GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

FIBER TO HOME TECHNICIAN

(Duration: Six Months)
Revised in July 2022
CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3

SECTOR – TELECOM

Directorate General of Training

FIBER TO HOME TECHNICIAN

(Non-Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 3

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

Sectoral Trade Course Committee of Telecom Sector

&

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CONTENTS

During the six months duration of Fiber to Home Technician trade a candidate is trained on professional skills and professional knowledge related to job role. In addition to this a candidate is entrusted to undertake project work and Extra-Curricular Activities to build up confidence. The broad components covered related to the trade are categorized in six months duration as below: -

The trainees begin with learning first aid, use of PPE and various safety practices for working in industry environment and use of basic Tools and measuring Instruments related to Electrical and Electronic circuit testing. They will Identify functions of AC and DC energy, Electronic components, Relationship between Current, Voltage and Resistance using OHM's Law and perform AC / DC measurements. The trainees will Perform Soldering and de-soldering techniques with Safety procedure for personnel, environment and the electronic gadget under service. The trainees will also Assemble different types of rectifier circuits, test for functioning and Measure o/p using CRO and DSO, test and verify the function of a transistor as a switch with a LED as output indicator. The trainees will be able to Construct, test and verify the input/output characteristics of various analog circuits using CRO and DSO. They will assemble, verify and test different basic digital circuits, assemble and test AM/FM transmitter and receiver trainer and check its performance. They will also be able to identify OFC trainer and Check its performance, prepare FIBER OPTIC NETWORK setup and execute transmission and reception, Prepare, crimp, terminate and test various cables and connectors, use crimping tools, splicing tools and test various cables used in FTTH network and Check various types of Splitters, perform connector terminations and perform Insertion Loss testing of Optical splitters in FTTH network. The trainees will Perform fiber preparation for splicing and apply fusion splicing technique, Perform OTDR test, measure the signal strength & losses and assess cable performance using Optical Power meter. They will be able to identify Passive Optical Network and measure gain, bandwidth and Attenuation, install and configure given computer system, perform networking of Computers and Configure IP address, troubleshoot various faults that can occur in different types of FTTH Modem/ONTs and troubleshoot and rectify Hardware and Software problems in FTTH network using firmware, driver S/W etc.

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of the economy/ labour market. The vocational training programs are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer programs of DGT for propagating vocational training.

'Fiber to Home Technician'trade is a newly designed trade under Craftsman Training Scheme (CTS). The course is of six months duration. It mainly consists of Domain area and Core area. Domain area (Trade Theory and Trade Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/ documentation, executes work, identify necessary materials and tools.
- Perform tasks with due consideration to safety rules, accident prevention regulations.
- Apply professional knowledge & employability skills while performing the job and maintenance work.
- Check the circuit/ equipment/ panel as per drawing for functioning, identify and rectify faults/ defects.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can join industry as Fiber Technician and will progress further as Senior Technician, IBS Supervisor, Passive infra planner - OSP and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship Programs in different types of industries leading to a National Apprenticeship Certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of six months: -

S No.	Course Element	Notional Training Hours
1.	Professional Skill (Trade Practical)	270
2.	Professional Knowledge (Trade Theory)	120
3.	On Job Training	150
4.	Employability Skills	60
	Total	**600**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical examination

Evidences of internal assessments are to be preserved until forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skills and accuracy in the field of work/ assignments. • A fairly good level of neatness and consistency to accomplish job activities. • Occasional support in completing the task/ job.
(b) Marks in the range of 75%-90% to be allotted during assessment	

For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels and accuracy in the field of work/ assignments. • A good level of neatness and consistency to accomplish job activities. • Little support in completing the task/ job.
(c) Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels and accuracy in the field of work/ assignments. • A high level of neatness and consistency to accomplish job activities. • Minimal or no support in completing the task/ job.

FTTH (Fiber to Home) Technician:

Optical fibre technician; is responsible for maintaining uptime and quality of the network segment (both optical media and equipment) assigned to him by undertaking periodic preventive maintenance activities and ensuring effective fault management in case of fault occurrence. He is also required to coordinate activities for installation and commissioning of Optical Fibre Cable (OF) as per the route plan.

Optical fibre splicer; is responsible for ensuring efficient splicing of the optical fibre cables and supports in optical fibre installation and in carrying out fibre testing using OTDR and power meter.

Information and Communications Technology Installers and Servicers, Other; include installers and servicers who install, repair and maintain telecommunications equipment, data transmission equipment, cables, antennae and conduits and repair, fit and maintain computers not elsewhere classified

Reference NCO-2015:

a) 7422.0801 – Optical Fibre Technician
b) 7422.0802 – Optical Fibre Splicer
c) 7422.9900 – Information and Communications Technology Installers and Servicers, Other

Reference NOS: TEL/N4131, TEL/N4128, TEL/N4200, TEL/N4201, and TEL/N9401 to TEL/N9412

Name of the Trade	FIBER TO HOME TECHNICIAN
Trade Code	DGT/2017
NCO - 2015	7422.0801, 7422.0802, 7422.9900
Mapped NOS	NOS: **TEL/N4131, TEL/N4128, TEL/N4200, TEL/N4201, and TEL/N9401 to TEL/N9412**
NSQF Level	Level-4
Duration of Craftsmen Training	Six Month (600 Hours)
Entry Qualification	Passed 10th Examination OR Passed in Level 3 Short term course related to fiber technology with two years relevant experience.
Minimum Age	16 years as on first day of academic session.
Eligibility for PwD	LD, CP, LC, DW, LV, AA, LV
Unit Strength (No. of Student)	24 (There is no separate provision of supernumerary seats)
Space Norms	35 Sq. m
Power Norms	3 KW
Instructors Qualification for:	
(i) Fiber to Home TechnicianTrade	B.Voc/Degree in ECE or Equivalent from AICTE/UGC recognized Engineering College/ university with **one-year** experience in the relevant field. OR 03 years Diploma in ECE or Equivalent from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with **two years' experience** in the relevant field. OR NTC/NAC in Fiber to Home Technician trade with minimum **3Years' experience** in relevant field.

