Model Curriculum

Fiber to-the Home (FTTH/X) Installer

SECTOR: TELECOM
SUB-SECTOR: PASSIVE INFRASTRUCTURE
OCCUPATION: NETWORK (PASSIVE) INSTALLATION
REF ID: TEL/Q4200, V1.0
NSQF LEVEL: 4

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

TELECOM SECTOR SKILL COUNCIL

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Fiber to-the Home (FTTH/X) Installer'
QP No. 'TEL/Q4200 NSQF Level 4'

Date of Issuance: 17th Oct 2018

Valid up to*: 17th Oct 2022

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

Authorised Signatory
(Telecom Sector Skill Council)

TABLE OF CONTENTS

Fiber to-the Home (FTTH/X) Installer

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a "Fiber to-the Home (FTTH/X) Installer" in the "Telecom" Sector/Industry and aims at building the following key competencies amongst the learner.

Program Name	**Fiber to-the Home (FTTH/X) Installer**		
Qualification Pack Name & Reference ID.	TEL/Q4200, Version 1.0		
Version No.	1.0	**Version Update Date**	17-Oct-18
Pre-requisites to Training	12th		
Training Outcomes	**After completing this programme, participants will be able to:** • **Follow procedures for outside plant cable installation –** Pre-installation checks and cable installation types – direct buried, underground (duct) and aerial installation • **Prepare cables for splicing –** Fiber cable preparation, and cable slack management • **Install passive FTTH/X components –** Installation of wall mount splitters, distribution ports and test the insertion loss and measure output power • **Construct FTTH/X cabling inside the building –** Cable installation through cable trays, conduits, false ceiling inside the customer premise and termination at Optical Network Terminal (ONT) and Telecommunication Outlet (TO) • **Follow safety precautions pertaining to optical fiber –** Use personal protective equipment such as safety glasses, safety hand-gloves while working with optical fiber and adhere the safety procedures		

This course encompasses 5 out of 5 National Occupational Standards (NOS) of "Fiber to-the Home (FTTH/X) Installer" Qualification Pack issued by "TSSC: Telecom Sector Skill Council"

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1.	**Introduction** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 00:00 **Corresponding NOS Code** Bridge Module	• Recall the fundamentals of optical fiber and their applications • Summarize the history of optical fiber • Solve the challenges faced during handling of fiber optics • Illustrate on working principle of optical fiber communication system • Compare optical fiber performance parameters like attenuation, bending, dispersion, cut-off wavelength and mode-field diameter • Explain the various fiber geometric parameters (core, clad and buffer) • Infer the importance of cable jackets, strength members and moisture/ water blocking compounds	NA
2.	**Outside plant cable installation procedure and practices** **Theory Duration** (hh:mm) 15:00 **Practical Duration** (hh:mm) 45:00 **Corresponding NOS Code** TEL/N4128	• Examine the pre-construction survey of the cable placing route • Test the cable with an OTDR • Inspect pre-installation cable for physical damage • Illustrate cable hauling process and pre-installation check with the following constraint check – maximum pulling tension, maximum bending radius, total cable length, splicing length requirement at end points • Carry out duct rodding, testing and cleaning processes • Select appropriate cables for installation procedures – direct buried installation (single jacket, dual jacketed cable), underground (duct) installation ("figure 8" demonstration), aerial installation (bending radius, placing tension)	Cable blowing machines, Protection Sleeves, Fiber Stripper, OTDR, Different types of fiber cables (aerial, buried and underground), drum flanges
3.	**Undertake splicing of Optical Fiber** **Theory Duration** (hh:mm) 30:00 **Practical Duration** (hh:mm) 55:00 **Corresponding NOS Code** TEL/N6400	• Identify various tools and equipment used during the splicing process – OTDR, Power Meter etc. • Test the connector end and follow the cleaning procedures • Carry out splicing – mechanical or fusion splicing as required on-ground • Test optical fiber cable for continuity, insertion loss and troubleshooting • Test the optical fiber cables using optical inspection microscope, OTDR, Visual Fault Locator (VFL)	Cleaver, Mechanical and fusion Splicing kit, Protection Sleeves, Fiber Stripper, Fiber reinforced plaster and Jointing, Optical test equipment - OTDR and power meter

