Model Curriculum

HVAC Technician

SECTOR: Electronics

SUB-SECTOR: Consumer Electronics

OCCUPATION: After Sales Support

REF ID: ELE/Q3112, v1.0

NSQF LEVEL: 4

Skill India
कौशल भारत-कुशल भारत

ESSCI
Skilling India in Electronics

Certificate

N·S·D·C
National
Skill Development
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Transforming the skill landscape

CURRICULUM COMPLIANCE TO QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

ELECTRONIC SECTOR SKILL COUNCIL OF INDIA

for the

MODEL CURRICULUM

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **'HVAC Technician Version 1.0' QP No. 'ELE/Q 3112 NSQF Level 4'**

Date of Issuance : November 15th, 2018

Valid up to* : November 14th, 2021

*Valid up to the next review date of the Qualification Pack

Authorised Signatory
(Electronic Sector Skill Council of India)

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HVAC Technician

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a **"**HVAC Technician**",** in the "Electronics Sector Skills" Sector/Industry and aims at building the following key competencies amongst the learner.

Program Name	HVAC Technician		
Qualification Pack Name & Reference ID	ELE/Q 3112 VERSION 1.0		
Version No.	1.0	**Version Update Date**	26/10/2018
Prerequisites to Training	*12th standard passed (Minimum 1 to 2 year AC plant working experience) or ITI/Diploma (Electrical/Mechanical/RAC)		
Training Outcomes	**After completing this programme, the participants will be able to:** • Identify and work with different types of HVAC system • Identify the client requirements • Prepare a list of solutions and suggest them to the client • Use standards and guidelines to service and repair HVAC systems installed at client site • Prepare daily work records and report the work done • Comply with the standards and communications norms specified by the organisation		

This course encompasses 04 compulsory and 01 optional National Occupational Standards (NOS) of "ELE/Q 3112" Qualification Pack issued by "Electronics Sector Skills Council".

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1.	**Role and Responsibilities of an HVAC Technician** **Theory Duration** (hh:mm) 30:00 **Practical Duration** (hh:mm) 20:00 **Corresponding NOS Code** ELE/N 3140	• Identify the work requirement, roles and responsibilities of an HVAC Technician • Define the basic concepts of RAC and HVAC • Identify basics of electricity, magnetism and motor theory • List the tools and equipment used by HVAC technician • Classify different types of HVAC systems used • Identify the working of various components of an HVAC system	Basic tool kit: Philips screw driver, plier set, flashlight, wrench set, Clamp meter, anemometer, pressure gauges Psychometric charts
2.	**Pre-requisites of Work** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** ELE/N 3101	• Demonstrate effective communication while interacting with the customer supervisor to get work requirement and work schedule • Identifying the requirement of service and repair by interacting with the client and supervisors • Analyse the drawings and layouts of site • Identify the possible solutions and suggest to client • Plan work schedule and collect tools equipment from store • Deliver quality work to get client satisfaction and positive feedback	HVAC system specification document, Warranty and service details
3.	**Service of an HVAC System** **Theory Duration** (hh:mm) 20:00	• Comply with the service and maintenance documents of HVAC system • Perform maintenance of a cooling tower and chiller • Use proper equipment to clean duct work, AHU and FCU	Dx chiller package, cooling tower, AHU, FCU, duct work, water pipes and motors, electrical panels Logbooks, maintenance and service documents