	Essential Qualification: Relevant Regular/RPL variants of National Craft Instructor Certificate (NCIC) under DGT.
(ii) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with training in Employability skills.
(iii) Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 LEARNING OUTCOMES

1. Use PPE, elementary first aid and basic Tools and measuring Instruments related to Electrical and Electronic circuit testing and measurements.TEL/N4131

2. Identify functions of AC and DC energy, Electronic components, Relationship between Current, Voltage and Resistance using OHM's Law and perform AC / DC measurements. TEL/N9401

3. Perform Soldering and de-soldering techniques with Safety procedure for personnel, environment and the electronic gadget under service. TEL/N9402

4. Assemble different types of rectifier circuits, test for functioning and Measure o/p using CRO and DSO. TEL/N9403

5. Test and verify the function of a transistor as a switch with a LED as output indicator. TEL/N9404

6. Identify and select different types of opto electronic components and verify the characteristics in different circuits. TEL/N9405

7. Construct, test and verify the input/output characteristics of various analog circuits using CRO and DSO. TEL/N9406

8. Assemble, verify and test different basic digital circuits. TEL/N9407

9. Assemble and test AM /FM transmitter and receiver trainer and check its performance. TEL/N9408

10. Identify OFC trainer and Check its performance. TEL/N9409

11. Prepare FIBER OPTIC NETWORK setup and execute transmission and reception. TEL/N4128

12. Prepare, crimp, terminate and test various cables and connectors, use crimping tools, splicing tools and test various cables used in FTTH network. TEL/N4131, TEL/N6400

13. Check various types of Splitters, connector terminations and perform Insertion Loss testing of Optical splitters in FTTH network. TEL/N4131, TEL/N4200

14. Perform fiber preparation for splicing and apply fusion splicing technique. TEL/N4131, TEL/N4200, TEL/N6400

15. Perform OTDR test, measure the signal strength & losses and assess cable performance using Optical Power meter. TEL/N4128, TEL/N4200

16. Select FTTH network, test the fiber for any damage or break using fiber detection OTDR meter, Check power and configuration of ONU/ONT. TEL/N4201

17. Identify Passive Optical Network and measure gain, bandwidth and Attenuation. TEL/N9410

18. Install and configure given computer system, perform networking of Computers and Configure IP address. TEL/N4201

19. Troubleshoot various faults that can occur in different types of FTTH Modem/ONTs. TEL/N9411

20. Troubleshoot and rectify Hardware and Software problems in FTTH network using firmware, driver S/W etc. NOS:TEL/N9412

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Use PPE, elementary first aid and basic Tools and measuring Instruments related to Electrical and Electronic circuit testing and measurements. NOS: TEL/N4131	Perform first aid / PPE in relevant trade.
	State standard safety norms.
	Patch up a test board with different types of switches and a lamp load and test it.
	Identify different types of meters & electronic measuring instruments.
	Identify different Electronic components.
	Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.
	Measure the resistor values using colour code and verify the reading by measuring with multi meter.
	Identify different inductors and measure the values using LCR meter.
	Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
	Identify Transformer & check step-up/ step-down transformer.
2. Identify functions of AC and DC energy, Electronic components, Relationship between Current, Voltage and Resistance using OHM's Law and perform AC /	Perform work in compliance with standard safety norms.
	Observe safety precaution during soldering/ de-soldering.
	Identify different types of mains transformers and test.
	Identify the primary and secondary transformer windings and test the polarity.
	Measure the primary and secondary voltage of different transformers.

DC measurements. TEL/N9401	Verify Ohm's Law, Connect a lamp load along with a rheostat to the transformer secondary and measure voltage variations with multimeter or panel meters, with the guidance of.	
	Identify and test the variac.	
3. Perform Soldering and de-soldering techniques with Safety procedure for personnel, environment and the electronic gadget under service. TEL/N9402	Prepare workstation for soldering de-soldering operation.	
	Perform work in compliance with standard safety norms.	
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.	
4. Assemble different types of rectifier circuits, test for functioning and Measure o/p using CRO and DSO. TEL/N9403	Construct and test a half & full wave rectifier with and without filter circuits.	
	Measure the output using multimeter and DSO.	
	Construct and test a bridge rectifier with and without filter circuits.	
	Measure the output using multimeter and DSO.	
	Perform different types of electronic filters.	
5. Test and verify the function of a transistor as a switch with a LED as output indicator. TEL/N9404	Identify the type of transistor.	
	Test with a multimeter whether the given transistor and LED are good or bad.	
	Assemble the transistor as a switch with LED as load and test the circuit with a DC source (9 V power pack Battery or a DC power supply).	
	Apply forward bias (Switch ON condition) and reverse bias (Switch OFF condition)to the transistor alternately and verify the ON/OFF status of LED.	
6. Identify and select different types of opto electronic components and verify the	Identify different types of Opto electronic devices.	
	Arrange bias settings to the Opto electronic component.	
	Apply variable DC supply voltage to an LED, IR LED and observe the characteristics of the device.	