Sr. No.	Module	Key Learning Outcomes	Equipment Required
4.	**Installation of passive FTTH/X components** **Theory Duration** (hh:mm) 25:00 **Practical Duration** (hh:mm) 35:00 **Corresponding NOS Code** TEL/N4200	• Trace the passive network components and their deployment environment • Outline the concept of feeder and distribution connections in a splitter • Distinguish types of optical splitter and relative features • Identify the splitter required on ground • Demonstrate installation for wall mount splitters (1X8, 1X16, 1X32) • Identify feeder and distribution – ports, cables/pigtails and connections on the devices • Define power test procedure and principle • Test the optical splitters – insertion loss and power output measurement (using OLTS and Light Source)	Optical power meter, Fiber optic test source, OLTS, Optical splitters, Pigtails
5.	**In-building FTTH/X Cabling** **Theory Duration** (hh:mm) 25:00 **Practical Duration** (hh:mm) 35:00 **Corresponding NOS Code** TEL/N4201	• Identify optical fiber types and characteristics for in-building deployments • Measure the bend radius of fiber cable and fusion splicing • Test the VLF principal and use of fiber pulling tools/equipment (fish tape) • Inspect the sites and identify the cabling path from outdoor fiber landing point to ONT installation point • Calculate the horizontal and vertical cable length to manage the cable slack • Measure the pre-existing load and post-installation load compliance of the cable trays • Lay the fiber along the identified tray tracks using appropriate cable pulling method • Tie the fiber along the cable tray • Demonstrate fiber pulling through conduits using appropriate tools (like fish tape) and technique (strength member) • Secure excess fiber at the termination point • Demonstrate cable installation through conduits on false ceiling • Illustrate fiber termination at Optical Network Terminal (ONT) & Telecommunication Outlet (TO) • Configure the ONT after providing power supply • Test ONT using IP network • Operate Visual Fault Locator (VFL) for the installed fiber run	Fiber cables, Fish tape, ONT, Cable trays, VFL, Fiber detection meter

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Test the live fiber using fiber detection meter • Record the test values	
6.	**Work Safety with fiber optics** **Theory Duration** (hh:mm) 10:00 **Practical Duration** (hh:mm) 10:00 **Corresponding NOS Code** TEL/N4131	• Carry out the fiber work safety • Use PPEs such as eye-safety to protect cornea or lens during work • Handle safely bare fiber from broken ends of fibers and scraps of fibers during termination and splicing • Compare the manufacturer supplied material safety data sheet (MSDS) with on-ground materials • Follow fire safety practices while using electric arc to make fusion splicers • Comply and adhere electrical safety norms while working with fiber hardware connectivity • Summarize the laser safety norms and applicable classes • Record the health and safety instances	Safety glasses, safety hand-gloves, microscope with infrared filters, isopropyl alcohol, adhesives, class III optical amplifiers
	Total Duration **Theory Duration 120:00** **Practical Duration 180:00**	**Unique Equipment Required:** Projector, Laptop/PC, White Board, Marker, Cable blowing machines, Protection Sleeves, Fiber Stripper, OTDR, Different types of fiber cables (aerial, buried and underground), drum flanges, Cleaver, Mechanical and fusion Splicing kit, Fiber reinforced plaster and Jointing, Optical test equipment -OTDR and Optical power meter, Fiber optic test source, OLTS, Optical splitters, Pigtails, Fish tape, ONT, Cable trays, VFL, Fiber detection meter, safety glasses, safety hand-gloves, microscope with infrared filters, isopropyl alcohol, adhesives, class III optical amplifiers.	

