the components of an air conditioning control system	
180.	Identify the components of an automatic temperature control system	
181.	Identify the components of an air distribution system	
182.	Identify air conditioning service tools.	

183.	Perform air conditioning system diagnosis.	
184.	Perform air conditioning service within legislated guidelines.	
185.	Explain replacement procedures for defective air conditioning components	
186.	Explain the operation of truck lighting circuits.	Week 20
187.	Explain the operation of truck accessory circuits	
188.	Perform basic test procedures on truck lighting circuits	
189.	Perform basic test procedures on truck accessory circuits.	
190.	Describe safety precautions related to supplemental restraint systems (SRS).	
191.	Explain fluid (oil and coolant) analysis.	
192.	Identify conditions caused by damage, wear or corrosion that would make a truck unsafe or inoperable.	
193.	Identify conditions that would require further inspection	
194.	<ul style="list-style-type: none"> • Browse the following website and create an account on each website <ul style="list-style-type: none"> ▪ 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: <ul style="list-style-type: none"> ▪ Company ▪ Category ▪ Location ▪ All jobs ▪ Agency ▪ Industry 	Week 21 onwards

Annexure-II:

HEAVY MACHINE MECHANIC

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=Qi6Xn7yKIIQ>

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-II

SUGGESTIVE FORMAT AND SEQUENCE ORDER OF MOTIVATIONAL LECTURE.

Mentor

Mentors are provided an observation checklist form to evaluate and share their observational feedback on how students within each team engage and collaborate in a learning environment. The checklist is provided at two different points: Once towards the end of the course. The checklists are an opportunity for mentors to share their unique perspective on group dynamics based on various team activities, gameplay sessions, pitch preparation, and other sessions, giving insights on the nature of communication and teamwork taking place and how both learning outcomes and the student experience can be improved in the future.

Session- 1 (Communication):

Please find below an overview of the activities taking place Session plan that will support your delivery and an overview of this session's activity.

Session- 1 OVERVIEW
Aims and Objectives:
<ul style="list-style-type: none"> • To introduce the communication skills and how it will work • Get to know mentor and team - build rapport and develop a strong sense of a team • Provide an introduction to communication skills • Team to collaborate on an activity sheet developing their communication, teamwork, and problem-solving • Gain an understanding of participants' own communication skills rating at the start of the program

Activity:	Participant Time	Teacher Time	Mentor Time
Intro Attend and contribute to the scheduled.			
Understand good communication skills and how it works.			
Understand what good communication skills mean			
Understand what skills are important for good communication skills			
Key learning outcomes:	Resources:		Enterprise skills developed:
• Understand the	• Podium		• Communication

<p>communication skills and how it works.</p> <ul style="list-style-type: none"> • Understand what communication skills mean • Understand what skills are important for communication skills 	<ul style="list-style-type: none"> • Projector • Computer • Flip Chart • Marker 	<ul style="list-style-type: none"> • Self Confidence • Teamwork
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Schedule	Mentor Should do
<p>Welcome: 5 min</p>	<p>Short welcome and ask the Mentor to introduce him/herself. Provide a brief welcome to the qualification for the class. Note for Instructor: Throughout this session, please monitor the session to ensure nothing inappropriate is being happened.</p>
<p>Icebreaker: 10 min</p>	<p>Start your session by delivering an icebreaker, this will enable you and your team to start to build rapport and create a team presentation for the tasks ahead. The icebreaker below should work well at introductions and encouraging communication, but feel free to use others if you think they are more appropriate. It is important to encourage young people to get to know each other and build strong team links during the first hour; this will help to increase their motivation and communication throughout the sessions.</p>
<p>Introduction & Onboarding: 20mins</p>	<p>Provide a brief introduction of the qualification to the class and play the “Onboarding Video or Presentation”. In your introduction cover the following:</p> <ol style="list-style-type: none"> 1. Explanation of the program and structure. (Kamyab jawan Program) 2. How you will use your communication skills in your professional life. 3. Key contacts and key information – e.g. role of teacher, mentor, and SEED. Policies and procedures (user agreements and “contact us” section). Everyone to go to the Group Rules tab at the top of their screen, read out the rules, and ask everyone to verbally agree. Ensure that the consequences are clear for using the platform outside of hours. (9am-8pm) 4. What is up next for the next 2 weeks ahead so young people know what to expect (see pages 5-7 for an overview of the challenge). Allow young people to ask any questions about the session topic.
<p>Team Activity Planning: 30 minutes</p>	<p>MENTOR: Explain to the whole team that you will now be planning how to collaborate for the first and second collaborative Team Activities that will take place outside of the session. There will not be another session until</p>