	characteristics in different circuits. TEL/N9405	Test the behavior of an LDR, photo diode and a photo transistor by applying light source to each device, one at a time.
		Observe the light intensity Vs current flow through each device.
		Identify photo coupler/ optical sensor input/output terminals and measure the quantum of isolation between the terminals.
		Measure the resistance, voltage, current through electronic circuit using multimeter.
7.	Construct, test and verify the input/output characteristics of various analog circuits using CRO and DSO. TEL/N9406	Construct and test a Zener based voltage regulator circuit.
		Use SMPS unit as a voltage regulator.
		Perform testing of Transistor – NPN & PNP types & verify its characteristics.
		Assemble and test transistor as an amplifier and tabulate the results.
		Demonstrate Audio amplifier with a speaker as output, Observe the response with variable voltage input and variable frequency input and Observe the useful range of amplifier, plot the voltage gain Vs bandwidth graph.
8.	Assemble, verify and test different basic digital circuits. TEL/N9407	Verify logic gates.
		Identify different types of digital ICs.
		Make different digital circuits by the digital trainer kit with safety.
		Identify various digital ICs, test IC using digital IC tester and verify the truth table.
		Construct and verify the truth table of all gates using NOR and NAND gates.
9.	Assemble and test AM /FM transmitter and receiver trainer and check its performance. TEL/N9408	Identify and demonstrate various control elements on front panel of a DSO.
		Modulate and Demodulate various signals using AM and FM on the trainer kit and observe waveforms.
		Modulate and Demodulate a signal using PAM, PPM, PWM Techniques.
		Measure different parameters of transmitter and receiver signals using DSO.
		Troubleshoot and replace the faulty components.
		Check the functionality of AM/FM receiver.

10. Identify OFC trainer and Check its performance. TEL/N9409	Select appropriate tools to complete the job safely.
	Identify the resources and their need on the given fiber optic trainer kit.
	Make optical fibre setup to transmit and receive analog and digital data.
	Apply FM modulation and demodulation using OFC trainer kit, audio signal and voice link.
	Perform PWM and PPM modulation and demodulation using OFC trainer kit using audio signal and voice link.
11. Prepare FIBER OPTIC NETWORK setup and execute transmission and reception. TEL/N4128	Assemble a FTTH network with the given equipment and accessories and test.
	Install software and test.
	Verify connectivity at various test points between Transmitter and Receiver.
	Check different types of networks/ data cables.
12. Prepare, crimp, terminate and test various cables and connectors, use crimping tools, splicing tools and test various cables used in FTTH network. TEL/N4131, TEL/N6400	Identify various tools used for FTTH working.
	Identify various cables and connectors used for crimping and splicing.
	Plan, work in compliance with standard safety norms.
	Perform splicing of FTTH cable and verify cable connectivity.
13. Check various types of Splitters, connector terminations and perform Insertion Loss testing of Optical splitters in FTTH network. TEL/N4131, TEL/N4200	Identify various Splitters.
	Check connector terminations.
	Perform Insertion Loss testing of Optical splitters in FTTH network.
	Work in compliance with standard safety norms.
14. Perform fiber preparation for splicing and apply fusion splicing technique.	Identify the portion of cable to be spliced.
	Make settings on Fusion Splicer and make Splicing of OFC cable, at the marked portion.

TEL/N4131, TEL/N4200, TEL/N6400	Test for Continuity after Splicing. Apply signal and Observe the response.
15. Perform OTDR test, measure the signal strength & losses and assess cable performance using Optical Power meter. TEL/N4128, TEL/N4200	Perform OTDR test.
	Measure the signal strength and losses and assess cable performance.
	Use Optical Power meter.
16. Select FTTH network, test the fiber for any damage or break using fiber detection OTDR meter, Check power and configuration of ONU/ONT. TEL/N4201	Use OTDR meter to test the Fiber for any break or damage.
	Identify the damaged point of the cable and perform splicing.
	Check power and configuration of ONU/ONT.
	Observe the performance of ONT and the impact on gain/loss of the system.
	Configure Wi-fi router with requisite authentication parameters.
17. Identify Passive Optical Network and measure gain, bandwidth and Attenuation. TEL/N9410	Install PON network and test the signals.
	Connect Modem and check response. Observe gain, bandwidth and attenuation of PON.
18. Install and configure given computer system, perform networking of Computers and Configure IP address. TEL/N4201	Work in compliance with standard safety norms.
	Install and Configure a given computer system.
	Distinguish hardware and software components.
	Install FTTH device drivers in the system.
19. Troubleshoot various faults that can occur in different types of FTTH Modem/ONTs. TEL/N9411	Identify various faults that can occur in an FTTH network.
	Troubleshoot various faults that can occur in different types of FTTH Modem/ONTs.
	Identify the Modem Problems, PON defects and find remedy.
20. Troubleshoot and rectify	Install network connection to the computers/ establish new

Hardware and Software problems in FTTH network using firmware, driver S/W etc. TEL/N9412	connection.
	Update/ Reinstall software.
	Identify various Software used for FTTH network Installation.
	Assign IP address to the given PC and Integrate the PC with the existing network.
	Identify Network connection problem and solve it.

7. TRADE SYLLABUS

SYLLABUS FOR FIBER TO HOME TECHNICIAN TRADE			
DURATION: SIX MONTHS			
Duration	**Reference Learning outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional skills 15 Hrs Professional Knowledge 6 Hrs	Use PPE, elementary first aid and basic Tools and measuring Instruments related to Electrical and Electronic circuit testing and measurements. NOS:TEL/N4131	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (3 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (1 hr) 3. Perform Use of Personal Protective Equipment (PPE). (2 hrs) 4. Perform elementary first aid. (2 hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/ shop floor. Introduction to PPEs. Introduction to First Aid. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as

		5. Perform Preventive measures for electrical accidents & steps to be taken in such accidents. (3 hrs) 6. Perform Use of Fire extinguishers. (2 hrs) 7. Study of different types of meters & electronic measuring instruments. (2 hrs)	applicable.
Professional skills 22 Hrs Professional Knowledge 9 Hrs	Identify functions of AC and DC energy, Electronic components, Relationship between Current, Voltage and Resistance using OHM's Law and perform AC / DC measurements. TEL/N9401	8. Identify conductors, Semiconductors & Insulators. (2 hrs) 9. Identify different Electronic components. (1 hr) 10. Measure the resistor values using colour code and verify the reading by measuring with multi meter. (2 hrs) 11. Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter. Verify Ohm's law. (3 hrs) 12. Identify different inductors and measure the value of Inductance using LCR meter. (1 hr) 13. Identify the different capacitors and measure capacitance using LCR meter. (1 hr) 14. Identify the primary and secondary transformer windings and perform cold test (without supply) to	Introduction to the FTTH course and future scope. Conductors, Semiconductors, Insulators. Overview of current, Voltage, Resistance (including color code). OHM's law - Description and Examples. Different types of meters & electronic measuring instruments and its functions in brief. Classification of Active and Passive devices. Functions of a Resistor, Capacitor and an Inductor in Electronic systems. Various types of Resistors, Capacitors and Inductors and their applications. Series and Parallel circuits with Passive elements and their behavior. Current and voltage in series and parallel circuits. Overview of Multimeter operation (Analog & Digital).

