Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"

Course Contents/ Lesson Plan

Course Title: Industrial Electrician

Duration: 6 Months

Course Details / Description & Preliminaries

Course Title	Industrial Electrician
Objectives and Expectations	**Employable skills through an intensive course on Industrial Electrician** 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.
Key Features of Training& Special Modules	**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.** 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

Training Tools/ Methodology	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 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 industrial 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. • Practice safe working methods on electrical systems. • Understand the relevant regulative requirements. • Demonstrate an understanding of electrical principles and units. • Identify a wide range of electrical equipment & devices and understand their principles of operation / connections. • Demonstrate an understanding of electrical systems, switchgear and circuit types. • diagnose basic faults and recognize their associated symptoms • Work with a range of cable types and carry out correct terminations and connections. • Recognition practically about Armed Cables, Hard cables, Flexible cable, VIR cable. • Recognize the most common industrial motor types and understand their operation, connections and maintenance requirements. • Demonstrate an understanding of Automatic star delta starter. • Use electrical test equipment effectively and carry out testing of a range of motors, solenoids, cables, etc. (using insulation, continuity, tong testers, etc.)

	• Identify motor and power circuit faults. • Use circuit diagrams as an aid to maintenance. • Read out and practically known the electrical drawing and symbols. • Access electrical enclosures and replace fuses, reset overloads etc. • Perform electrical isolation, testing for dead, etc. on a wide range of devices and circuits safely. • Understand the principles of earthing / protection and associated protective devices.
Course Execution Plan	Total Duration of Course: 6 Months (26 Weeks)
	Class Hours: 4 Hours per day (06 Days/Week)
	Theory: 20% Practical: 80%
	Weekly Hours: 24 Hours Per week
	Total Contact Hours: 600 Hours
Companies Offering Jobs in the respective trade	Public/Private industries including: Pakistan Atomic energy commission (PAEC), Pakistan Ordnance factories (POFs), WAPDA, OGDCL, Construction companies, Oil mills, flour mills, Petrol & CNG stations etc.
Job Opportunities	• Technician / Electrician in industry (Textile, Leather, Pharmaceuticals, Food Processing, Automotive, Cement etc.) • Self-employment.
No of Students	25
Learning Place	Classroom / Lab / Workshop / Industry

WEEKLY SCHEDULE OF TRAINING

Scheduled Week	Module Title	Learning Units	Remarks
Week 1	**Introduction**	• Course Introduction • **Motivational Lecture** (For further detail please see Page No: 3-4) • Application of the course • Job market overview • **Institute/Work ethics(**For further detail please see Annexure-II at the end) • Health & Safety	**Task-1** (Details may be seen at Annexure-I)
Week 2	**Basic Numeracy**	• Recognize basic arithmetic symbols. • State the correct sequence for arithmetical operations and solve equations. • Common Weights and Measures • Units of Measurements & Their interconversion. • Identify two- and threedimensional shapes which may include: Rectangle, Triangle, Sphere, Cube, Cylinder, Pyramid, Square, Polygons, Circle, Cuboids • Calculate area andvolume of regular shapesand objects • Demonstrate basiccalculation procedures related to money andtime, including whole numbers, simple fractionsand decimals • Demonstrate knowledgeof graphs and tables • Demonstrate use ofsimple formulae & algebraic expressions may relate to: Area, Perimeter, Dimensions of regular and irregular shapes • **Success story**(For further detail please see Page No: 4-5and Annexure-III at the end)	**Home Assignment-1** (Details may be seen at Annexure-IV)