Grand Total Course Duration: **300Hours, 0 Minute**

*(This syllabus/ curriculum has been approved by **TSSC: Telecom Sector Skill Council)***

Trainer Prerequisites for Job role: "Fiber to-the Home (FTTH/X) Installer" mapped to Qualification Pack: "TEL/Q4200, V1.0"

Sr. No.	Area	Details
1	**Description**	Fiber to-the Home (FTTH/X) Installer will undertake on-ground implementation of fiber cabling from drop point – Optical Line Terminals (OLTs) to the last mile connectivity i.e. customer premise (termination point). The work will include fiber splicing and termination at every distribution point. The work will follow the structured cabling norms and compliance to telecommunication cabling guidelines on the subject.
2	**Personal Attributes**	Good inter-personal skills, on-site problem-solving, eye for details, attention to compliance to work instructions & parameters and clear communication skills to interact with team members and higher-ups are required for the role
3	**Minimum Educational Qualifications**	ITI/ Diploma
4a	**Domain Certification**	Certified for Job Role: "Fiber to-the Home (FTTH/X) Installer" mapped to QP: "TEL/Q4200", Version No. 1.0 Minimum accepted score should be mentioned as 80%
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102", Version No. 1.0 Minimum accepted score as per SSC guidelines is 80%.
5	**Experience**	• The trainer should be certified by TSSC as 'Train the Trainer' and 'Assessor' • Worked as Optical Fiber Technician for a minimum of 1 year

Annexure: Assessment Criteria

Assessment Criteria	
Job Role	**Fiber to-the Home (FTTH/X) Installer**
Qualification Pack	**TEL/Q4200, V 1.0**
Sector Skill Council	**Telecom**

Sr. No.	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	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS
4	Individual assessment agencies will create unique question papers for theory and skill practical part for each candidate at each examination/ training center
5	To pass the Qualification Pack, every trainee should score a minimum 70% of aggregate marks to successfully clear the assessment
6	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**	**Total Marks**	**Out Of**	**Theory**	**Skills Practical**
TEL/N4128 **Outside Plant Cable Installation Procedure & Practices**	PC1. carry out pre-construction survey of the cable placing route and identify all probable pit-falls and account for them	**100**	4	2	2
	PC2. perform pre-test of optical cable using a OTDR		6	2	4
	PC3. undertake pre-installation cable inspection to identify any visible damage or non-compliances		6	0	6
	PC4. confirm basic parameters like max pulling tension, max bending radius, total cable length, splicing length required at termination points		3	2	1
	PC5. demonstrate duct rodding, testing and cleaning process/procedure		2	0	2
	PC6. select appropriate cable for direct buried (single jacket, dual jacket) as per the sight requirements		6	3	3
	PC7. demonstrate armor bonding and grounding		4	1	3
	PC8. handle cable while bending and placing tension		6	0	6
	PC9. perform cable laying and trench compacting practices and placement of markers		4	0	4
	PC10. carry out reinstatements		4	2	2
	PC11. understand best practices in duct cable pulling using proper tools and accessories (pulling rope, cable pulling grip, breakaway swivel)		4	0	4
	PC12. demonstrate cable reel positioning and pulling		7	2	5
	PC13. demonstrate “figure 8” winding/storing of cable		5	0	5
	PC14. understand cable blowing process (wing compressed air)		6	0	6
	PC15. understand practices on duct integrity testing, duct fill ratio, co-efficient of friction and their effect on cable laying/longevity		5	2	3
	PC16. understand specific construction of aerial cables making them suitable for such deployment		10	4	6
	PC17. demonstrate cable handling practices for aerial cables (bending radius, placing tension)		7	3	4
	PC18. demonstrate use and uniqueness of messenger strand		6	3	3
	PC19. demonstrate deployment and use of self-supporting cables		2	0	2
	PC20. demonstrate deployment process for aerial cable		3	2	1
	TOTAL		**100**	**28**	**72**