		find the primary and secondary resistance. (2 hrs) 15. Identify different types of mains transformers and perform hottest (with supply) to measure primary and secondary voltages. (2 hrs) 16. Identify & check step-up/ step-down transformer. (2 hrs) 17. Demonstrate the AC current flowing through a transformer and the resistance load using a Trainer kit. Measure the voltage and current flowing through the load. (2 hrs) 18. Connect a lamp load along with a potentiometer to the 9V/12V transformer secondary and measure voltage variations with Digital multimeter and current using panel meters. (3 hrs) 19. Identify and test a Variac with load. Measure output AC voltage. (1 hr)	Transformer and its working principle. Types of transformers. Relationship between current and voltage in a transformer. Properties of a transformer. Step up and step down transformer. Formulas.
Professional skills 7 Hrs Professional Knowledge 3 Hrs	Perform Soldering and de-soldering techniques with Safety procedure for personnel, environment and the electronic gadget under service.	20. Observe safety precautions during soldering/ de-soldering. (02 hrs) 21. Perform Soldering & de-soldering of various Electronic components. (05 hrs)	Soldering techniques, Precautions and Safety methods to be followed - for the personnel, environment and the electronic gadget under service.

	TEL/N9402		
Professional skills 15 Hrs Professional Knowledge 09 Hrs	Assemble different types of rectifier circuits, test for functioning and Measure o/p using CRO and DSO. TEL/N9403	22. Identify different types of diodes & test. (3 hrs) 23. Construct and test a half & full wave rectifier with and without filter circuits. Measure the output using multimeter and DSO. (5 hrs) 24. Construct and test a bridge rectifier with and without filter. Measure the ouput using multimeter and DSO. (3 hrs) 25. Demonstrate different types of electronic filters – Low pass, high pass and band pass filter. (2 hrs) 26. Construct and test Zener diode based voltage regulator and IC regulator. (2 hrs)	Classification of Diodes. Diode characteristics, Different types of diodes and their Power rating. Diode as a Switch and as a Rectifier. Classification of Rectifiers. Functional description of different rectifier circuits. Filters – Capacitor filter, RLC filter. Ripple factor, Formulas. Applications of diodes in Electronic systems. DC power supply using rectifier and filter. Classification of filters. Factors that determine the max current through the dc power supply. Limitations of a DC power supply using rectifier circuit. Zener as a Voltage regulator. Need for voltage regulation and Practical Limitations with respect to Load requirement – PPTs and videos.
Professional skills 09 Hrs Professional Knowledge 06 Hrs	Test and verify the function of a transistor as a switch with a LED as output indicator. TEL/N9404	27. Perform testing of Transistor & verify its characteristics. (6 hrs) 28. Demonstrate use of transistor as a switch. (3 hrs)	Classification of a transistor, NPN and PNP transistors. Biasing of NPN and PNP transistor. Description with Videos. Functional description-Transistor as a Switch. Applications of transistor as oscillator and amplifier with sufficient examples, PPTs and videos.
Professional skills 6 Hrs	Identify and select different types of opto electronic	29. Assemble a photo transistor switching circuit and measure the resistance,	Classification of Opto Electronic Devices.

Professional Knowledge 4 Hrs.	components and verify the characteristics in different circuits. TEL/N9405	voltage, current through photo transistor switch using multimeter. Observe the output with a LED. (3 hrs) 30. Identify Opto electronic devices - Opto coupler, optical sensor, laser diode input/output terminals and Observe the quantum of isolation between the terminals, by exciting the device with a light source. (3 hrs)	LED, IR LEDs, photo diode, laser diode, photo transistor, LDR, Optocouplers etc. Description of Characteristics and operation of each device.
Professional skills 27 Hrs Professional Knowledge 10 Hrs	Construct, test and verify the input/output characteristics of various analog circuits using CRO and DSO. TEL/N9406	31. Assemble and test a Crystal oscillator. (5 hrs) 32. Identify and demonstrate various functions and switches on front panel of a DSO. Refer User Manual. (6 hrs) 33. Assemble and test an Astable multivibrator as a Free running variable oscillator. Observe waveforms using DSO. (5 hrs) 34. Assemble and test an audio amplifier circuit using a transistor. Test audio amplifier with an audio input from an oscillator or microphone. Observe waveforms using DSO. Calculate voltage and current gain and plot frequency response graph. (6 hrs) 35. Demonstrate voltage regulation using Switch	Oscillators – brief functional description, crystal oscillator. Timer (Astable Multivibrator) using IC 555. Audio amplifier circuit description and procedure for testing audio amplifier. Gain and bandwidth of an amplifier. Frequency response curve of an amplifier. Switch Mode Power Supply as a regulated DC power supply. Difference between analog and Digital systems. Advantages of Digital Electronic System.