Week 3	**Basic Electrical Theory**	• **Motivational Lecture** (For further detail please see Page No: 3-4) • Matter &different states of matter with examples • Atom& Atomic Structure • Description of proton, electron and neutron • Definition of valence and free electrons • Properties of positive and negative charge • Definition of electricity • Conventional current and electron flow theory • Static and dynamic charge • Insulator, Conductor&Semi-Conductor (Properties &examples) • Tools & Equipment used by an Electrician	**Task-2** (Details may be seen at Annexure-I)
Week 4	**Basic Electrical Theory,** **Continued…**	• Generation of Electricity • Describe Voltage, Voltage Drop, Current, Resistance, Electric Charge, Conductance, Load and their units • Relation between current (I), voltage (V) and resistance (R) • Ohm's Law • Laws of resistance • Definition of resistivity • Factors affecting resistance of conductors • Calculating resistance of a conductor with regard to cross sectional area, length, resistivity and operating temperature • Basic Symbols of Electricity • **Case Study** (Health & Safety) (For further detail please see Page No: 5-6)	**Home Assignment-2** (Details may be seen at Annexure-IV) **Monthly Test 1**

Week 5	**Describe sources of electricity generation** **Basic Electric circuits**	• **Motivational Lecture** (For further detail please see Page No: 3-4) • Sources of electricity generation Static electricity Electromagnetic induction Electrochemistry Photovoltaic effect Thermoelectric effect Piezoelectric effect Nuclear transformation • Alternating & Direct Current (AC & DC) • Importance of polarity in DC circuits • Electric Circuit & its types Series Circuit Parallel Circuit Series-Parallel Circuit Open Circuit Closed Circuit Short Circuit • Calculate electrical quantities (Voltage, Current, Resistance and Power etc.) in circuits • Briefly Describe Transmission Line, Feeder, Distributer and Service Mains	**Task-3** (Details may be seen at Annexure-I)
Week 6	**Describe basic magnetism and electromagnetism**	• **Institute/Work ethics** (For further detail please see Annexure-II at the end) • Magnet & its types. • Describe magnetic lines of force and list their characteristics/properties. • Describe Magnet rules of action. • Define Flux, Flux Density, MMF, Magnetic Field, Magnetizing Force & their units. • Introduction to Magnetic Materials. • **Success story**(For further detail please see Page No: 4-5 and Annexure-III at the end)	**Home Assignment-3** (Details may be seen at Annexure-IV)
Week 7	**Understand Magnetic Effects Of Electric Current**	• Describe Magnetic field of a straight current carrying conductor and coil. • Briefly describe effect of iron core in a coil. • Briefly explain mechanical force on a	**Task-4** (Details may be seen at Annexure-I)

		current carrying conductor in a magnetic field. • Apply the fundamental laws of magnetism Fleming's Right hand & Left hand rules • **Case Study**(Health & Safety) (For further detail please see Page No: 5-6)	
Week 8	**Understand Electromagnetic Induction**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • Electromagnetic Induction • Faraday's Laws of Electromagnetic Induction & its applications • Describe dynamically & statically induced e.m.f • Describe self & Mutual Inductances • Briefly describe Hysteresis & Eddy Current Losses	**Home Assignment-4** (Details may be seen at Annexure-IV) **Monthly Test 2**
Week 9	**Describe AC Single Phase Electrical Supply/Circuits, Power factor**	• Introduction to AC Single Phase (1-Ø) Supply • Define alternating current & voltage • Describe working principle of A.C. Generator • Define terms cycle, frequency, phase difference, Impedance, phase angle, & power factor • Describe resistive, inductive and capacitive loads • Measure power factor of grid electricity • State the advantages and disadvantages of low power factor and high power factor • Explain the causes of low power factor and techniques to improve it • **Case Study** (For further detail please see Page No: 5-6)	**Task-5** (Details may be seen at Annexure-I)
Week 10	**Describe Three Phase Electrical Supply/Circuits**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • Introduction to AC Three Phase (3-Ø) Supply • Describe generation of two-phase & 3-phase e.m.f. • Draw & explain star & delta connections • Verification of the line and phase relationship in star and delta connections	**Task-6** (Details may be seen at Annexure-I)