	<p>the next session so this step is required because communicating and making decisions outside of a session requires a different strategy that must be agreed upon so that everyone knows what they are doing for this activity and how.</p> <ul style="list-style-type: none"> • “IDENTIFY ENTREPRENEURS” TEAM ACTIVITY • “BRAINSTORMING SOCIAL PROBLEMS” TEAM ACTIVITY” <p><i>As a team, collaborate on a creative brainstorm on social problems in your community. Vote on the areas you feel most passionate about as a team, then write down what change you would like to see happen.</i></p> <p>Make sure the teams have the opportunity to talk about how they want to work as a team through the activities e.g. when they want to complete the activities, how to communicate, the role of the project manager, etc.</p> <p>Make sure you allocate each young person a specific week that they are the project manager for the weekly activities and make a note of this.</p> <p>Type up notes for their strategy if this is helpful - it can be included underneath the Team Contract.</p>
<p>Session Close: 5 minutes</p>	<p>MENTOR: Close the session with the opportunity for anyone to ask any remaining questions.</p> <p>Instructor: Facilitate the wrap-up of the session. A quick reminder of what is coming up next and when the next session will be.</p>

MOTIVATIONAL LECTURES LINKS.

TOPIC	SPEAKER	LINK
How to Face Problems In Life	Qasim Ali Shah	https://www.youtube.com/watch?v=OrQte08MI90
Just Control Your Emotions	Qasim Ali Shah	https://www.youtube.com/watch?v=JzFs_yJt-w
How to Communicate Effectively	Qasim Ali Shah	https://www.youtube.com/watch?v=PhHAQEGehKc
Your ATTITUDE is Everything	Tony Robbins Les Brown David Goggins Jocko Willink Wayne Dyer Eckart Tolle	https://www.youtube.com/watch?v=5fS3rj6eIFg
Control Your EMOTIONS	Jim Rohn Les Brown TD Jakes Tony Robbins	https://www.youtube.com/watch?v=chn86sH0O5U
Defeat Fear, Build Confidence	Shaykh Atif Ahmed	https://www.youtube.com/watch?v=s10dzfbozd4
Wisdom of the Eagle	Learn Kurooji	https://www.youtube.com/watch?v=bEU7V5rJTtw
The Power of ATTITUDE	Titan Man	https://www.youtube.com/watch?v=r8LJ5X2ejqU
STOP WASTING TIME	Arnold Schwarzenegger	https://www.youtube.com/watch?v=kzSBrJmXqdg
Risk of Success	Denzel Washington	https://www.youtube.com/watch?v=tbnzAVRZ9Xc

SUCCESS STORY

S. No	Key Information	Detail/Description
1.	Self & Family background	
2.	How he came on board NAVTTC Training/ or got trained through any other source	
3.	Post-training activities	
4.	Message to others (under training)	

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

1. To call a passed out successful trainee of the institute. He will narrate his success story to the trainees in his own words and meet trainees as well.
2. To see and listen to a recorded video/clip (5 to 7 minutes) showing a successful trainee 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, etc) and narrates his/her story in the teacher's own motivational words.

* The online success stories of renowned professional can also be obtained from **Annex-II**

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 the importance of work and manifested by determination or desire to work hard.

The following ten work ethics are defined as essential for student 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 weight and help others who are struggling. Recognize when to speak up with an idea 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 lifetime

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. Take 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 work 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.