		Mode Power Supply Trainer, by applying variable input voltage to SMPS unit and obtain constant DC output. (5 hrs)	
Professional skills 19 Hrs Professional Knowledge 09 Hrs	Assemble, verify and test different basic digital circuits. TEL/N9407	36. Verify the truth table of basic logic gates using IC. (4 hrs) 37. Verify the truth table of Universal gates using IC. (4 hrs) 38. Demonstrate encoder and decoder functions using Digital trainer. (4 hrs) 39. Demonstrate Multiplexer and demultiplexer functions using Digital trainer. Demonstrate A to D converter and D to A converter using ADC and DAC trainer. (7 hrs)	Number system (Binary, Hexadecimal, BCD), Overview of ICs, Analog and Digital ICs and applications. Different types of Logic gates. (basic & universal gates) (07hrs) Concept of Encoder and Decoder, Multiplexer and Demultiplexer, A to D converter and D to A converter. Introduction to Microprocessor and Microcontrollers.
Professional skills 15 Hrs Professional Knowledge 09 Hrs	Assemble and test AM /FM transmitter and receiver trainer and check its performance. TEL/N9408	40. Modulate and Demodulate various signals using AM and FM on the trainer kit, measure output voltages and Observe waveforms. Check the functionality of the system. (4 hrs) 41. Modulate and demodulate a signal using Pulse code modulation Technique using PCM trainer. (4 hrs) 42. Measure different parameters of transmitter and receiver signals using DMM & DSO. (4 hrs) 43. Simulate various faults in the PCM trainer and practice procedure for rectification.	**Introduction to Communication technology.** Concept of modulation and demodulation. Need for modulation. Difference between AM, FM and PM. Use of Transmitter and Receiver for broadcasting audio and video, used in Radio and TV broadcasting stations. Significance of Pulse modulation. Concept of Analog to Digital conversion and vice versa. Present Telephone communication – uses Digital communication – Pulse Code Modulation technique.

		(3 hrs)	
Professional skills 15 Hrs 0020 Professional Knowledge 06 Hrs	Identify OFC trainer and Check its performance. TEL/N9409	39. Study of Optical properties of light. (3 hrs) 40. Study of intensity of light and Wavelength of light spectrum. (4 hrs) 41. Study of FTTH system Trainer function. (3 hrs) 42. Identification of various sections of the FTTH trainer system. (5 hrs)	**Introduction to Fiber Optic Communication:** Description for the following Terminologies used in Optical communication. Properties of light, Relationship between Frequency and Bandwidth, Electromagnetic spectrum, Modes of Propagation of EM wave, Lightwave transmission. **Definitions:** Velocity of light, Signal to noise ratio, Dispersion (pulse spreading), Wavelength, Attenuation, Fresnel reflection, Snell's law of Refraction, Refractive Index, Total internal Reflection, Numerical aperture, Intrinsic and extrinsic losses, Return Loss, Reflection Loss, Scattering of light, Absorption. Multiplexing in Fiber Optics.
Professional skills 12 Hrs Professional Knowledge 06 Hrs	Prepare FIBER OPTIC NETWORK setup and execute transmission and reception. TEL/N4128	43. Identification of various Networking devices used in the Optical communication network - PON, OLT, Optical Splitter, FDMS and ONT /ONU. (3 hrs) 44. Make optical fibre setup to transmit and receive Analog and digital data. (3 hrs) 45. Test the signal flow path of a FTTH system. Measure voltages and Observe waveforms on transmitter section and receiver	**Fiber to Home Networks: Architecture and types:** Introduction to FTTH Networks. FTTH Topology and Technology. Elements of FTTH system – PON, OLT, Optical Splitter, FDMS and ONT/ONU. Types of Optical Fibers. Optical Fiber Specifications. Fiber Optic Standards. Advantages & Disadvantages of Optical Fibers. Classification of different FTTx networks- FTTC, FTTH, FTTN,

		section. (3 hrs) 46. Configure Wi-fi router with requisite authentication parameters. (3 hrs)	FTTD, FTTP. (8 hrs) Network device security and its features
Professional skills 09 Hrs Professional Knowledge 06 Hrs	Prepare, crimp, terminate and test various cables and connectors, use crimping tools, splicing tools and test various cables used in FTTH network. TEL/N4131, TEL/N6400	47. Demonstration of safe handling methods for fiber optic cable and Cable handling issues. (1 hrs) 48. Identify various tools used for FTTH working. (2 hrs) 49. Identify various cables and connectors used for crimping and splicing. Plan, work in compliance with standard safety norms. (2 hrs) 50. Identification of SMF and MMF fibre. Measurement of Fibre Radius and other geometrical parameters. (2 hrs) 51. Identify the appropriate fiber to be joined based on color coding and sequence. (2 hrs)	**Principle of Optical Fiber communication & its Structure:** How Optical Fiber Works. Total Internal Reflection and Numerical Aperture. Classification of Fibers: SMF, MMF Step-Index Fibers, Graded-Index Fibers. Optical fiber performance parameters and selection criteria. Principles of optical transport media & OFC communication. Color coding followed in Optical fiber usage.
Professional skills 15 Hrs Professional Knowledge 06 Hrs.	Check various types of Splitters, connector terminations and perform Insertion Loss testing of Optical splitters in FTTH network. TEL/N4131, TEL/N4200	**OFC Connectors& Splitters:** 52. Classification of OFC connectors (ST, SC, FC/PC, MT-RJ, LC) for a given application. (4 hrs) 53. Understanding connector types and their use. Identify connectors based on color coding. (4 hrs) 54. Perform connector termination on field environment (use of termination tools, cable tools & test equipment)	Classification of OFC connectors (ST, SC, FC/PC, MT-RJ, LC) based on the type of equipment and application. Connecting Techniques and their insertion loss.