TEL/N6400 **Undertake Splicing of Optical Fiber**	PC1.	verify that cable is installed as per the installation plan and visually inspect cable for signs of sheath damage	**100**	2	2	0
	PC2.	ensure minimum bend ratios are maintained according to manufacturer's specifications to prevent cable damage and signal degradation		5	2	3
	PC3.	ensure cable is placed on stable jointing pit		3	2	1
	PC4.	secure cable according to safe industry practice to avoid cable and sheath damage		3	0	3
	PC5.	identify the appropriate fiber to be joined based on colour coding and sequence		6	2	4
	PC6.	identify appropriate place for the joint chamber location		4	2	2
	PC7.	clean the fiber appropriately as per company/ manufacturer's specifications		2	2	0
	PC8.	ensure availability of test equipment like OTDR and Power meter for carrying out optical tests		1	1	0
	PC9.	ensure availability of optical equipment like spool, joint closure, connectors, splicer and cleaver		1	1	0
	PC10.	ensure that faulty equipment sent to logistics team for repair and replacement		2	1	1
	PC11.	ensure availability of Optical Fiber joint kits, Pigtails, patch cords, 0dB connector, protection sleeves, heat shrinks		1	1	0
	PC12.	ensure continuous power supply at site for the splicing operation by use of portable generators or stand-by heavy-duty batteries		1	1	0
	PC13.	ensure availability of RCC joint chambers with covers as per specifications		1	1	0
	PC14.	ensure availability of sand for filling the chambers		1	1	0
	PC15.	ensure availability of one spare cable drum for emergency replacement of laid cables		1	1	0
	PC16.	ensure calibration status of equipment to be used (e.g. splicing machine, OTDR, power meter, cleaver)		1	0	1
	PC17.	ensure clean environment for splicing operations		2	2	0
	PC18.	ensure cables are stripped off their protective coating areas where splicing must be performed as per the standard process		2	2	0
	PC19.	ensure the fiber ends are cleaved with a precision cleaver and are inspected with magnifier to ensure appropriateness		6	2	4
	PC20.	in case of fusion splicing - insert fibers strand to the fusion machine in accordance to product/equipment specifications		6	2	4

PC21.	in case of mechanical splice, align the fibers together by a precision-made sleeve and place the prepared fiber in mechanical splicing kit	6	2	4
PC22.	verify the spliced fiber for appropriate splicing in the magnifier window	1	1	0
PC23.	ensure appropriate splice protectors like heat shrink splice protectors are utilized to protect the splice	2	2	0
PC24.	test the fiber joint with OTDR to confirm conformance to design requirements	2	2	0
PC25.	ensure optical losses - reflectance, return and insertion are within the defined specifications/ limits	4	3	1
PC26.	ensure sealing of Joint closure through heat shrinking /multi diameter seals/mechanical seals as appropriate	3	2	1
PC27.	ensure FRP - Fiber Reinforced Plastic is used to strengthen the joint as required	3	2	1
PC28.	test the fiber at both ends for instances of cross fiber using power source and power meter tests and ensure their elimination	4	2	2
PC29.	ensure joint is placed in the chamber properly	1	0	1
PC30.	ensure spare cable (loop) is coiled appropriately and placed inside the joint	3	1	2
PC31.	ensure that sand is filled in the chamber to the brim and the chamber covers are placed properly	3	2	1
PC32.	ensure that Joint indicator is planted 1 meter behind the chamber location (away from road)	1	1	0
PC33.	ensure that the indicator is painted proper color (for example yellow for joint)	1	1	0
PC34.	ensure appropriate disposal of the cut fibers, sleeves and cable pieces	1	0	1
PC35.	ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms	1	1	0
PC36.	ensure that work is carried out in accordance to the level of competence and legal requirements	1	1	0
PC37.	ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work	2	1	1
PC38.	ensure compliance to health and safety guidelines by optical splicer and installation labor workers	1	1	0
PC39.	ensure that Personal protection equipment like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required	1	0	1
PC40.	ensure environmental conditions and hazards like Earth Potential Rise (EPR) are considered while carrying out the work	2	0	2
PC41.	ensure escalation of safety incidents to relevant authorities as per guidelines	1	1	0

	PC42.	ensure appropriate cable marking and Installation of chamber & route marker for direction and route identification		1	1	0
	PC43.	ensure preparation of jointing record for future reference		1	1	0
	PC44.	ensure that documents that are required to be updated are identified		1	1	0
	PC45.	ensure completion of OTDR register showing complete record of jointing tests		1	1	0
	PC46.	ensure that documents are available to all appropriate authorities to inspect		1	1	0
		TOTAL		**100**	**59**	**41**
TEL/N4200 **Installation of passive FTTH/X components**	PC1.	identify components of passive devices (splitters)	**100**	10	4	6
	PC2.	demonstrate installation practices for wall mount splitters (1x8, 1x16, 1x32)		18	7	11
	PC3.	identify feeder and distribution ports on the devices		13	4	9
	PC4.	identify feeder and distribution cables/pigtails		12	5	7
	PC5.	demonstrate feeder and distribution connections		14	5	9
	PC6.	demonstrate insertion loss testing of optical splitters (OLTS and Light Source)		16	5	11
	PC7.	demonstrate power output measurement at output port by use of power meter and light source (using OLTS & Light Source)		17	4	13
		TOTAL		**100**	**34**	**66**
TEL/N4201 **In-building FTTX Cabling**	PC1.	inspect the site as per building lay-out plan	**100**	4	0	4
	PC2.	identify the cabling path from the outdoor fiber landing point (in the building premises) up to the intended ONT installation point (this to include both the cable tray as well as conduit runs)		8	2	6
	PC3.	calculate the horizontal and vertical cable length, accounting for the slack to be maintained		5	5	0
	PC4.	ascertain the pre-existing load and post installation load compliance of the cable trays		4	2	2
	PC5.	ascertain and account for existing cable services on the cable trays (power cables, other data/voice cables etc.)		4	0	4
	PC6.	lay the fiber along the identified tray tracks using appropriate cable pulling method		5	1	4
	PC7.	secure the fiber along the cable tray ensuring proper slack management (especially for the vertical run)		5	0	5
	PC8.	demonstrate fiber pulling through conduit using appropriate technique and tools (pulling through		8	2	6

		'strength member' and using correct tools like 'fish tape')				
	PC9.	demonstrate proper coiling and securing of excess fiber (approx. 3 meter) at the termination end		6	2	4
	PC10.	demonstrate cable installation through false ceiling, using "figure 8" method		8	2	6
	PC11.	demonstrate cable installation through conduits on false ceiling		8	2	6
	PC12.	demonstrate fiber termination and connectorisation at ONT		9	3	6
	PC13.	demonstrate fiber termination at TO		6	0	6
	PC14.	demonstration powering and configuring of ONT		5	2	3
	PC15.	test installed ONT using IP network		5	2	3
	PC16.	undertake VFL (visual fault locator) for the installed fiber run		6	3	3
	PC17.	test the live fiber using fiber detection meter		4	2	2
TOTAL				**100**	**30**	**70**
TEL/N4131 **Work Safety practices whilst working with Fiber optics**	PC1.	demonstrate eye-safety measures whilst at work	**100**	12	4	8
	PC2.	demonstrate safe handling of bare fiber (broken ends of fiber and scraps)		14	6	8
	PC3.	read and comprehend manufacturer supplied MSDS for safe handling of fiber		12	4	8
	PC4.	demonstrate fire safety practices (whilst working with high voltage arc in fusion splicers)		12	4	8
	PC5.	demonstrate electrical safety norms where fiber is placed along with electrical cables		12	6	6
	PC6.	adhere to laser safety rules		12	8	4
	PC7.	demonstrate use of safety gloves and boots, in required situations		12	6	6
	PC8.	complete any health and safety records legibly and accurately		14	6	8
TOTAL				**100**	**44**	**56**