	Practical Duration (hh:mm) 50:00 **Corresponding NOS Code** ELE/N 3140	• Analyse and check water pipelines and pumps for any damage • Devise solutions to fix faults in electrical control panels and supply boxes • Use appropriate tools and equipment for maintenance and service • Prepare maintenance and service records	Basic tool kit: Philips screw driver, plier set, flashlight, wrench set, Clamp meter, anemometer Personal protective equipment**:** Safety shoes, gloves, mask, helmet, goggles
4.	**Repair of the System and Performance Check** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 50:00 **Corresponding NOS Code** ELE/N 3140	• Analyse customer input or complain to identify the issue • Perform basic troubleshooting steps to identify issues in chiller and cooling tower • Identify and fix the faulty units in chiller and cooling tower • Identify and fix faults in the AHU, FCU and ducts for faults • Evaluate and repair the electrical connections, Earthing and motor issues • Examine the air flow through ducts and temperature range in different regions • Identify the fault and perform replacement of faulty modules such as condenser, evaporator, filter and so on • Examine the system performance as per ISHRAE/ASHRAE and contract standards. • Examine the air flow and electrical parameters to calculate efficiency of the system • Record and report the repair work done	Dx chiller package, cooling tower, AHU, FCU, duct work, water pipes and motors, electrical panels Logbooks, maintenance and service records Basic tool kit: Philips screw driver, plier set, flashlight, wrench set, Clamp meter, anemometer Personal protective equipment**:** Safety shoes, gloves, mask, helmet, goggles
5.	**Safety at Workplace** **Theory Duration** (hh:mm) 20:00	• Use organisational safety policies and standards while working • Use PPE such as safety shoes, mask, gloves, goggles, ear plug, helmet and so on	Fire extinguishers, sand bucket, fire exit plans Personal protective equipment: Safety shoes, gloves, mask, helmet, goggles

	Practical Duration (hh:mm) 30:00 **Corresponding NOS Code** ELE/N 1002	• Comply with the emergency escalation procedure and escape plan • List the types of fire and fire extinguishing method • Practice fire and other safety related norms and participate in drills • Comply with the correct methods while working with heavy objects and elevated places	
6.	**Work Ethics and Management Skills** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** ELE/N 9905	• Demonstrate basics of personal grooming • Practice cleanliness to ensure that the work area, tools and equipment are clean and well maintained • Comply with the organisation policies and work ethics • Demonstrate good communication skills while interacting with client • Identify the basic knowledge and skills required for an entrepreneur	Organisation policy and standard documents
7	**Service and Repair of Packaged Type HVAC Ducted Systems** **(Optional Module)** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 50:00	• Identify the components of a packaged type HVAC ducted system. • Perform maintenance of compressor, condenser, evaporator and motor • Perform cleaning of coils, fan and filter • Replace the faulty modules • Check refrigerant leakage • Refill refrigerant • Ensure safety while repairing and filling gas • Document and report about the work done	Packaged type HVAC system, Duct system, refrigerant gas filling apparatus Logbooks, maintenance and service records Basic tool kit: Philips screw driver, plier set, flashlight, wrench set, Clamp meter, anemometer Personal protective equipment**:** Safety shoes, gloves, mask, helmet, goggles

	Corresponding NOS Code ELE/N 3141 (Optional NOS)		
	Total Duration 350:00 **Theory Duration** 150:00 **Practical Duration** 200:00	Unique Equipment Required: HVAC system installed (Cooling tower, chiller, ducts, AHU, FCU, motor, water pumps) Gauge manifold, Charging hoses, Micron gauge, Two stage rotary vacuum pump, Digital weighing scale, Sling psychrometer, Digital thermometer, DE spanner set of 18 pcs , DE ring spanner set, of 18 pcs, Pipe wrench, sizes 12" and 18" , Socket set with ratchets, Allen key set, Cable crimping tool, Stripper plier, Duct cleaning equipment, Condenser descaling equipment Safety shoes, gloves, mask, helmet, goggles Fire extinguisher (water, foam and other types) Laptop, Projector, Projector Screen, White Board, Marker, Duster, Attendance Sheet, Internet	

Grand Total Course Duration: **350 Hours 0 Minutes**

*(*This syllabus/ curriculum has been approved by ***Electronics Sector Skills Council of India)***

Trainer Prerequisites for Job role: "HVAC Technician" mapped to Qualification Pack: "ELE/Q 3112" Version 1.0

Sr. No.	Area	Details
1	**Job Description**	The individual at work performs maintenance and repair of heating, air conditioning and ventilation systems in commercial and industrial areas. The individual engages with the client to understand the work requirement and follow organizational norms to complete the work.
2	**Personal Attributes**	The individual must be willing to work in the field and travel throughout the day from one location to another. The individual should have skills such as good interpersonal relationship building, critical thinking, punctuality, patience and amenable behaviour.
3	**Minimum Educational Qualifications**	ITI/Diploma (Electrical/Mechanical/RAC) or Science Graduate
4a	**Domain Certification**	Certified for Job Role: "HVAC technician" mapped to QP: "ELE/ Q 3112 version1.0". Minimum accepted score is 80%
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102" with scoring of minimum 80%
5	**Experience**	Minimum educational qualification is diploma with 5 years of plant experience or Science graduate with 3 years of plant experience with a minimum of 1 year of Training Delivery experience.