		• Describe 3-Phase, 4-wire distribution network • Compare Star (Y) & Delta (∆) Connections with their uses • Describe advantages of 3-phase supply over single phase supply. • Application of phase sequence meter.	
Week 11	**Demonstrate knowledge of electric power& energy, Calculations**	• Describe active & reactive component, actual power, apparent power & reactive power with relationships. • Define the terms KVA, KVAR and KW. • Describe electrical relationships of power and energy. • Power equation in single phase & three phase systems. • Calculate Power & Energy billing of single phase & three phase installation. • Describe Measurement of power in single phase & three phase system. • **Success story**(For further detail please see Page No: 4-5and Annexure-III at the end)	**Task-7** (Details may be seen at Annexure-I)
Week 12	**Electrical Measuring Instruments** **Demonstrate routine electrical measurement procedures**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • Electrical Measuring Instruments & its Applications (Voltmeter, Ampere Meter, Ohmmeter, Watt Meter, Energy Meter, Multimeter, Clamp meter/Tong Tester, Frequency Meter, Power Factor Meter, Tachometer, Megger, Earth Tester, Potentiometer, Pyrometer, Temperature Gun, etc.) • Methods to connect the above electrical measuring instruments in circuit. • Demonstrate procedures or inspecting wiring and distribution board • Conduct operational and functional tests • Demonstrate log out/tag out & labeling procedures	**Task-8** (Details may be seen at Annexure-I)

Week 13	**Overview of the previous weeks & Mid Term Examination**		
Week 14	**Describe Electrical Wires, Cables and Jointing**	• Difference between Wires, Cable. • Construction, Types and sizes of electrical Wires & Cables according to voltage grade, core and strands, Insulation & current carrying capacity. • Calculate size of cable for a given load • Electrical Joints& Soldering. • Electrical power cable joints • Special purpose cables. • Copper, Silver, Aluminum and its identification. • Overhead conductor and its types. • **Success story**(For further detail please see Page No: 4-5and Annexure-III at the end)	**Task-9** (Details may be seen at Annexure-I)
Week 15	**Install wiring**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • The basic domestic/commercial electrical system. • Methods of Electrical Wiring Systems w.r.t Taking Connection. Joint box system or Tee system Loop – in system • Types of Electrical Wiring Systems. • Comparison between Different Wiring Systems. • Confirm wiring specifications. • Prepare installation of cables. • Demonstrate procedures for installing conduits and/or ducts. • Demonstrate procedures for connecting fixture. • Perform final testing. • Demonstrate procedures for final quality inspection.	**Task-10** (Details may be seen at Annexure-I)
Week 16	**Industrial switches & sockets, their symbols and application/Uses**	• Mechanical Switches: →Single Pole Single Throw (SPST) →Single Pole Double Throw (SPDT) →Double Pole Single Throw (DPST) →Double Pole Double Throw (DPDT)	**Task-11** (Details may be seen at Annexure-I)

		→2 poles 6 throw →Intermediate switch • Plugs, sockets and combination units • **Case Study** (For further detail please see Page No: 5-6)	
Week 17	**Electrical / Electronic Switches (Transistor, MOSFETS, Relay)** **Job Search & Entrepreneurial Skills**	• Brief Introduction of Electrical / Electronic Switches (Transistor, MOSFETS, Relay) • Push Buttons • Selector Switches • Limit Switches • Emergency Switches • Indicators Local & international brands of all of the above • Job market & job search • Job related skills. • Interpersonal skills • Communication skills • **Success story**(For further detail please see Page No: 4-5and Annexure-III at the end)	**Task-12** (Details may be seen at Annexure-I)
Week 18	**Introduction to electrical machines** **Job Search & Entrepreneurial Skills (CV Building)**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • Briefly describe DC Generators, Motors & their types. • Briefly describe AC Generators & Motors & their types. • Briefly describe Transformer and its types. • Session on CV Building. • How to make notable CV. • Dos and Don'ts of CV making.	**Home Assignment-5** (Details may be seen at Annexure-IV) **Monthly Test 4**