		including connector inspection and cleaning. (4 hrs) 55. Demonstrate insertion loss testing of optical splitters. (3 hrs)	
Professional skills 14 Hrs Professional Knowledge 06 Hrs.	Perform fiber preparation for splicing and apply fusion splicing technique. TEL/N4131, TEL/N4200, TEL/N6400	**Fibre Splicing and Testing** 56. Demonstrate Optical cable splicing technique. (6 hrs) 57. Demonstrate fiber preparation for splicing (strip jacket, dressing buffer tubes & fibers, strength members, removal of buffer coating). (4 hrs) 58. Demonstrate fusion splicing. (4 hrs)	Techniques adopted for Optical cable splicing. Procedure followed for splicing and use of Mechanical Splicing components. Need for splicing. Principle of operation of optical splitters. Concept of feeder and distribution connections in a splitter. Types of optical splitters and relative features/limitations. Techniques adopted for Optical cable splicing. Procedure followed for splicing and use of Mechanical Splicing components. Need for splicing closure. Fusion Splicer, Fusion Splicing methods.
Professional skills 09 Hrs Professional Knowledge 06 Hrs.	Perform OTDR test, measure the signal strength & losses and assess cable performance using Optical Power meter. TEL/N4128, TEL/N4200	**Optical Time Domain Reflectometer (OTDR)** 59. Study of OTDR and Power meter for carrying out optical tests. (1 hr) 60. Perform OTDR test and measure the signal strength and losses. (1 hr) 61. Practice measurement, saving and loading files using OTDR meter. (1 hr) 62. Observe cable performance with waveforms. (1 hr) **Optical Power meter**	OTDR Measurement Preparation/ Connection Set up. Procedure followed for OTDR measurements. Classification of Losses incurred in Optical Communication. Factors that give rise to losses in communication. OTDR Fault Localization Techniques. Gain and loss calculation. Procedure for Distance Measurement, Saving & Loading Files.

		63. Perform Study of Optical power meter. (1 hr) 64. Demonstrate power output measurement at output port using power meter and light source. (2 hrs) 65. Measure signal strength and quality of given SMF and MMF fibre cables using power meter. (2 hrs)	Principle of operation of Optical Power Meter. Concept of dB, dBm, optical power. Interpretation of Power in various Units of measurement. Difference between SMF and MMF cable properties.
Professional skills 09 Hrs Professional Knowledge 04 Hrs.	Select FTTH network, test the fiber for any damage or break using fiber detection OTDR meter, Check power and configuration of ONU/ONT. TEL/N4201	**FTTH Installation** 66. Demonstrate fiber termination at OLT. (2 hrs) 67. Demonstrate installation practices for splitters (1:8, 1:16, 1:32). (2 hrs) 68. Identify feeder and distribution ports on the devices. (1 hr) 69. Test the fiber for any damage or break using fiber detection OTD Rmeter. (2 hrs) 70. Demonstrate fiber termination and connector termination at ONU. (1 hr) 71. Demonstrate powering and configuring of ONU/ONT. Measure gain and losses for the installed connection using OTDR. (1 hr)	Overview of FTTH network system. Function of Optical line terminal (OLT) and its features. Configuring OLT. Function of Optical network Unit. ONU/ONT) and its features. Configuring ONU. Difference between Active and Passive modules. Types of Optical Splitters. Choice of Splitters according to requirement. Techniques followed while connecting splitter and OFC.
Professional skills 08 Hrs Professional Knowledge 04 Hrs.	Identify Passive Optical Network and measure gain, bandwidth and Attenuation. TEL/N9410	**Passive Optical Network (PON)** 72. Identify PON section in OFC trainer. (3 hrs) 73. Measure Input signals and output signals of PON section. Observe waveforms. (2 hrs) 74. Measure gain, Bandwidth	Role of Passive Optical Networks in FTTH. PON - Principles & Benefits. PON types (BPON / EPON / GPON) x PON - description. Upstream and downstream technology. Different types of OLT & ONU

		and attenuation. (3 hrs)	and their features and best practices related to FTTH networking and testing.
Professional skills 27 Hrs Professional Knowledge 06 Hrs.	Install and configure given computer system, perform networking of Computers and Configure IP address. TEL/N4201	**Computer Hardware and Networking:** 75. Assembling and testing of Desktop Computer system. (08 hrs) 76. Identification of various Sections of motherboard. (4 hrs) 77. Install, configure given computer system, demonstrate networking of Computers and configure IP address. (08 hrs) 78. Demonstrate simple Networking errors / problems. (7 hrs)	Components of Personal Computer system and motherboard. Introduction to Networking. Types of networks – LAN, WAN, MAN. Network Addressing, Inter NIC Register, IP Address, DNS Address, Gateway, Subnet Mask, Ports, HTTP, FTP. Basics of networking devices such as cables, hubs and switches, routers, Servers and Clients. Fast Ethernet – 10BaseT, 100BaseT, Optical-FX Configuring IP in PC. Trouble shooting networks CMD commands: IPCONFIG (windows) / IFCONFIG (LINUX) PING, etc.
Professional skills 13 Hrs Professional Knowledge 03 Hrs.	Troubleshoot various faults that can occur in different types of FTTH Modem/ONTs. TEL/N9411	**Troubleshooting and fault finding in FTTH system.** 79. Perform Post-installation testing with the OTDR. Perform Visual laser testing. (5 hrs) 80. Perform Visual inspection & Maintenance. (4 hrs) 81. Measure reflectance with a dead zone box. (4 hrs)	Faults likely to occur in FTTH network. Types of fiber optic damage. Procedures to be followed for: Testing of drop cables, Reflection testing, Measuring reflectance with a dead zone box, Optical loss testing, System related problems. Typical causes of failure Eye diagrams Types of fiber optic damage Typical cable system faults.
Professional skills 04 Hrs	Troubleshoot and rectify Hardware and Software	**Safety in Fiber Optic Installations.** 82. Demonstrate eye-safety	Safety in Fiber Optic Installations. Safety measures to be followed

Professional Knowledge 2 Hrs.	problems in FTTH network using firmware, driver S/W etc. TEL/N9412	measures whilst at work. (2 hrs) 83. Demonstrate fire safety practices (whilst working with high voltage arc infusion splicers). (2 hrs)	while handling OFC. Environmental and quality requirements for site risk control.

On the Job Training: 150 Hrs (Compulsory).