Assessment Criteria for "HVAC Technician"

Job Role	HVAC Technician
Qualification Pack	ELE/Q 3112, Version1.0
Sector Skill Council	Electronics Sector Skills Council of India

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. Each NOS will have assessed both for theoretical knowledge and practical
3. The assessment will be based on knowledge bank of questions created by the SSC.
4. Individual assessment agencies will create unique question papers for theory and skills practical part for each candidate at each examination/training centre
5. To pass the Qualification Pack, every trainee should score a minimum of 70% 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.
7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Compulsory NOS **Total Marks: 500**				**Marks Allocation**	
Assessment outcomes	**Assessment Criteria for outcomes**	**Total marks**	**Out of**	**Theory**	**Skills Practical**
ELE/N3101 Engage with customer for service	PC1. Get the client's requirement from customer care or the daily work schedule	100	3	2	1
	PC2. Call the client to confirm requirement and fix time for visit		3	2	1
	PC3. Greet the client and confirm the registered requirement		3	2	1
	PC4. Enquire about the symptoms of the problem(s) and the age of the appliance		4	1	3
	PC5. Check about warranty status and annual maintenance contract of the appliance		4	1	3
	PC6. Identify the problem based on the client's information		3	2	1
	PC7. Ascertain the client's location to make the route plan for the day		3	2	1
	PC8. Understand the condition and requirements of the site		4	1	3
	PC9. Seek client's requirement and study drawings and layouts of the work site		4	2	2
	PC10. Anticipate possible problems to carry tools and equipment parts accordingly		18	5	13
	PC11. Check the specification of equipment to be serviced or repaired		4	2	2

	PC12. Discuss the identified problem(s) with the client and educate on possible reasons		4	2	2
	PC13. Suggest possible solutions and costs involved		4	2	2
	PC14. Explain the time required and methodology for service or repair		4	2	2
	PC15. Seek client's approval on further action		4	2	2
	PC16. Prepare most optimum route plan to complete daily target visits		5	2	3
	PC17. Assess the problem accurately and offer most appropriate and cost-effective service as per client's requirement to avoid repeat problems post service		19	5	14
	PC18. Set the system for optimum performance setting and record the details post repair and service work		4	2	2
	PC19. Record and report about work done		3	1	2
Total			100	40	60
ELE/N3140 Service, troubleshoot and repair a HVAC system	PC1. Clean chiller, cooling tower, condenser, blower, filter, coils and pump valves	100	3	1	2
	PC2. Lubricate fan and motor bearings		2	1	1
	PC3. Adjust fan belt tension		2	1	1
	PC4. Check water treatment		2	1	1
	PC5. Fix broken gasket and insulation lining of water piping		2	1	1
	PC6. Fix cracks and leaks in water piping		2	1	1
	PC7. Tighten all screws and fasteners to remove vibration		2	1	1
	PC8. Tighten electrical connections		2	1	1
	PC9. Check and fix damper linkages, set screws and blade adjustment		2	1	1
	PC10. Clean, but not lubricate, the nylon damper rod bushings		2	1	1
	PC11. Prepare maintenance and service record		2	1	1
	PC12. Use appropriate tools and equipment for maintenance and service		2	1	1
	PC13. Perform basic troubleshooting of high side components such as chiller, cooling tower, compressor and pumps		3	1	2
	PC14. Troubleshoot low side components such as AHU, fan and filter		3	1	2
	PC15. Check electrical components such as electric circuit, Earthing connection, fuses, electrical panels etc. and make cable connections		3	1	2
	PC16. Check for any noise or vibration in the HVAC system		3	1	2
	PC17. Check flow of air through the grills and diffusers		3	1	2
	PC18. Check filters, contamination and indoor air quality		3	1	2
	PC19. Check the cooling temperature and pressure in refrigerant/water lines		3	1	2
	PC20. Use manometer to check pressure loss in filters		3	1	2
	PC21. Check FCU, water valves and expansion valves		3	1	2

	PC22. Check the motor conditions: overheat, noise, excessive vibration, slow run and failure to start		3	1	2
	PC23. Check and fix capacitor, relays etc.		3	1	2
	PC24. Perform leak detection test of refrigerants		3	1	2
	PC25. Repair faulty insulation in refrigerant lines and water pipes		3	1	2
	PC26. Use clamp meter to check current and voltage		3	1	2
	PC27. Replace the faulty electrical components such as capacitor, relay, motor and cables		3	1	2
	PC28. Replace faulty condenser, evaporator, filter and expansion valve		3	1	2
	PC29. Record and report the repair work done		3	2	1
	PC30. Check the performance of the HVAC system as per standards		3	1	2
	PC31. Check that the voltage and the current range of the supply to the electrical systems is in optimum range		3	1	2
	PC32. Check the airflow through the ducts using an anemometer		3	1	2
	PC33. Check the level of humidity		3	1	2
	PC34. Test cooling and heating temperature range as per requirement		3	1	2
	PC35. Record dry bulb and wet bulb temperature at each cooling/heating region		3	2	1
	PC36. Check the efficiency of the system		3	1	2
	PC37. Record performance parameters of the system		3	2	1
Total			100	40	60
ELE/N9905 Work effectively at the workplace	PC1. Exchange information and instructions with others at the workplace clearly, accurately and within agreed timelines	100	5	2	3
	PC2. Seek clarification to obtain complete information and confirm understanding while receiving communications		4	2	2
	PC3. Display helpful behaviour by assisting others in performing tasks where required		3	1	2
	PC4. Follow communication etiquette while working to convey politeness, assertiveness, care and professionalism		5	2	3
	PC5. Share all relevant information with stakeholders in agreed formats using appropriate mode of communication		5	2	3
	PC6. Identify and obtain clarity regarding organisational, team and own goals and targets		5	2	3
	PC7. Prioritise and plan work in order to achieve goals and targets		5	2	3
	PC8. Monitor own and team performance as per agreed plan		4	1	3
	PC9. Complete duties accurately, systematically and within required timeframes		3	1	2

	PC10. Maintain orderliness and cleanliness in the work area		4	2	2
	PC11. Identify own strengths and weaknesses in relation to goals and targets		4	2	2
	PC12. Select opportunities for continuous learning and maintaining currency of professional practice		4	2	2
	PC13. Develop a professional development plan to enhance professional capabilities		5	2	3
	PC14. Examine developments and trends in field of work and potential impact on work		4	2	2
	PC15. Invite peers and others to observe, and provide feedback, on own performance and practices		3	1	2
	PC16. Use feedback from colleagues and clients to identify and introduce, improvements at work		3	1	2
	PC17. Perform tasks as per workplace standard and in compliance with organisational policies and legislative requirements		3	1	2
	PC18. Display appropriate professional appearance for the workplace while adhering to organisational policy for dress code		3	1	2
	PC19. Demonstrate responsible and disciplined behaviors in the workplace		5	2	3
	PC20. Identify the cause of conflict and options for resolution when faced with situations of conflict		4	2	2
	PC21. Escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		3	1	2
	PC22. Protect the rights of the client and organisation when delivering services		4	2	2
	PC23. Ensure services are delivered equally to all clients regardless of personal and cultural beliefs		3	1	2
	PC24. Operate within an agreed ethical code of practice		3	1	2
	PC25. Recognise unethical conduct and report to an appropriate person		3	1	2
	PC26. Follow organisational guidelines and legal requirements on disclosure and confidentiality		3	1	2
Total			100	40	60
ELE/N1002 Apply health and safety practices at the workplace	PC1. Identify job-site hazardous work and state possible causes of risk or accident in the workplace	100	5	2	3
	PC2. Carry out safe working practices while dealing with hazards to ensure the safety of self and others		7	3	4
	PC3. Use appropriate personal protective equipment (PPE)		5	2	3
	PC4. Follow standard safety procedures while handling tools and equipment		5	2	3
	PC5. Follow standard safety procedures while handling hazardous substances or working in hazardous environments		4	1	3
	PC6. Dispose electronic waste as per industry approved techniques		5	2	3

	PC7. Avoid damage of components due to negligence in electrostatic discharge (ESD) procedures		4	1	3
	PC8. State the name and location of people responsible for health and safety in the workplace		3	1	2
	PC9. State the names and location of documents that refer to health and safety in the workplace		3	1	2
	PC10. Follow methods of accident prevention in the work environment of the job role		5	2	3
	PC11. State location of general health and safety equipment in the workplace		3	1	2
	PC12. Lift heavy objects safely using correct procedures		4	1	3
	PC13. Apply good housekeeping practices at all times		5	2	3
	PC14. Identify common hazard signs displayed in various areas		3	1	2
	PC15. Use the various appropriate fire extinguishers on different types of fires correctly		6	2	4
	PC16. Demonstrate rescue techniques applied during fire hazard		6	2	4
	PC17. Take preventive measures in order to prevent fire hazards		5	2	3
	PC18. Demonstrate how to free a person from electrocution		3	1	2
	PC19. Administer appropriate first aid to victims where required e.g. in case of bleeding, burns, choking, electric shock, poisoning etc.		5	2	3
	PC20. Demonstrate basic techniques of bandaging		3	1	2
	PC21. 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		4	1	3
	PC22. Participate in emergency procedures		3	1	2
	PC23. Demonstrate correct method to move injured people and others during an emergency		4	1	3
Total			100	35	65

OPTIONS **Option 1: Packaged Type HVAC Ducted System** **Total Marks: 100**				**Marks Allocation**	
Assessment outcomes	**Assessment Criteria for outcomes**	**Total marks**	**Out of**	**Theory**	**Skills Practical**
ELE/N3141 Service and repair of packaged type HVAC ducted system	PC1. Identify any fault in beam clamp, conduit, dampers, pipe hanger, duct hanger and refrigeration system	100	4	2	2
	PC2. Check bend, kink or crack in ducts		3	1	2
	PC3. Inspect return air, supply air and duct sizes		3	2	1
	PC4. Check the fan, blower and motors		3	1	2
	PC5. Perform cleaning of ducts by robotic/manual methods		3	2	1

	PC6. Descale water cooled condensers		3	1	2
	PC7. Check the drains of AHU and FCU		3	1	2
	PC8. Fix air leaks in ducts		3	1	2
	PC9. Tighten all insulation and acoustic seals		3	1	2
	PC10. Replace leaking dampers on ventilation system		3	1	2
	PC11. Use proper tools and equipment and maintain safety while working		4	2	2
	PC12. Check, clean and tighten electrical terminals, thermostat and fuses		3	1	2
	PC13. Check voltage balance		3	2	1
	PC14. Check and clean cooling tower		3	1	2
	PC15. Check and clean coils of evaporator and air cooled condenser		3	1	2
	PC16. Inspect and fix belts, pulleys, bearings, and lubricate motors and bearings		4	2	2
	PC17. Lubricate motor bearings		3	1	2
	PC18. Clean or replace air filters		3	1	2
	PC19. Check and fix refrigerant pressure and leaks		3	1	2
	PC20. Check the refrigerant gas level and charge the gas		3	1	2
	PC21. Check and replace compressor and metering devices		3	1	2
	PC22. Adjust the controls of the system as per requirement		3	2	1
	PC23. Use proper tools while doing repair		3	1	2
	PC24. Maintain safety while handling refrigerants		3	1	2
	PC25. Complete maintenance checklist and report		3	1	2
	PC26. Check cooling efficiency and heating efficiency		3	1	2
	PC27. Check the air flow with anemometer		3	1	2
	PC28. Check the static pressure		3	1	2
	PC29. Check the refrigerant charge		3	1	2
	PC30. Check the EER of the system		3	1	2
	PC31. Check the temperature drop across the coils		3	1	2
	PC32. Check the parameters as per the requirements		4	2	2
Total			100	40	60