Week 19	**Relays**	• Electromechanical Relay (EMR) • Solid State Relay (SSR) • Hybrid Relay • Reed Relay • Thermal Relay (Overload Relay) • Polarized & Non-polarized Relay • Time Delay Relays • Protective Relays • Buchholz relay • **Case Study** (For further detail please see Page No: 5-6)	**Task-13** (Details may be seen at Annexure-I)
Week 20	**Contactors, and timers, their Application/Uses** **Job Search & Entrepreneurial Skills(self-business)**	• Contactors: Construction, Operation/working Principal, Types & Applications. • Difference between Relay & Contactor • Timer: Construction, Operation/working Principal, Types & Applications. • Local & international brands of all of the above • Session on Self-Employment • How to start a Business. • Requirements (Capital, Physical and Human requirements etc) • Benefits/Advantages of self-employment • **Success story**(For further detail please see Page No: 4-5and Annexure-III at the end)	
Week 21	**Describe Protective devices**	• **Motivational Lecture**(For further detail please see Page No: 3-4) • Fuses: Construction, Operation/working Principal, Types & Applications. • Installation of fuses. • Circuit Breakers: Construction, Operation/working Principal, Types & Applications. • Installation of circuit breakers • Lightning arrestors: Construction, Operation/working	**Home Assignment-6** (Details may be seen at Annexure-IV)

		Principal, Types & Applications • Installation of lightning arrestors.	
Week 22	**Earthing System**	• Describe earthing system & its types • Importance of earthing system • Components/parts of earthing system • Earthing system installation • Measurement of earthing resistance • Industrial earthing system • **Case Study**(For further detail please see Page No: 5-6)	**Task-14** (Details may be seen at Annexure-I)
Week 23	**Insulators** **Job Search & Entrepreneurial Skills(General Employment)**	• Describe insulators and its types. • Application of different types of insulators. • Session on General Overseas Employment opportunities. • Job search Avenues. • Visa Processes and other necessary requirements. • Immigration Information (Legal age requirements, Health Certificate, Police Clearance &Travel Insurance) • **Success story**(For further detail please see Page No: 4-5and Annexure-III at theend)	**Monthly Test 5**
Week24	**Inspect and troubleshoot systems**	• Inspection requirements • Explain the purpose of visual inspection • Interpretation of drawings and circuit diagrams • Troubleshooting requirements • Implement troubleshooting procedures and identify fault • Maintenance of electrical instruments and equipment; Types of common faults of wiring; Load balance; Safety precautions • Define the terms: Troubleshooting Fault Loads Schedule inspection	**Task-15** (Details may be seen at Annexure-I)

Week 25	**Remove faults** **Job Search & Entrepreneurial Skills(Overseas Employment)**	• Apply the diagnostic procedures for troubleshooting • Identify faulty parts and / or equipment • List the tools for required troubleshooting • Explain the procedures for monitoring load • Describe procedures to monitor electrical power/energy consumption • Identify the repair or replace component parts • Carry out operational testing • Explain the reason for short circuit and leakage current • Identify the fault finding techniques Selection of two countries of destination (Gulf Countries, Malaysia, South Korea etc) focusing on:- I. Trade specific Job Prospects and Earning levels in that country. II. Country Specific Labor laws, entry and exit requirements (Legal age requirements, Health Certificate, Police Clearance & Travel Insurance etc.).	
Week 26	**Final Assessment**	• Final Assessment	**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 INDUSTRIAL ELECTRICIAN

Task No.	Task	Description
1	**Prepare safety charts.**	Showing General & Trade specific safety measure (text/pictorial). Each trainee will prepare different chart.
2	**Draw different Tools, Equipment, Measuring Instruments & their symbols.**	Each trainee to draw sketches of different Tools & Equipment (at least 10) on drawing sheet.
3	**Draw and label the line diagram of electrical power system.**	Each trainee to draw neat & clean detailed line diagram of electrical power system (from the generating station to consumer end) on drawing sheet.
4	**Make an electromagnet**	Each trainee to make an electromagnet, trace the lines of force on drawing sheet and identify its magnetic poles. Further, clearly label the magnet, poles, lines of force, magnetic field etc.
5	**Make a staircase circuit and draw its circuit diagram using standard symbols.**	Staircase circuit is a common switching connection used to operate a lamp from two different places (i.e. above or below the stairs). We can use this circuit at other places also like Store / Bathroom etc.
6	**Make Direct On Line (DOL) Starter, also draw its Power and Control circuits using standard symbols.**	This is a simple kind of motor starter used to operate single phase or three phase motors. A DOL applies the full line voltage to the motor's input.
7	**Make Forward- Reverse Circuit (with limit switches) for a 3-Phase Motor, also draw its power & control circuits.**	This circuit is used to change the direction of rotation of a 3-Phase induction motor (i.e. forward & backward or upward & downward). Forward-Reverse movement of a 3-Phase motor can be obtained by changing its phase sequence.

8	**Make Automatic Star-Delta Starter, also draw its power & control circuits.**	3-phase induction motors (squirrel cage) are needed some suitable starting mechanism/arrangement because at the time of starting it draw a huge amount of current and when such large machines are started directly, it ultimately can cause damage to the machine or attached equipment.
9	**Make different types of Electrical Joints.**	Make and draw neat sketches the following types of electrical joints. Britannia Joint. Straight Joint. Tee Joint. Western Union Joint. Married Joint.
10	**Make Godown or Tunnel wiring circuit and draw its circuit diagram using standard symbols.**	This circuit is used to operate No. of lamps in a sequential manner by operating only one lamp at a time. It is commonly used in godowns, tunnels, long passages/tracks etc.
11	**Make Star/Delta (Y-Δ) - Reverse/Forward circuit for 3-phase motor, also draw circuit diagram using standard symbols.**	This can be used in conveyor belts, Escalator, Lifts, etc
12	**Perform insulation resistance test with the help of megger.**	An electrical system degrades its quality of insulation resistance with time and various environmental conditions including temperature, moisture, dust particles & humidity. Megger is a measuring instrument used for the measurement of insulation resistance of an electrical system.
13	**Make an ATS Circuit, also draw circuit diagram using standard symbols.**	This circuit is widely used in industries. The trainees have to make such circuit with the following options.\ 1. When the main supply goes down, The Generator Will Turn ON automatically after 5 Min. 2. When the Generator Turned ON, the load shifts to Generator after 3 min. automatically. 3. When the main supply becomes available, shift load immediately on main while the Generator will then run without load for 3 min. and then turn OFF automatically.
14	**Carry out Earth Continuity Test and find the resistance of an existing earth pit with the help of earth tester.**	All the equipment of the power system is connected to the earth system. The resistance of the earth is kept very low, so the fault current passes to the earththrough the earth electrode.

15	**What are the techniques to detect a Fault in an Electrical System? Troubleshoot an electrical fault by using any of the stated technique.**	Troubleshooting is the process of analyzing the behavior or operation of a faulty circuit to determine what is wrong with the circuit. It then involves identifying the defective component(s) and repairing the circuit. Depending on the type of equipment.

Annexure-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 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-III

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.

Annexure-IV

HOME ASSIGNMENTS FOR INDUSTRIAL ELECTRICIAN

Assign. No.	Assignment
1	i. Find area of a circle having radius = 6cm, also convert the result into inches. ii. Find area of a square having each side = 3 inches, also convert the result into mm. iii. Find area of a triangle having height = 8.6 cm& base = 0.05m, also convert the result into inches. iv. Cylinder having height = 2.25ft& radius = 255mm, also convert the result into meters. (**Note: Draw neat and clean sketches of all of the above on drawing sheet)**
2	Draw & explain ohm's law triangle
3	Compare permanent magnet & electromagnet, also how could you prove that when electric current passes through a wire it produces a magnetic field?
4	Study of self-induction of a coil and effect of introducing iron core in it.
5	Explain the purpose of star/delta starter in detail.
6	Draw the wiring/circuit diagram of any of the lab/workshop of your institute. "From Main Board to final circuit using standard symbols. (should be made on drawing sheet) For wiring/circuit diagram each trainee will select different lab/workshop. In case less number of labs/workshops, the trainees can select two offices of admin block/two class rooms etc."