1. Familiarise various cables and connectors, usage of crimping tools, splicing tools and test of various cables used in FTTH network.
2. Perform OTDR test and measure the signal strength and losses and assess cable performance. To become Conversant with use of FTTH splicer, OTDR and Optical Power meter.
3. In a FTTH network, Test the fibre for any damage or break using fibre detection OTDR meter.
4. Perform powering and configuring of ONU/ONT.
5. Perform Study of Passive Optical Network and measure gain, bandwidth and Attenuation.
6. Troubleshooting of various faults that can occur in different types of FTTH Modem/ONTs.
7. Troubleshoot & Rectify Hardware and Software problems in FTTH network using firmware, driver S/W etc.

Revision & Examination

SYLLABUS FOR CORE SKILLS

1. Employability Skills (Common for all 6 Month CTS trades) (60 Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ www.dgt.gov.in

LIST OF TOOLS & EQUIPMENT			
FIBER TO THE HOME TECHNICIAN (for 24 Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
LIST of Items for TRAINEES TOOL KIT – (24 + 1) sets for 24 trainees.			
1.	Soldering Iron (Changeable bits)	25 W, 230 V • Input voltage: 190 to 270V • Temperature range 180 to 450 °C)	24+1 nos.
2.	De-soldering pump (Pencil type)		12 nos.
3.	Nose Cutter		24+1 nos.
4.	Long nose pliers	150mm	24+1 nos.
5.	Neon tester	500 V	24+1 nos.
6.	Electrician knife	100 mm	24+1 nos.
7.	Tweezers	150 mm	24+1 nos.
8.	Wire stripper	High grade alloy steel stripper/cutter	24+1 nos.
9.	Screwdriver set	Screwdrivers of different shapes and sizes Set of 7	24+ 1 set
	Insulated combination pliers	150mm	12 Nos.
10.	Optical Fibre Stripper	High quality mechanical fiber stripper	12 nos.
11.	Cable Cutter	150mm	12 nos.
12.	Sheath Cutter	150mm	12 nos.
List of Tools & Equipment			
13.	Digital Multimeter	3 ¾ Digit Digital Multimeter	12 nos.
14.	SMD Soldering and De soldering Station	40 W, 230 V Soldering Operation: Power Consumption: 60W Input Voltage: 170-270V Temperature Range:180-270ºC Temperature accuracy: ±1ºC De Soldering Operation: Power Consumption: 70W Input Voltage: 170-270V	6 nos.

		Temperature Range: 180-480ºC Pump: Diaphragm Type.	
15.	Multi Fiber Polarity Tester		4 nos.
16.	Drum flanges Cleaver	Single fiber SM/MM cleaver	2 nos. each.
17.	Optical fusion Splicing machine	Typical splice loss of 0.05dB or more. (Automatic Fusion splicing machine with cleaver and accessories) Color LCD Monitor & 200 Magnification, Reversible monitor with control panel on each side, simultaneous X and Y views, Large capacity internal battery	2 nos.
18.	Joint closure kit	2/4 fiber joint kit (Comprising of joint closures, tissue paper, bushes, ferrule) etc.	4 nos. each.
19.	Fusion Splicing kit	Connectorization and Fusion Splicing tool kit including all accessories, tools and consumables to prepare and practice connector and splice with fibers.	3 nos.
20.	Loose Tube Cutter (cutting of fibre tube from center)	Optical fiber buffer cutter, Model: Slitter	6 nos.
21.	Different types of test JIG Box		4 sets
22.	Programmable DC Power Supply/Dual Regulated power supply unit	With display to read Output voltage: (0– 30) V; Max Current: 2 Amp DC 0-30 V; 0-3 Amp with numeric keypad for settings of voltage and current and LCD for display of Voltage, Current & Power Current limit exceed indication (LED) Step increment for Voltage Constant voltage source and Constant current source USB PC interface with computer software	4 nos.
23.	Function generator (Sine, Square, Triangle, Ramp, Pulse, Serial Data, TTL and Modulation.)	Frequency Range: (1 mHz -10 MHz) , Function/ Pulse – Modulation Generator with Built in 40MHz Frequency Counter.	2 nos.

24.	CRO (Dual trace)	20 MHz (with component testing facilities)	2 nos.
25.	DSO 100Mhz, 100MHz 4 Channel	Dual channel, 100MHz, TFT colour display, Autoset and Auto-ranging functions. 100MHz 4 analog Channel digital storage oscilloscope with 1GSa/s sampling, Memory Depth more than 20 Mpts, vertical rage 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, automatic measurements 26 nos and 6 bits hardware counter, advance serial bus trigger and decoding functions including RS232/UART, I2C and SPI, multi triggering facility, different Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs.7 inches WVGA TFT Display, Computer Interface USB host and device and LAN.	1 no.
26.	OTDR	Handheld Battery Operated OTDR with 1310nm/1550nm/1650nm (Filtered), dynamic range of 37/35/32dB, Smart Link mapper option for FTTh, facility to store results on cloud in real-time, remotely controlled using smart access. touch screen display, built-in Laser Source, 2x USB 2.0 ports, 1x mini-USB 2.0 port and can store more than 10000 OTDR Traces. Operating range – (0 to 50) Kms.	4 nos.
27.	Different types of test JIG BOX (for placing splitters terminations on poles/outdoor premises)	Capacity (1x4), (1x8)	2 nos. each
28.	Optical power meter with light source (up to 30 km)	Dynamic range: (-30db to +20db) 660 & 950nm wavelength, battery operated, handheld with LCD display. Handheld Power Meter display battery status, shut-off	4 nos.

