Curriculum

Industrial Electrician (Oil & Gas)

SECTOR: HYDROCARBON
SUB-SECTOR: Midstream
OCCUPATION: Refinery
REF ID: HYC/Q 6101, V1.0
NSQF LEVEL: 4

TABLE OF CONTENTS

1. Curriculum **01**

2. Trainer Prerequisites **13**

3. Annexure: Assessment Criteria **14**

Industrial Electrician (Oil & Gas)

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a "Industrial Electrician (Oil & Gas)", in the "Hydrocarbon" Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	**Industrial Electrician (Oil & Gas)**		
Qualification Pack Name & Reference ID. ID	HYC/Q 6101		
Version No.	1.0	**Version Update Date**	19-04-2017
Pre-requisites to Training	**Class XII**		
Training Outcomes	After completing this program, participants will be able to: • **Job requirements and related processes:** He does the wiring work in the installation, repair and maintenance of electrical systems, Work involves performing skilled electrical tasks in the installation, repair and maintenance of the plant, Work is usually performed under the supervision of a Electrical Foreman, He occasionally supervises a small group making work layouts on the basis of verbal or written instructions, blueprints or sketches, usually received from a superior. • **Industrial Electrical wiring:** Plan installation work using drawings and documentation provided, Read and interpret drawings, circuit diagrams and electrical code specifications to plan wiring layouts, Read and interpret drawings, blueprints, schematics and electrical code specifications to determine layout of industrial electrical equipment installations, Install, examine, replace or repair electrical wiring, receptacles, switch boxes, conduits, feeders, fibre-optic and coaxial cable assemblies, lighting fixtures and other electrical components, Maintain, repair, test and install electrical motors, generators, alternators, industrial storage batteries and hydraulic and pneumatic electrical control systems, Troubleshoot and isolate faults in electrical and electronic systems and remove and replace faulty parts, Conduct preventive maintenance programs and keep maintenance records • **Work effectively in a team:** colleagues, superiors, members of own work group, people in other work groups within or outside the organization, communicate, face-to-face, by telephone, in writing • **Practice health, safety and security procedures:** Health and Safety, Fire safety, Safety systems, Emergencies, rescue and first-aid procedures		

This course encompasses 4 out of 4 National Occupational Standards (NOS) of "Industrial Welder (Oil & Gas)" Qualification Pack issued by "Hydrocarbon Sector Skill Council".

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	**Introduction** **Theory Duration** (hh:mm) 04:00 **Practical Duration** (hh:mm) 16:00 **Corresponding NOS Code** Bridge Module	• Introduction, Importance operations and maintenance.	• Participant hand book • Pen, Pencil, Note pad and other training aids • LCD Projector • Laptop and Speakers
2	**Job requirements and related processes** **Theory Duration** (hh:mm) 60:00 **Practical Duration** (hh:mm) 240:00 **Corresponding NOS Code** HYC/N 6101	• Understand Health and safety legislation, obligations and documentation • Diagnostic approaches to problem solving • Diligently follow electrical safety procedures • Follow the situations when personal protective equipment must be used • Identify and use the appropriate personal protective equipment including safety footwear, ear and eye protection • Introduce related trades to support customer requirements • The common types of problem which can occur within the work process • The importance of keeping a tidy work area • The principles of working safely with electricity • Trends and developments in the industry including new technology, • Work efficiently and check progress and outcomes regularly • Able to understand clearly the basics of Engineering drawing and how to make simple drawing. • Able to draft and illustrate engineering drawing. • Use Engineering drawing- Equipment, mini drafter etc • Ability to prepare drawing as per standard. • Understand Projections	• Pictorial presentation • Sample SOP • Flip chart • Sample Job card • Class Room • White Board and Markers • LCD Projector • Laptop • Speakers

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Understand Dimensioning and Tolerance and its importance • Draw ,Read, interpret and revise drawings and documentation including: • Make wiring diagram of DOL starter, star delta starter • Able to make dimensional drawing of D.C machine parts • Draw sketches of the following as per BIS specifications • Generate single line diagram of distribution substation • Ability to use the computer to generate CAD for Electrical Drawing • Understand basic mathematical calculation. • Select and apply basic Calculation of area and volume • use appropriate mathematical concepts and skills to solve problems in Fractions, Decimals, Percentage and ratio • Develop ability to perform basics of Algebra and understand Simple algebraic equations and problem • Acquire the techniques of solving simple Trigonometric problems • Ability to apply knowledge of Metals and non-metals • Ability to identify Ferrous and non-ferrous metals • Ability to integrate Steel - Properties and applications of the following Carbon Steels and Alloy Steels • Explain the differences in properties of different materials, including metals, alloys, ceramics, polymers and composites • To be able to work independently or as part of a team in the following areas • Understand the task required and plan ahead what steps must be taken to achieve the outcome • Carry out marking on the materials as per the drawing using • Will be able to do the drilling • Set up and adjust metalworking tools and do threading • Set up and/or operate hand tools • Correctly use and maintain the tools • Measure and mark materials as per the drawing and Check accuracy and quality of finished parts • Knowledge and ability to use different hand tools	• BIS Reference book • CAD / E-CAD Software • Different Metal & Non metals • Hand tools related to drawing • Plumbing tools • CRO • FG • All electronics components

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		and power tools in plumbing and appreciate the advantage of correct tools used. • Under the basics of Fundamentals of electronics and also to select and install • What do you mean Active & Passive components and where are they used • Different application and use of electronics devices ,Diode- Rectifier, Logic gate wave shaping circuits, Transistor – amplifier, switch, impedance matching, Oscillator circuit, UJT- relaxation oscillator. • Knowledge of the Basics of digital electronics	• All Gate ICs • Digital trainer kit • Analog trainer kit
3	**Industrial Electrical wiring** **Theory Duration** (hh:mm) 100:00 **Practical Duration** (hh:mm) 400:00 **Corresponding NOS Code** **HYC/N 6102**	• Understand the principle of electricity • Will be able to define ○ Voltage, ○ resistor, ○ current, power • The importance of basic laws – Ohms law • The principles D.C Circuits (Source • Understand the basics of Cell and Battery • The correct operation of the electrical installation in accordance with the planned specification • Able to install of various electrical power supplies, such as single phase, three-phase, direct current and low voltage. • Follow the terminologies like ○ amplitude, ○ phase angle, ○ cycle, ○ frequency, ○ power ○ power factor • Read , understand and interpret drawings and documentation including ○ 1Ø System through RLC circuits with phase diagram ○ 3Ø System- generation of 3Ø system ○ 3 Ø type 1.Star, 2.Delta • What is Conversion of Star to Delta And Conversion of Delta to Star • Understand Indian Electrical standard rules. • Awareness of Rules and Regulation of Electrical	• Class Room • Participant hand book • White Board and Markers • LCD Projector • Laptop • Speakers • Voltmeter • Ammeter • Wattmeter • Battery • Phase sequence meter • Frequency meter • PF Meter • Different types of resistive, inductive & capacitive load • IE Rules reference book • IS code reference book • All Personal protective equipments • All wiring materials for residential, commercial & industrial wiring

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		Inspectorate other standardize authority • Industrial regulations and standards applicable to different types of installations • Diligently follow electrical safety procedures • Identify and use the appropriate personal protective equipment including safety footwear, ear and eye protection • Select, use, clean, maintain and store all tools and equipment safely • Read, interpret and revise drawings and documentation including: o Layout and circuit drawings o Follow written instructions • Plan installation work using drawings and documentation provided • Ducting and wiring systems for commercial, domestic, residential, godown, agricultural and industrial use and when and where to use a specific ducting and/or wiring system • The range of electrical switchboards used for commercial, domestic, residential, agricultural and industrial uses and when and where to use a specific switchboard system including staircase wiring and master control wiring • Types of electric lighting and heating systems for commercial, domestic residential and industrial use • Understand different control devices and socket outlets used for commercial, domestic, residential, agricultural and industrial uses • Install structured cabling systems including: computer network cabling, fire/burglar alarm), control and monitoring, access control closed circuit television. • Plan installation work using drawings and documentation provided • Trends and developments in the industry including new technology, standards and working methods. • Range of materials and installation techniques to be used in different environments • Different types of standards, drawings, installation descriptions and manuals • Ability to use o Direct ON Line start (Both power line and control) o Star – Delta Stator • Different types of installations for o Fluorescent Light o Metal Halide	• Contactors • OLR • Fluorescent lamp

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		○ High Pressure Mercury Vapour ○ High Pressure Sodium Vapour ○ LED ○ Flame Proof Lighting Fixtures • Select and install equipment as per drawings and documentation provided • Understand the following elements ○ Parts of transformer ○ Working principle and construction ○ Types of transformer and its use (Single phase & Poly phase) ○ Spatial Transformer (Auto, CT, PT) construction and its application ○ Maintenance of transformer oil testing and filtration ○ Inspection of silica gel, breather, conservator, temperature ○ Maintenance of HT and LT Transformers yards • Connect A.C Motor as per instructions provided to include: structured cabling systems as per manufacturer's instructions and current industrial standards and regulations • Understand the working A.C Motor and its Construction • How the classification of A.C motor (Synchronous and Asynchronous) is done • The working and type of single phase motor and its working and poly phase (3 phase) and its working • Set-up equipment to Speed control and torque control of AC motor • Advantage of AC drive system • Ability for assembling and replacing of bearing with proper equipment's, referring to the standard catalogue. • Troubleshoot and take general care maintenance of AC motor • Different types of DC motors and the following details • Motor construction and working ○ Type of DC motor ○ Torque equation of DC motor ○ Characteristics of DC motor ○ Application of DC motor ○ Speed control of DC motor ○ DC drive system ○ General care maintenance of DC motor • The importance of Special Electrical Motor in	• Metal halide • HPMV • HPSV • LED • Flame proof lights • CT • PT • Oil testing kit • Oil filtration kit • AC motor • DC motor • AC Drive • DC Drive • Bearing fitting tools

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		relation to petro chemical industry ○ Universal motor ○ Servo motor ○ Stepper motor ○ Brush Less A.C motor and Brush Less D.C motor ○ Flame proof motors, Specification, Application, Care & maintenance • Install the required electrical supply systems including transformers, generators, circuit breakers, isolators, bus bars, measuring equipment for voltage, current, power, energy, frequency, RPM, wiring, fuses, earthing, switchboard, control panels, relays etc. as per the required specifications. • Conduct a test process to ensure the performance of installed electrical equipment as per the defined specifications • Understand the different elements of generator as below: ○ Construction and working of generator ○ Characteristics of generator ○ Type of DC generator ○ EMF equation ○ Application of DC generator ○ Maintenance with ABC type ○ Alternator construction & characteristics ○ Types, Application & Maintenance of alternator ○ Diesel Generator Care & Maintenance ○ Basics of engine ○ Basics of fuel system, Basics of air system, Basics of lubrication system, Basics of cooling system ○ DG control panel. ○ General maintenance • Read, interpret and study drawings and documentation including: ○ Layout and circuit drawings ○ Follow written instructions • Plan installation work using drawings and documentation provided • Understand and read the Symbol of electrical parts • Ability to connect and track of electrical diagram • Able to properly layout structure of substation and work instruction • Install electrical switchboards onto a surface in a secure way and assemble switchboard apparatus in a switchboard as per layout drawings	• Universal motor • Servo motor • Stepper motor • Brush Less A.C motor and Brush Less D.C motor • Flame proof motors, Specification , ○ Type of switch ○ SPST, SPDT, DPST, DPDT, Toggle switch, pushbutton

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Test installations before energizing and check for proper connection • Test installations when energized by checking complete function on all equipment • installed to ensure correct operation of new installation as per instructions • Understand the working of the following elements o Definition and use of circuit breaker o Type of switch o SPST, SPDT, DPST, DPDT, Toggle switch, pushbutton switch, level actuator, limit switch, selector switch, flame proof switch o Types of circuit breaker o MCB o MCCB o ELCB o Air circuit breaker (ACB) o SF6 o Vacuum Breaker (VCB) o Flame Proof Switch gear o Specification, Application, Care & maintenance. • Identify cable types and sizes Types of cables, specification current rating, application • Identify sub-circuits and determine cable for connection of security control panel. • Install and terminate cable to connect security control panel to existing sub-circuit. • Knowledge of Flame proof cables Specification, Application, Care & maintenance. • Inspect, test, rectify abnormal conditions, and commission connection of circuit • The ability to different joints in the cable o Straight through, long routes and repaired section o Branch Y joints – for branch of a sector o T- Joint – for branching of a sector o Transition Joints – Special joint between two different types of cable • Troubleshoot electrical installations and identify faults in cable • Understand earth attachment positions on conductors, plant and equipment and the local earth are described in terms of earthing terminals, tail clamp attachment points, clamp rating and compatibility. • Check earting in terms of portable earths, voltage rating, fault level, and conductor rating.	switch, level actuator, limit switch, selector switch, flame proof switch o Types of circuit breaker o MCB o MCCB o ELCB o Air circuit breaker (ACB) o SF6 o Vacuum Breaker (VCB) o Flame Proof Switch gear Specification, Application, Care & • All types of joint kits

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Ability to do earthing compliance requirements are described in terms of acceptable surface condition and cleanliness; and clamps, leads, fittings, sticks and poles, and terminations. • Understand the importance of o Importance of earthing in electrical and hazard system o Types of earthing system desired value o Measurement of earth resistance o Earthing in Transformer o Earthing in substation • Explain the type and working of different stand by power systems like o Basics of UPS, online and offline o Basics of inverter and its controls o Basics of cells and battery and rating o Care and maintenance of battery banks and its controls • Ability to use different measuring instruments and their calibration o Digital multimeter and adaptor o Power meter o Phase sequence meter o Clamp on multi meter o Continuity tester o Ground Fault tester o Insulation tester (meger) o Versatile Data logger o Ability to handle the following equipment's, their function, care and calibration o Study of CRO o Study of Tacho meter and speed measurement using proximity o Study of vibration analyser o Study of frequency analyser o Study of phase sequence analyser o Study of Temperature controller o Study of pressure measurement •	• Digital multimeter • Phase sequence meter • Clamp meter • Earth tester • Techno meter • Vibration tester • Frequency meter • Thermos meter • Pressure meter
5.	**basic, health, safety and security**	• use protective clothing/equipment for specific tasks and work Conditions • state the name and location of people responsible	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	procedures **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 80:00 **NOS Code** HYC/N 6104	for health and safety in the workplace • state the names and location of documents that refer to health and safety in the workplace • dentify job-site hazardous work and state possible causes of risk or accident in the workplace • carry out safe working practices while dealing with hazards to ensure the safety of self and others • state methods of accident prevention in the work environment of the job role Methods of accident prevention: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors • state location of general health and safety equipment in the workplace • inspect for faults, set up and safely use steps and ladders in general use • work safely in and around trenches, elevated places and confined areas • lift heavy objects safely using correct procedures • apply good housekeeping practice • identify common hazard signs displayed in various areas • retrieve and/or point out documents that refer to health and safety in the workplace • use the various appropriate fire extinguishers on different types of fires correctly • demonstrate rescue techniques applied during fire hazard • demonstrate good housekeeping in order to prevent fire hazards • demonstrate the correct use of a fire extinguisher • List issue concerning the safety and familiar in your work style • Empower to address the unsafe condition in your work place or to stop the unsafe behaviour • Record all miss incidents ,damages, illness or injury • Comprehend the applicable laws, regulations and codes as per standard • Promote and maintain a positive safety culture • Apply and appraise the use and storage of hazardous substance and their safety • Assess the threats and to protect from the threats • Awareness of own safety and safety of others • Bring the concern and report the HSE concern • Report all incident to the supervisor • Identifies and describes the property of different	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		petroleum products. • Operates and handle spills and respond to the spills • demonstrate how to free a person from electrocution • Administer appropriate first aid to victims were required eg. in case of bleeding, burns, choking, electric shock, poisoning etc. • demonstrate basic techniques of bandaging • respond promptly and appropriately to an accident situation • perform and organize loss minimization or rescue activity during an accident in real or simulated environments • administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases • demonstrate the artificial respiration and the CPR Process • participate in emergency procedures • complete a written accident/incident report or dictate a report to another person, and send report to person responsible Incident Report includes details of: name, date/time of incident, date/time of report, location, environment conditions, persons involved, sequence of events, injuries sustained, damage sustained, actions taken, witnesses, supervisor/manager notified • demonstrate correct method to move injured people and others during an emergency	
	Work effectively in a team **Theory Duration** (hh:mm) 16:00 **Practical Duration** (hh:mm) 64:00 **NOS Code** HYC/N 6103	• maintain clear communication with colleagues • work with colleagues as a team • pass on information to in line with organisational requirements • work in ways that show respect for colleagues • carry out commitments made to colleagues • let colleagues know in good time if cannot carry out commitments, explaining the reasons • identify problems in working with colleagues and take the initiative to solve these problems • follow the organisation's policies and procedures for working with colleagues • ability to share resources with other members as per priority of tasks	
	Total Duration	**Unique Equipment Required:**	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	1000 **Theory Duration 200:00** **Practical Duration 800:00**	• Safety helmet, ,Types of log book, First Aid box, Participant hand book, LCD Projector, Laptop and Speakers.	

Grand Total Course Duration: 1000 Hours, 0 Minutes

Trainer Prerequisites for Job role: "Industrial Electrician (Oil & Gas)" mapped to Qualification Pack: "HYC/Q 6101"

Sr. No.	Area	Details
1	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "HYC/Q 6101".
2	**Personal Attributes**	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well organized and focused, eager to learn and keep oneself updated with the latest in the mentioned field.
3	**Minimum Educational Qualifications**	Minimum-Diploma
4a	**Domain Certification**	Certified for Job Role: "industrial Electrician (Oil & Gas)" mapped to QP: "HYC/Q 6101". Minimum accepted score is 80%

4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "SSC/Q 1402". Minimum accepted score is 80%.
5	**Experience**	Minimum 5 years of industry experience in relevant job role and a Minimum of 3 years Training experience in relevant job role.

Annexure: Assessment Criteria

Job Role: Industrial Electrician (Oil & Gas) **Qualification Pack:** HYC/Q 6101 **Sector Skill Council**: Hydrocarbon Sector Skill Council
Guidelines for Assessment 1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC 2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC 3. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below) 4. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on these criteria 5. To pass the Qualification Pack, every trainee should score a minimum of 60% in every NOS 6. In case of successfully passing only certain number of NOS's, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack

Outcomes to be assessed			Assessment criteria for the outcome			
HYC/N 6101 Job requirements and related processes	Work related	PC1.Understand Health and safety legislation, obligations and documentation	45	1	1	0
		PC2.Diagnostic approaches to problem solving		1	0.5	0.5
		PC3. Diligently follow electrical safety procedures		1	0.5	0.5
		PC4. Follow the situations when personal protective equipment must be used		1	0.5	0.5
		PC5. Identify and use the appropriate personal protective equipment including safety footwear, ear and eye protection		1	0.5	0.5
		PC6. Introduce related trades to support customer requirements		1	0.5	0.5
		PC7. The common types of problem which can occur within the work process		1	0.5	0.5
		PC8.The importance of keeping a tidy work area		1	0.5	0.5
		PC9.The principles of working safely with electricity		1	0.5	0.5
		PC10. Trends and developments in the industry including new technology,		1	0.5	0.5
		PC11. Work efficiently and check progress and outcomes regularly		1	0.5	0.5
	Understand the basics drawings	PC12. Able to understand clearly the basics of Engineering drawing and how to make simple drawing.		1	0.5	0.5
		PC13. Able to draft and illustrate engineering drawing.		1	0.5	0.5
		PC14. Use Engineering drawing-Equipment, mini drafter etc		1	0.5	0.5
		PC15. Ability to prepare drawing as per standard.		1	0.5	0.5
		PC16. Understand Projections		1	0.5	0.5
		PC17.Understand Dimensioning and Tolerance and its importance		1	0.5	0.5
		PC18.Draw ,Read, interpret and revise drawings and documentation including:		1	0.5	0.5

		PC19.Make wiring diagram of DOL starter, star delta starter		1	0.5	0.5
		PC20.Able to make dimensional drawing of D.C machine parts		1	0.5	0.5
		PC21.Draw sketches of the following as per BIS specifications		1	0.5	0.5
		PC22.Generate single line diagram of distribution substation		1	0.5	0.5
		PC23.Ability to use the computer to generate CAD for Electrical Drawing		1	0.5	0.5
	Mathematical skills with respect to electrician	PC24. Understand basic mathematical calculation.		1	0.5	0.5
		PC25. Select and apply basic Calculation of area and volume		1	0.5	0.5
		PC26.use appropriate mathematical concepts and skills to solve problems in Fractions, Decimals, Percentage and ratio		1	0.5	0.5
		PC27.Develop ability to perform basics of Algebra and understand Simple algebraic equations and problem		1	0.5	0.5
		PC28.Acquire the techniques of solving simple Trigonometric problems		1	0.5	0.5
	Knowledge on different types of materials used	PC29.Ability to apply knowledge of Metals and non-metals		1	0.5	0.5
		PC30.Ability to identify Ferrous and non-ferrous metals		1	0.5	0.5
		PC31.Ability to integrate Steel - Properties and applications of the following Carbon Steels and Alloy Steels		1	0.5	0.5
		PC33.Explain the differences in properties of different materials, including metals, alloys, ceramics, polymers and composites		1	0.5	0.5
	Knowledge on basic workshop practice and tools used	PC 34.To be able to work independently or as part of a team in the following areas		1	0.5	0.5
		PC 35.Understand the task required and plan ahead what steps must be taken to achieve the outcome		1	0.5	0.5
		PC 36.Carry out marking on the materials as per the drawing using		1	0.5	0.5
		PC 37.Will be able to do the drilling		1	0.5	0.5

		PC 38.Set up and adjust metalworking tools and do threading		1	0.5	0.5
		PC 39.Set up and/or operate hand tools		1	0.5	0.5
		PC 40.Correctly use and maintain the tools		1	0.5	0.5
		PC 41.Measure and mark materials as per the drawing and Check accuracy and quality of finished parts		1	0.5	0.5
		PC 42. Knowledge and ability to use different hand tools and power tools in plumbing and appreciate the advantage of correct tools used.		1	0.5	0.5
	Knowledge on basic electronics	PC 43.Under the basics of Fundamentals of electronics and also to select and install		1	0.5	0.5
		PC 44.What do you mean Active & Passive components and where are they used		1	0.5	0.5
		PC 45.Different application and use of electronics devices ,Diode- Rectifier, Logic gate wave shaping circuits, Transistor – amplifier, switch, impedance matching, Oscillator circuit, UJT- relaxation oscillator.		1	0.5	0.5
		PC 46. Knowledge of the Basics of digital electronics		1	0.5	0.5
			total	45	23	22
HYC/N 6102 Industrial Electrical wiring	Basics of Electricity	PC1.Understand the principle of electricity	100	2	2	0
		PC1.Will be able to define ○ Voltage, ○ resistor, ○ current, power		1	0.5	0.5
		PC1.The importance of basic laws – Ohms law		1	0.5	0.5
		PC1.The principles D.C Circuits (Source		2	1	1
		PC1.Understand the basics of Cell and Battery		2	1	1
		PC1.The correct operation of the electrical installation in accordance with the planned specification		1	0.5	0.5
	SINGLE PHASE AND POLY PHASE SYSTEM	PC2.Able to install of various electrical power supplies, such as single phase, three-phase, direct current and low voltage.		2	1	1

		PC2.Follow the terminologies like ○ amplitude, ○ phase angle, ○ cycle, ○ frequency, ○ power ○ power factor		1	0.5	0.5
		PC2.Read , understand and interpret drawings and documentation including ○ 1Ø System through RLC circuits with phase diagram ○ 3Ø System- generation of 3Ø system ○ 3 Ø type 1.Star, 2.Delta		2	1	1
		PC2.What is Conversion of Star to Delta And Conversion of Delta to Star		1	0.5	0.5
	INDIAN ELECTRICAL RULES (IE Rules)	PC3.Understand Indian Electrical standard rules.		2	1	1
		PC3.Awareness of Rules and Regulation of Electrical Inspectorate other standardize authority		1	0.5	0.5
		PC3.Industrial regulations and standards applicable to different types of installations		1	0.5	0.5
	DIFFERENT TYPES OF WIRING	PC5.Diligently follow electrical safety procedures		2	1	1
		PC5.Identify and use the appropriate personal protective equipment including safety footwear, ear and eye protection		1	0.5	0.5
		PC5.Select, use, clean, maintain and store all tools and equipment safely		1	0.5	0.5
		PC5.Read, interpret and revise drawings and documentation including: • Layout and circuit drawings • Follow written instructions		2	1	1
		PC5.Plan installation work using drawings and documentation provided		1	0.5	0.5
		PC5.Ducting and wiring systems for commercial, domestic, residential, godown, agricultural and industrial use and when and where to use a specific ducting and/or wiring system		1	0.5	0.5
		PC5.The range of electrical switchboards used for commercial, domestic, residential, agricultural and industrial uses and when and where to use a		1	0.5	0.5

		specific switchboard system including staircase wiring and master control wiring				
		PC5.Types of electric lighting and heating systems for commercial, domestic residential and industrial use		1	0.5	0.5
		PC5.Understand different control devices and socket outlets used for commercial, domestic, residential, agricultural and industrial uses		1	0.5	0.5
		PC5.Install structured cabling systems including: computer network cabling, fire/burglar alarm), control and monitoring, access control closed circuit television.		1	0.5	0.5
	INDUSTRIAL WIRING	PC6.Plan installation work using drawings and documentation provided Trends and developments in the industry including new technology, standards and working methods.		1	0.5	0.5
		PC6.Range of materials and installation techniques to be used in different environments		1	0.5	0.5
		PC6.Different types of standards, drawings, installation descriptions and manuals		1	0.5	0.5
		PC6.Ability to use • Direct ON Line start (Both power line and control) • Star – Delta Stator		2	1	1
	ILLUMINATION SPECIFICATION APPLICATION OF DIFFERENT ELEMENTS OF CIRCUITS	PC7.Different types of installations for ○ Fluorescent Light ○ Metal Halide ○ High Pressure Mercury Vapour ○ High Pressure Sodium Vapour ○ LED ○ Flame Proof Lighting Fixtures		2	1	1
	TRANSFORMER CARE AND MAINTENANCES	PC8.Select and install equipment as per drawings and documentation provided		2	1	1
		PC8.Understand the following elements ○ Parts of transformer ○ Working principle and construction ○ Types of transformer and its use (Single phase & Poly phase)		3	1.5	1.5

		○ Spatial Transformer (Auto, CT, PT) construction and its application ○ Maintenance of transformer oil testing and filtration ○ Inspection of silica gel, breather, conservator, temperature ○ Maintenance of HT and LT Transformers yards				
	MOTOR	PC9.Connect A.C Motor as per instructions provided to include: structured cabling systems as per manufacturer's instructions and current industrial standards and regulations		3	1.5	1.5
		PC9Understand the working A.C Motor and its Construction		2	1	1
		PC9How the classification of A.C motor (Synchronous and Asynchronous) is done		1	0.5	0.5
		PC9The working and type of single phase motor and its working and poly phase (3 phase) and its working		1	0.5	0.5
		PC9Set-up equipment to Speed control and torque control of AC motor		1	0.5	0.5
		PC9Advantage of AC drive system		2	1	1
		PC9Ability for assembling and replacing of bearing with proper equipment's, referring to the standard catalogue.		1	0.5	0.5
		PC9Troubleshoot and take general care maintenance of AC motor		1	0.5	0.5
	D.C Motor	PC10.Different types of DC motors and the following details ○ Motor construction and working ○ Type of DC motor ○ Torque equation of DC motor ○ Characteristics of DC motor ○ Application of DC motor ○ Speed control of DC motor ○ DC drive system ○ General care maintenance of DC motor		2	1	1
		PC11.The importance of Special Electrical Motor in relation to petro		2	1	1

		chemical industry ○ Universal motor ○ Servo motor ○ Stepper motor ○ Brush Less A.C motor and Brush Less D.C motor Flame proof motors, Specification, Application, Care & maintenance				
	GENERATOR	PC12. Install the required electrical supply systems including transformers, generators, circuit breakers, isolators, bus bars, measuring equipment for voltage, current, power, energy, frequency, RPM, wiring, fuses, earthing, switchboard, control panels, relays etc. as per the required specifications.		2	1	1
		PC12Conduct a test process to ensure the performance of installed electrical equipment as per the defined specifications		2	1	1
		PC12 Understand the different elements of generator as below: ○ Construction and working of generator ○ Characteristics of generator ○ Type of DC generator ○ EMF equation ○ Application of DC generator ○ Maintenance with ABC type ○ Alternator construction & characteristics ○ Types, Application & Maintenance of alternator ○ Diesel Generator Care & Maintenance ○ Basics of engine ○ Basics of fuel system, Basics of air system, Basics of lubrication system, Basics of cooling system ○ DG control panel. ○ General maintenance		2	1	1
	STUDY OF SINGLE LINE DIAGRAM OF ELECTRICAL WIRING SYSTEM	PC13.Read, interpret and study drawings and documentation including: • Layout and circuit drawings • Follow written instructions		3	1.5	1.5
		PC13.Plan installation work using drawings and documentation provided		1	0.5	0.5

		PC13.Understand and read the Symbol of electrical parts		1	0.5	0.5
		PC13.Ability to connect and track of electrical diagram		1	0.5	0.5
		PC13.Able to properly layout structure of substation and work instruction		1	0.5	0.5
	CIRCUIT BREAKER/ SWITCH GEAR CARE AND MAINTENANCE	PC14.Install electrical switchboards onto a surface in a secure way and assemble switchboard apparatus in a switchboard as per layout drawings		1	0.5	0.5
		PC14.Test installations before energizing and check for proper connection PC14.Test installations when energized by checking complete function on all equipment PC14.installed to ensure correct operation of new installation as per instructions		2	1	1
		PC14.Understand the working of the following elements • Definition and use of circuit breaker • Type of switch • SPST, SPDT, DPST, DPDT, Toggle switch, pushbutton switch, level actuator, limit switch, selector switch, flame proof switch • Types of circuit breaker ○ MCB ○ MCCB ○ ELCB ○ Air circuit breaker (ACB) ○ SF6 ○ Vacuum Breaker (VCB) ○ Flame Proof Switch gear ○ Specification, Application, Care & maintenance.		4	2	2
	CABLE AND CABLE JOINTS	PC15.Identify cable types and sizes Types of cables, specification current rating, application		2	1	1
		PC15.Identify sub-circuits and determine cable for connection of security control panel.		1	0.5	0.5
		PC15.Install and terminate cable to connect security control panel to		1	0.5	0.5

		existing sub-circuit.				
		PC15.Knowledge of Flame proof cables Specification, Application, Care & maintenance.		2	1	1
		PC15.Inspect, test, rectify abnormal conditions, and commission connection of circuit		1	0.5	0.5
		PC15.The ability to different joints in the cable ○ Straight through, long routes and repaired section ○ Branch Y joints – for branch of a sector ○ T- Joint – for branching of a sector ○ Transition Joints – Special joint between two different types of cable		3	1.5	1.5
		PC15. Troubleshoot electrical installations and identify faults in cable		1	0.5	0.5
	EARTHING SYSTEM	PC16.Understand earth attachment positions on conductors, plant and equipment and the local earth are described in terms of earthing terminals, tail clamp attachment points, clamp rating and compatibility.		3	1.5	1.5
		PC16.Check earting in terms of portable earths, voltage rating, fault level, and conductor rating.		1	0.5	0.5
		PC16.Ability to do earthing compliance requirements are described in terms of acceptable surface condition and cleanliness; and clamps, leads, fittings, sticks and poles, and terminations.		1	0.5	0.5
		PC16. Understand the importance of ○ Importance of earthing in electrical and hazard system ○ Types of earthing system desired value ○ Measurement of earth resistance ○ Earthing in Transformer ○ Earthing in substation		2	1	1
	POWER SYSTEM AND MEASUREMENT	PC17.Explain the type and working of different stand by power systems like ○ Basics of UPS, online and offline		2	1	1

		○ Basics of inverter and its controls ○ Basics of cells and battery and rating ○ Care and maintenance of battery banks and its controls				
		PC18. Ability to use different measuring instruments and their calibration ○ Digital multimeter and adaptor ○ Power meter ○ Phase sequence meter ○ Clamp on multi meter ○ Continuity tester ○ Ground Fault tester ○ Insulation tester (meger) Versatile Data logger Ability to handle the following equipment's, their function, care and calibration ○ Study of CRO ○ Study of Tacho meter and speed measurement using proximity ○ Study of vibration analyser ○ Study of frequency analyser ○ Study of phase sequence analyser ○ Study of Temperature controller ○ Study of pressure measurement		2	1	1
			total	100	51	49
HYC/N 6104 Use basic, health, safety and security procedures	**Health and safety**	PC1.use protective clothing/equipment for specific tasks and work Conditions	100	2	1	1
		PC2.state the name and location of people responsible for health and		2	1	1

		safety in the workplace				
		PC3.state the names and location of documents that refer to health and safety in the workplace		2	1	1
		PC4.identify job-site hazardous work and state possible causes of risk or accident in the workplace		2	1	1
		PC5.carry out safe working practices while dealing with hazards to ensure the safety of self and others		2	1	1
		PC6.state methods of accident prevention in the work environment of the job role **Methods of accident prevention**: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors		3	1	2
		PC7.state location of general health and safety equipment in the workplace		2	1	1
		PC8.inspect for faults, set up and safely use steps and ladders in general use		2	1	1
		PC9.work safely in and around trenches, elevated places and confined areas		2	1	1
		PC10. lift heavy objects safely using correct procedures		2	1	1
		PC11. apply good housekeeping practices		2	1	1
		PC12. identify common hazard signs displayed in various areas		2	1	1
		PC13.retrieve and/or point out documents that refer to health and safety in the workplace		2	1	1
	Fire safety	PC14. use the various appropriate fire extinguishers on different types of fires correctly		3	1	2

		PC15. demonstrate rescue techniques applied during fire hazard		3	1	2
		PC16. demonstrate good housekeeping in order to prevent fire hazards		3	1	2
		PC17. demonstrate the correct use of a fire extinguisher		3	1	2
	Safety systems	PC18. List issue concerning the safety and familiar in your work style		3	1	2
		PC19. Empower to address the unsafe condition in your work place or to stop the unsafe behaviour		3	1	2
		PC20. Record all miss incidents ,damages, illness or injury		2	1	1
		PC21. Comprehend the applicable laws, regulations and codes as per standard		3	1	2
		PC22. Promote and maintain a positive safety culture		2	1	1
		PC23. Apply and appraise the use and storage of hazardous substance and their safety		3	1	2
		PC24. Assess the threats and to protect from the threats		2	1	1
		PC25. Awareness of own safety and safety of others		3	1	2
		PC26. Bring the concern and report the HSE concern		2	1	1
		PC27. Report all incident to the supervisor		3	1	2
		PC28. Identifies and describes the property of different petroleum products.		2	1	1
		PC29. Operates and handle spills and respond to the spills		3	1	2
	Emergencies ,rescue and first-aid procedures	PC30. demonstrate how to free a person from electrocution		2	1	1
		PC31. Administer appropriate first aid to victims were required eg. in case of bleeding, burns, choking, electric shock, poisoning etc.		3	1	2

		PC32. demonstrate basic techniques of bandaging		2	1	1
		PC33. respond promptly and appropriately to an accident situation		3	1	2
		PC34. perform and organize loss minimization or rescue activity during an accident in real or simulated environments		3	1	2
		PC35. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases		3	1	2
		PC36. demonstrate the artificial respiration and the CPR Process		2	1	1
		PC37. participate in emergency procedures		2	1	1
		PC38. complete a written accident/incident report or dictate a report to another person, and send report to person responsible **Incident Report includes details of**: name, date/time of incident, date/time of report, location, environment conditions, persons involved, sequence of events, injuries sustained, damage sustained, actions taken, witnesses, supervisor/manager notified		5	2	3
		PC39. demonstrate correct method to move injured people and others during an emergency		2	1	1
		TOTAL		100	41	59
HYC/N 6103 Work effectively in a team	**Compulsory**	PC1. maintain clear communication with colleagues	50	5	2	3
		PC2. work with colleagues as a team		5	2	3
		PC3. pass on information to in line with organisational requirements		6	2	4
		PC4. work in ways that show respect for colleagues		5	2	3

		PC5. carry out commitments made to colleagues		6	2	4
		PC6. let colleagues know in good time if cannot carry out commitments, explaining the reasons		6	2	4
		PC7. identify problems in working with colleagues and take the initiative to solve these problems		5	2	3
		PC8. follow the organisation's policies and procedures for working with colleagues		6	3	3
		PC9. ability to share resources with other members as per priority of tasks		6	3	3
		TOTAL		50	21	29