		mode, operation mode, units dB, dBm, W and pass/fail, USB connectivity and software.	
29.	Visual Fault Locator	Pen Shape 650nm Laser Diode (Class- IIIA laser diode) for 2.5mm Ferrule Output power: 0.5mW into single-mode fiber. Detection distance: <6 Km. high powered laser (1 mW) for single mode, (>7 km and multimode (> 5 km), Continuous or Flash illumination, Universal connector interface for quick and easy connection 2.5 mm connector input.	4 nos.
30.	Fibre optic test source	Handheld Laser Source Wavelength: 1310 and 1550 nm, output power (-3dBm), CW, modulation frequencies 270 Hz, 330 Hz, 1 kHz and 2 kHz. display for wavelengths, power level, modulation, battery status, shut-off mode, - operation mode and source status	4 nos.
31.	OLT– Optical Line Termination.	GPON OLT type, Output ports – 4 port, 8 port	1 no each
32.	Optical Network Termination.	With Inbuilt WiFi/ without wifi	6 nos.
33.	Optical Distribution Network		12 nos.
34.	Optical splitters	1:2, 1:4, 1:8, 1:16 ratio splitters	2 nos. each
35.	Fibre detection meter	LFI head accepts multiple cable diameters (250µm to 3mm jacketed fibers), Durable metal input adapters (2.5 and 1.25mm) for OPM, Measure both absolute (dBm) and relative (dB) power, Store and recall up to 100 OPM readings. Detection sensitivity -30dBm at 1550nm, Inbuilt OPM with -60 to +10dBm	4 nos.
36.	Microscope	X100 Microscope Dual magnification (200X and 400X) Magnification toggle button allows easy switching in both live and analysis views, automatic image centering , Repeatable pass/fail as	4 nos.

		per IEC user-selectable acceptance profiles software for analysis and reporting with laptops/PCs. Automatic image centering.	
37.	Class III optical amplifiers (EDFA)	1:4, Output Voltage -12V, +16dB	2 nos.
38.	Insertion loss and return loss power meter	Complete Tier 1 fiber testing to TIA/ISO/IEC Standards Dedicated SM Fiber end-face inspection with automated pass/fail analysis on both local and remote devices, onboard storage for all test results, color touch screen, reporting software. Real-time simultaneous return loss measurements at multiple wavelengths. Automated pass/fail fiber inspection analysis, 70 dB high precision return loss meter, color touch screen with integrated stylus.	2 nos.
39.	Multiplexer with Splitter (WDM) WDM Training System	(1310nm/1550nm) 15 Bit Data Generators, 1310nm & 1550nm Laser sources, option for external signal modulation, RS232 PC Interface to perform experiments like study of Wavelength-Division Multiplexing and De-multiplexing, Data Communication using WDM, PC to PC communication using WDM.	4 nos.
40.	RF transmitter and receiver set up trainer for AM/FM.	RF Transmitter and receiver arrangement with Antennas to test voice communication Indoor, with test points to measure voltage and waveforms at different stages.	2 nos.
41.	Modulator – Demodulator trainer for Pulse Code Modulation.	For voice communication through PCM trainer, with provision to test voice signals, waveforms at various stages. PCM, DPCM Modulator and Demodulator on same board, On-board DDS Signal Generator for	2 nos.

		frequency range of 500Hz, 1KHz, 2KHz, 3KHz with signals like Sine, Square, Triangle and Arbitrary. Sampling frequencies with respective line speed, On board Transmission effect, On board 2nd order Butterworth Low Pass filter, SMD LED indicators	
42.	VSWR meter		4 nos.
43.	OFC Trainer	Transmitter and Receiver arrangement with OFC cable (for connecting end to end) to test voice communication within campus, with test points to measure voltage, power and waveforms at different stages. Specifications: Full Duplex Analog & Digital Trans-receiver, 660 nm & 950 nm Fiber Optic LED channel with Transmitter & Receiver, AM-FM-PWM modulation / demodulation, PC-PC communication with RS232 ports & software, On board Function Generator and voice link, Numerical Aperture measurement jig and mandrel for bending loss measurement, Data Generator with selectable clock (64/ 128/ 256 KHz), Noise Generator with variable gain, Eye pattern observation and Bit Error Rate measurement, Four digits (Seven segment display)Bit Error Counter, Switched faults on Transmitter & Receiver. Classroom, laboratory teaching and learning licensed software on Fiber Optics.	4 Nos.
44.	Multiplexer / De multiplexer – Coder / Decoder Trainer	Crystal Controlled Clock, on board Sine wave and Digital Signal Generator, 4-channel Time Division Multiplexing/Demultiplexing (Analog), 16-channel Time Division	4 nos.

		Multiplexing/ Demultiplexing (Digital), Manchester Coding and Decoding, Pulse Position Modulation.	
45.	Network Cards with accessories	Broad band connection, Modem, 1:16 Routers, WiFi dongles, hubs, 1/8 port switches, necessary cables and accessories.	As required
46.	Desktop computer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM: - 4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	12 Nos.
47.	Fibre optic learning software	classroom, laboratory teaching and learning licensed software on Fiber Optics.	12 user licenses
48.	Fiber Spool (SMF, MMF)		As required
49.	Fiber Connectors		As required
50.	Wi-fi Router	4 Port	As required
B. LIST OF CONSUMABLES			
51.	Solder Wire	The composition of most solder wire is Tin/ Lead in the ratio 60:40 or 63:37	As required
52.	Brush	Only ESD-Safe cleaning brushes	10 nos.
53.	Iso propyl alcohol for cleaning boards		As required
54.	Jumper Wire		As required
55.	Solder Paste		As required.
56.	Liquid Flux		As required.
57.	Breadboard		As required.
58.	Cleaning Cotton		As required.
59.	Paste Flux		As required.
60.	De-soldering Wire		As required.
61.	Hand Gloves		24 sets.
62.	Optical fiber cable	2 core, 4 core - length in meters	As required

63.	OFC connectors – different types	Ferrule C, LC, SC	As required
64.	Lab Coat		24 nos.
65.	Type of connectors FC, LC, SC		As required
66.	FDMS		As required.
67.	Patch cords	Long Connector – Square Connector, SC-SC types,	10 nos. each.
68.	Attenuators	5db, 10db, LC type, SC type - types.	As required
69.	Hook up wire	Good quality	As required
70.	PCB 6x4 size	General purpose	As required

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities