Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

SPECIFICATION FOR ELECTRONICS TRAINERS

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

TABLE OF CONTENTS

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

1   Network and Internet Security Trainer

1.1   Basic Indicative Diagram

1.2   **Network Security Module:**

1.2.1   This training system should help to understanding of Local Area Network (LAN) including fundamentals of networking.

1.2.2   It should assist for knowledge of all network layers, cable designing and building of a complete network of computers.

1.2.3   Students can study of various topologies using different standards given by IEEE with actual connections made in different topologies and data can be transferred.

1.2.4   It should have provision to understand protocols, topologies used in networking, measurement of error rate, throughput and effect of errors on protocols.

1.2.5   It should have PC to PC using RJ-45 Connector, Star topology using RJ45 Connector, Ring topology using DB9 Connector.

1.2.6   Trainer should be RoHS complained. It should be compact, lightweight and housing should be made of ABS material. It should come with technical chart pasted on its cover to learn and understand more about applications and technical details.

1.2.7   This training system should have software by which student can study Star & Ring selection, Protocols: CSMA /CD, CSMA /CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring, Packet size: 128, 256, 512, 1024, 2048, 4096, 8192, 16384Inter Packet delay: 1000 – 5000 ms, Error generation: Acknowledgment lost, bad packet, auto error generation, Complete analysis of Network & Protocols, Real time Graphic representation of data on s/w screen with packet details, Network details like, Indication of computer name, IP address, MAC address, Port number, status of network, Network & protocol analysis like Indication of packet serial number, file name, file size, file number, receiver name, receiver IP address, total packets, packet length, time out, protocol, topology, receiver, MAC address, port number, file send start time, file sent completion time, transmission time data rate(Mbps),percentage error.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

1.3 **Internet Security Module:**

1.3.1 Networking: Policy Based Routing, Automatic Gateway Failover

1.3.2 Administration: Multiple Administrator Support, Administrator Profile Management

1.3.3 Centralized Management System: Dashboard, Appliance Monitoring and Alerts

1.3.4 Bandwidth management: User Bandwidth control, Traffic shaping, Bandwidth Limit for each profile/user

1.3.5 URL Filtering: Category Based, Custom Web Lists, HTTP & HTTPS Blocking

1.3.6 High Availability: Active/Stand By with Automatic and Force Synchronization, Email and SMS notification

1.3.7 Mail Protection: Mail Antivirus and Anti-spam, Attachment Control, (SMTP, POP3 and IMAP), Attachment Control, Keyword Blocking in Email

1.3.8 Firewall & Security Features: Intrusion Prevention System, Gateway Antivirus

1.3.9 User Authentication: Internal Database, Active Directory Integration, IP / MAC Binding, Multiple Authentication Servers

1.3.10 Technical Details

    1.3.10.1 Interfaces:

        1.3.10.1.1 Copper Port: 02 Nos.

        1.3.10.1.2 Console Port: 01 No.

        1.3.10.1.3 USB Port: 04 Nos.

    1.3.10.2 Firewall TCP Throughput: 2200 Mbps

    1.3.10.3 Antivirus Throughput: 170 Mbps

    1.3.10.4 Users/ Nodes: Unrestricted

    1.3.10.5 Three year licensed software

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

2   ADC to DAC Cards Trainer

2.1   Basic Indicative Diagram

2.2   ADC Trainer Card:

2.2.1   4 bit discrete & 8 bit Monolithic converters

2.2.2   Unipolar & Bipolar DC voltages

2.2.3   O/P status displayed by LED

2.2.4   Functional block indicated on board mimic.

2.2.5   Built in DC power supply

2.2.6   Trainer should be RoHS compliant

2.2.7   Trainer should be compact, lightweight and housing should be made of ABS material.

2.2.8   Technical chart should be pasted on the trainer to learn and understand more about applications and technical details.

2.2.9   A/D Conversion:

    2.2.9.1 4 Bit discrete (ramp)

    2.2.9.2 8 Bit Monolithic converter

2.2.10   Signal source: Unipolar & Bipolar DC voltages

2.2.11   O/P Indication: By LEDs separate for each type

2.2.12   Inter connections: 2mm banana socket

2.2.13   Power Supply: 230V, 50Hz.

2.3   DAC Trainer Card

2.3.1   4 bit weighted resistor-4 R-2R network

2.3.2   10 bit monolithic D/A converters.

2.3.3   On board Sine Generator

2.3.4   Functional block indicated on board mimics

2.3.5   Built in DC power supply

2.3.6   Trainer should be RoHS compliant

2.3.7   Trainer should be compact, lightweight and housing should be made of ABS material.

2.3.8   Technical chart should be pasted on the trainer to learn and understand more about applications and technical details.

2.3.9   D/A Conversion:

    2.3.9.1   4 Bit weighed resistor

    2.3.9.2   4 Bit R-2R ladder network

    2.3.9.3   8 Bit Monolithic D/A Converter

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

2.4	Signal:	DC supply with toggle switches
2.5	O/P indication:	On DMM or Oscilloscope
2.6	Inter Connections:	2mm. banana sockets
2.7	Power Supply:	230V, 50Hz

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
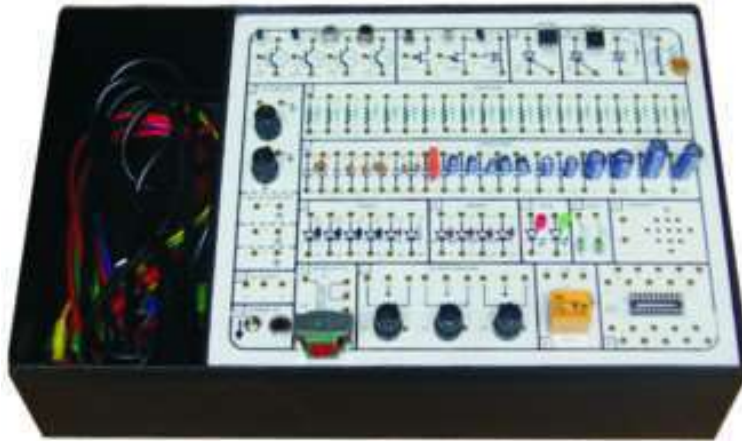SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

3   Basic Electronics Trainer

3.1   Basic Indicative Diagram

3.2   On Platform Breadboard to design circuits

3.3   On board DC Power Supply: +5V/1A (fixed); ±15V/1A (fixed); ±15V/200mA (Variable)

3.4   On Board AC Supply: 5V-0V-5V; 10V-0V-10V (Provision to use as 5V, 10V, 15V, 20V AC & also as center tap)

3.5   Sine/ Square/ TTL Generator: 10Hz to 1MHz in 4 Steps (Variable in between the steps)

3.6   Amplitude: Sine (0 to 15Vpp); Square Wave (0 to 10Vpp); TTL-5V (fixed)

3.7   Volt/Current/Frequency Measurement for Voltage Range +12V to -12V DC, Current Range 0 to 500mA DC and Frequency Range DC to 100KHz (All with respect to Ground)

3.8   Display: LCD

3.9   Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt,), Frequency 300Hz to 3.4kHz)

3.10   Continuity Tester: For testing the continuity. Provided with Beeper Sound.

3.11   Fixed TTL (Clock):   0.1Hz

3.12   Data Switches: 8 in Nos (Toggle switches for High/Low TTL levels) with LED indication

3.13   LED Display: 8 in Nos (for High/Low TTL levels indication)

3.14   Logic Probe: Logic level identifier H/L for TTL level (7 segment display)

3.15   Potentiometer: 6mos (100Ω to 47KΩ)

3.16   Speaker: 8Ω/2W for audio use

3.17   Power Supply: 110-220V, 50Hz

3.18   Trainer should be RoHS compliant

3.19   Trainer should be compact, lightweight and housing should be made of ABS material.

3.20   Ready to use experiment board should be fitted in place of bread board to perform following experiments on Rectifier Circuits board:
3.20.1 To study Half wave Rectifier
3.20.2 To study Center tap Full wave Rectifier
3.20.3 To study Bridge Rectifier

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

3.21 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog & Digital Electronic with following key features:

3.21.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various technologies in electronics including advance technologies, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog and Digital Electronic with following topics:

3.21.2 Software module on Analog and Digital Electronic to understand fundamental concept of Atom, Charge, Introduction to Electricity, DC and AC Sources of Electricity, Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff's Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter, Digital Electronics, Number Systems, Codes, Complements, Boolean Algebra, Logic Gates, Arithmetic Circuits: Adder, Subtractor, Combinational Circuits: Multiplexer, Demultiplexer, Encoder, Decoder, Sequential Circuits (Flip-Flops): S-R Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop, Registers and Counters etc.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

4   **Discrete Components Trainer**

4.1   Basic Indicative Diagram

4.2   Flexibility of making circuit connections

4.3   Online learning material for step by step procedure to perform the experiment and other details related to theory and experiments.

4.4   Trainer should be RoHS compliant

4.5   Trainer should be compact, lightweight and housing should be made of ABS material.

4.6   DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed), + 12V, 500 mA (Variable), -12V, 500 mA (Variable)

4.7   AC Supply: 9V-0V-9V, 500mA

4.8   Breadboard: Breadboard for making various circuits and testing them. External components/IC can be fitted conveniently.

4.9   Function Generator: Operating modes Sine, Square and Triangular. Frequency range 1 Hz to 100 KHz.

4.10   Volt/ Current/ Frequency Measurement: Voltage Range +12V to -12V DC, Current Range 0 to 500mA DC, Frequency Range DC to 100KHz (All with respect to Ground)

4.11   Display: LCD

4.12   Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)

4.13   Continuity Tester: For testing the continuity. Provided with beeper sound.

4.14   Power Supply: 110-220 V, 50Hz.

4.15   Ready to use experiment board should be fitted in place of bread board to perform following experiments on Diode Characteristics (Si, Zener, LED)

         4.15.1   Study of V-I characteristics of Silicon Diode

         4.15.2   Study of V-I characteristics of Zener Diode

         4.15.3   Study of V-I characteristics of Light Emitting Diode (LED)

4.16   The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:

         4.16.1   The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various technologies in electronics including advance technologies, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

4.16.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff's Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

5   Digital and Analog Bread Board Trainer

5.1   Basic Indicative Diagram

5.2   On Platform Breadboard to design circuits
5.3   On board DC Power Supply: +5V/1A (fixed); ±15V/1A (fixed); ±15V/200mA (Variable)
5.4   On Board AC Supply: 5V-0V-5V; 10V-0V-10V (Provision to use as 5V, 10V, 15V, 20V AC & also as center tap)
5.5   Sine/ Square/ TTL Generator: 10Hz to 1MHz in 4 Steps (Variable in between the steps)
5.6   Amplitude: Sine (0 to 15Vpp); Square Wave (0 to 10Vpp); TTL-5V (fixed)
5.7   Volt/ Current/ Frequency Measurement for Voltage Range +12V to -12V DC, Current Range 0 to 500mA DC and Frequency Range DC to 100KHz (All with respect to Ground)
5.8   Display: LCD
5.9   Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt)
5.10   Continuity Tester: For testing the continuity. Should provided with beeper sound.
5.11   Fixed TTL (Clock):   0.1Hz
5.12   Data Switches: 8 in Nos (Toggle switches for High/Low TTL levels) with LED indication
5.13   LED Display: 8 in Nos (for High/Low TTL levels indication)
5.14   Logic Probe: Logic level identifier H/L for TTL level (7 segment display)
5.15   Potentiometer: 6mos (100Ω to 47KΩ)
5.16   Speaker: 8Ω/2W for audio use
5.17   Power Supply: 110-220V, 50Hz
5.18   Trainer should be RoHS compliant
5.19   Trainer should be compact, lightweight and housing should be made of ABS material.
5.20   The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog & Digital Electronic with following key features:

5.20.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various technologies in electronics including advance technologies, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog and Digital Electronic with following topics:

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

5.20.2 Software module on Analog and Digital Electronic to understand fundamental concept of Atom, Charge, Introduction to Electricity, DC and AC Sources of Electricity, Electronic Components, Series & Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff's Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter, Digital Electronics, Number Systems, Codes, Complements, Boolean Algebra, Logic Gates, Arithmetic Circuits: Adder, Subtractor, Combinational Circuits: Multiplexer, Demultiplexer, Encoder, Decoder, Sequential Circuits (Flip-Flops): S-R Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop, Registers and Counters etc.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

6   Digital IC Trainer

6.1   Basic Indicative Diagram

6.2   Trainer should be RoHS compliant

6.3   Trainer should be compact, lightweight and housing should be made of ABS material.

6.4   Size of Breadboard: 172.5 mm x 68mm

6.5   DC Supply: +5 V, 500 mA

6.6   Clock Frequency: 1 Hz, 100 Hz, 1 KHz, 100 KHz

6.7   Amplitude: 3.3V (TTL)

6.8   Duty Cycle: 50 %, TTL output

6.9   Pulsar Switches: 2 Nos.

6.10   Graphical LCD: 128 X 64 dots(To display pin diagram of various digital ICs so that students can make by their own digital circuits)

6.11   Data switches: 8 Nos. (Toggle switches for both TTL modes)

6.12   Digital Circuits: Virtual, should be interfaced with real time Inputs/outputs

6.13   LED display: 8 Nos. (TTL)

6.14   Seven Segment Display: 3 Nos.

6.15   ZIF Socket: ZIF socket consists of 40 pins with 2mm output socket for each pin 8, 14,16,20,40 pin ICs can be inserted without force. Supply Inputs can be connected to the ZIF socket through 2mm patch Chord.

6.16   Main Supply: 100V - 240V AC, 50Hz

6.17   The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Digital Electronic with following key features:

6.17.1   The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Digital Electronics, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Digital Electronic with following topics:

6.17.2   Number Systems, Codes, Complements, Boolean Algebra, Logic Gates, Arithmetic Circuits: Adder, Subtractor, Combinational Circuits: Multiplexer, De multiplexer, Encoder, Decoder, Sequential Circuits (Flip-Flops): S-R Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop, Registers and Counters

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

7   Electronics Sensor Trainer - 10 Sensors

7.1   Basic Indicative Diagram

7.2   IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor & DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output.

7.3   Ethernet port to connect real world.

7.4   Inverting, Non – Inverting, Power, Current, Instrumentation and Differential Amplifier, F to V, V to F, I to V, V to I Converter, High Pass and Low Pass Filter, Buffer, LED, Buzzer, LED Bar Graph, Touch Switch.

7.5   Trainer should be RoHS compliant, should be compact, lightweight and made of ABS enclosure.

7.6   It should come with technical chart pasted on it to learn and understand more about applications and technical details.

7.7   The Trainer should include the following Sensors:

7.7.1   Thermocouple: K Type Thermocouple, -200°C to 1250°C

7.7.2   RTD - Platinum RTD: 100Ω at 0°C (Temp. coefficient 0.385 Ω /°C)

7.7.3   Load Cell/ Strain Gauge

7.7.4   LVDT

7.7.5   Smoke Detector Sensors: Gas(Smoke) : Methane, Butane, LPG, Smoke

7.7.6   Speed Sensor

7.7.7   Limit Switch

7.7.8   Photo sensors: L14G1 Photo Transistor: 500nm – 1100nm

7.7.9   Opto coupler

7.7.10   Proximity Sensor

7.8   Trainer should have to perform following experiments:

7.8.1   Learn the detailed fundamentals of signal conditioning.

7.8.2   Learn in-depth study of sensors and it's circuit diagram.

7.8.3   Learn how automation can implement using sensors and actuators.

7.8.4   Testing and understanding graph of Thermocouple and photo transistor .

7.8.5   Testing and understanding the working of Amplifiers like inverting amplifier, Non inverting

7.8.6   Amplifier, Differential Amplifier, Instrumentation Amplifier, Current Amplifier

7.8.7   Testing and understanding the working of Filters like High Pass filter and Low Pass Filter

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

7.8.8   Testing and understanding the working of Types of and Converters like Frequency to Voltage and Voltage to Frequency convertor, Current to Voltage and Voltage to current convertor.

7.8.9   Study of output blocks like LED, Buzzer and LED bar graph.

7.8.10   Testing and understanding graph of Gas (Smoke), Limit switch, proximity sensor, Opto coupler sensors.

7.8.11   Fault finding to Types of signal conditioning and Sensors.

7.8.12   See the sensor real timer graph using computer based software

7.8.13   Sensors data logging using computer based software

7.8.14   HDMI and Ethernet connectivity.

7.9   The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various sensors and its signal conditioning, interfacing, applications etc. the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. following topics:

7.9.1   Sensor, Transducer and actuator

7.9.2   Difference between sensor and transducer

7.9.3   Signal Conditioning: Inverting amplifier, Non inverting amplifier, Differential Amplifier, Instrumentation Amplifier, F to V Convertor, V to F convertor, I to V Convertor, V to I convertor, Current Amplifier, High and Low Pass Filter

7.9.4   Characteristic of different types of Sensors. Working of Sensors like RTD, Thermocouple, Photo Diode, Gas (Smoke), Limit switch, speed sensor, load cell, LVDT, Opto coupler and Proximity Sensor

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

8   Fiber Optic Communication Trainer

8.1   Basic Indicative Diagram

8.2	Full Duplex Analog & Digital Trans-receiver
8.3	660 nm & 950 nm Fiber Optic LED channel with Transmitter & Receiver
8.4	AM-FM-PWM modulation / demodulation
8.5	PC-PC communication with RS232 ports & software
8.6	On board Function Generator
8.7	Functional blocks indicated on-board
8.8	Input-output & test points provided
8.9	On board voice link
8.10	Built in DC Power Supply
8.11	Numerical Aperture measurement jig and mandrel for bending loss measurement
8.12	Data Generator with selectable clock (64/ 128/ 256 KHz)
8.13	Noise Generator with variable gain
8.14	Eye pattern observation and Bit Error Rate measurement
8.15	Four digits (Seven segment display)Bit Error Counter
8.16	Switched faults on Transmitter & Receiver
8.17	Trainer should be RoHS compliant
8.18	Trainer should be compact, lightweight and housing should be made of ABS material.
8.19	Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
8.20	Transmitter: 2 Nos., Fiber Optic LED having peak wavelength of emission 660 nm & 950 nm
8.21	Receiver: 2 Nos., Fiber Optic Photo detector
8.22	Modulation Techniques: AM, FM, PWM.
8.23	Drivers: 1 No. with Analog & Digital modes
8.24	AC Amplifier: 2 Nos.
8.25	Clock: Crystal controlled Clock 4.096 MHz
8.26	PLL detector: 1 No.
8.27	Comparator: 2 Nos.
8.28	Filters: 2 Nos. 4th order Butterworth, 3.4 KHz cut-off frequency
8.29	Analog Band Width: 350 KHz
8.30	Digital Band Width: 2.5 MHz
8.31	Function Generator: 1 KHz Sine wave (Amplitude adjustable) 1 KHz Square Wave (TTL)
8.32	Voice Link: Fiber Optic voice link using microphone & speaker (built in)
8.33	PC-PC Communication: Using 2 channel RS232
8.34	Port: RS232 (9 Pin)
8.35	Baud Rate: 19200

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

8.36	Switched Faults:	4 in Transmitter & 4 in Receiver
8.37	Fiber Optic Cable:	Connector type standard SMA
8.38	Cable Type:	Step indexed multimode PMMA plastic
8.39	Core Refractive Index:	1.492
8.40	Clad Refractive Index:	1.406
8.41	Numerical Aperture:	Better than 0.5
8.42	Acceptance Angle:	Better than 60 deg.
8.43	Fiber Diameter:	1000 microns
8.44	Outer Diameter:	2.2 mm
8.45	Fiber Length:	0.5m & 1m
8.46	Test Points:	50 nos.
8.47	Inter connections:	2 mm sockets
8.48	Power Supply:	110 -220 V, 50 Hz
8.49	Learning Material:	Online including Theory, Procedure, reference results, etc.

8.50   Accessories: Numerical Aperture Measurement Jig, Mandrel, Fiber Cables, Microphone, Headphone, Set of Patch Cords, PC-PC Communication Software, Optical Waveguide Set including straight, Curved with Laser pointer, Eye Pattern and BER measurement module, Power Supply.

8.51   Experiments that can be performed

    8.51.1   Setting up Fiber Optic Analog & Digital link

    8.51.2   AM system using Analog & Digital input signals

    8.51.3   Frequency Modulation system and Pulse Width Modulation system

    8.51.4   Study of Propagation Loss, Bending Loss & measurement of Numerical Aperture

    8.51.5   Characteristics of Fiber Optic communication link

    8.51.6   Setting of Fiber Optic voice link using Amplitude, Frequency & PWM Modulation

    8.51.7   Study of Switched Faults in AM, FM & PWM system

    8.51.8   Full Duplex Computer Communication using RS232 ports and software

    8.51.9   V-I characteristics of LED (E - O converter)

    8.51.10 Characteristics of Photo Detector

    8.51.11 Demonstration of optical wave inside of a fiber using optical waveguides to show losses and total internal reflection in optical cable

    8.51.12 Experiments with Eye pattern and BER measurement module

    8.51.13 Measurement of Bit Error Rate

    8.51.14 Study of Eye pattern

8.52   The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Fiber Optics with following key features:

    8.52.1   The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Fiber Optics Communication, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Fiber Optics with following topics:

    8.52.2   Basic Laws of Fiber Optics, Types of Fiber Optics: Single Mode, Multi Mode, Step Index, Graded Index, Attenuation. Optical Sources: LED and LASER Wavelength Division Multiplexing, Components of Fiber Optics, Fiber optic Communication Components: Cables, Connectors etc.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

9   Frequency Modulator and Demodulator Trainer

9.1   Basic Indicative Diagram

9.2   On-board audio oscillator, 3 types of FM modulators
9.3   5 different types of demodulator, amplitude limiter & filter,
9.4   Experiment for effect of noise in FM single
9.5   Test points 30 nos or more for wave form observation & analysis
9.6   Switched faults 10 nos or more to understand working of a block in detail
9.7   LED indication for signal flow & Selection.
9.8   Experiment for effect of noise on detection of FM Signal
9.9   Modulating signal range: 300Hz to 3.4KHz
9.10   Carrier frequency Range (Fixed):   455 KHz
9.11   Carrier frequency Range (Variable):   10 KHz to 200 KHz
9.12   FM Modulator Type: Reactance Modulator, Varactor Modulator, VCO Based Modulator
9.13   FM Demodulator type: Detuned Resonant Detector, Quadrature Detector, Foster-Seeley Detector, Ratio Detector, PLL Detector (2 types: IC 4046 and IC 565 based),
9.14   Low Pass Filter: 3.4 KHz cut off frequency amplifier (with adjustable Gain)
9.15   Trainer should be RoHS compliant
9.16   Trainer should be compact, lightweight and housing should be made of ABS material.
9.17   Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
9.18   **The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Communication with following key features:**
        9.18.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Analog Communication, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Communication with following topics:
        9.18.2 It should help students to analyse & design different analog communication schemes. It should consist of fundamental concepts of analog communication, performance analysis of modulated signals. This module should also cover Fourier analysis, Amplitude Modulation: Standard Amplitude Modulation, DSBSC Modulation, SSB Modulation

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

10   Linear IC Trainer

10.1   Basic Indicative Diagram

10.2   It should have built-in Function Generator, Continuity Tester, Toggle Switch, Potentiometer, Frequency Measurement, Computer Interface

10.3   Functional Blocks indicated on board mimic

10.4   On board DC and AC Power Supply, Function Generator, Continuity Tester

10.5   On board Toggle Switches and Potentiometers

10.6   Solder less Breadboard

10.7   On Board Voltage/ Current/Frequency Measurement

10.8   Trainer should be RoHS compliant

10.9   Trainer should be compact, lightweight and housing should be made of ABS material.

10.10   Regulated DC power supplies: +5V-1A (Fixed), ±12V-500mA (Fixed), ± 12V-500mA (Variable)

10.11   AC supply: 9V-0V-9V/500mA

10.12   Function Generator
        10.12.1 Operating modes: Sine, Square, Triangular
        10.12.2 Frequency range: 1 Hz to 100 KHz

10.13   Volt/Current/Frequency Measurement: Voltage Range +12V to -12V DC Current Range 0 to 500mA DC

10.14   Display: LCD

10.15   Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)

10.16   Continuity Tester: For testing the continuity. Provided with Beeper Sound.

10.17   The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:

        10.17.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Analog Electronics, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:

        10.17.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff`s Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

11   Machine Shop Sensor Trainer

11.1   Basic Indicative Diagram

11.2   Inductive Sensor, Capacitive Sensor, Magnetic Sensor, Ultrasonic Sensor should be mounted on panel along with DAQ and Counter Box.

11.3   Precise Signal conditioning

11.4   Real-time DAQ interface with ADC, DAC & digital input/output

11.5   Supplied with Dashboard Software for supervisory control of the process with data acquisition

11.6   Computer Based Data Logging

11.7   Interface with Ethernet based DAQ

11.8   Sensitive, linear, stable and accurate

11.9   Industrial look & feel

11.10   User friendly, self explanatory system

11.11   Experiments configurable through patch board

11.12   Enhanced electrical safety considerations

11.13   Practice Troubleshooting skills

11.14   Compact tabletop ergonomic design

11.15   Ready Experimental details

11.16   Robust design and construction

11.17   Online Product Tutorial

11.18   Data Acquisition System (DAQ):   1 No.
        11.18.1 Analog Inputs: 8 Nos.
        11.18.2 Digital Inputs: 8 Nos.
        11.18.3 Digital Outputs: 8 Nos.
        11.18.4 ADC Resolution: 24 Bit
        11.18.5 RS485 Interface: Yes
        11.18.6 USB Interface: Yes
        11.18.7 Ethernet Interface: Yes
        11.18.8 Data Logging: Yes

11.19   Inductive Sensor: 1 No.
        11.19.1 Operating input voltage: 10-30 V DC
        11.19.2 Sensor type: PNP
        11.19.3 Output voltage: 10-30V DC
        11.19.4 Sensing Range: 0-5 mm
        11.19.5 Switch Type: No
        11.19.6 Body: Cubical/Cylindrical

11.20   Capacitive Sensor: 1 No.
        11.20.1 Operating input voltage: 10-30 V DC
        11.20.2 Sensor Type: PNP

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

11.20.3	Output Toltage:	10-30V DC
11.20.4	Sensing Range:	2-8 mm
11.20.5	Switch Type:	No
11.20.6	Body:	Cubical/Cylindrical
11.21	**Magnetic Sensor:**	1 No.
11.21.1	Operating input voltage:	10-30 V DC
11.21.2	Sensor Type:	PNP
11.21.3	Output Voltage:	10-30V DC
11.21.4	Sensing Range:	60 mm (approximately)
11.21.5	Switch Type:	No
11.21.6	Body:	Cubical/Cylindrical
11.22	**Ultrasonic Sensor:**	1 No.
11.22.1	Operating Input Voltage:	10-30 V DC
11.22.2	Sensor Type:	PNP
11.22.3	Output Voltage:	10-30V DC
11.22.4	Sensing Range:	80 - 300 mm (approximately)
11.22.5	Switch Type:	No
11.23	**Connecting Wires:**	15 Nos. (Patch cord)
11.24	**Motor:**	1 No.
11.24.1	Operating Voltage:	24V DC
11.24.2	Current Rating:	1A (Approx)
11.25	**Motor Driver:**	1 No.
11.26	**Power Distribution Box:**	1 No.
11.26.1	Operating Voltage:	24V DC
11.26.2	Current Rating:	4A (approx)
11.27	**Counter Box:**	1 No.
11.27.1	Supply Voltage:	90-230V AC
11.27.2	Display Configuration:	6 Digits Counts, 5 Digits RPM Indicator
11.27.3	Counting Direction:	Up, Down, Bi directional
11.27.4	Sensor Type:	PNP
11.27.5	Sensor Output Voltage:	10-30 VDC
11.27.6	Current Rating:	0.05A
11.28	**Indication Box:**	1 No.
11.28.1	Supply:	24V DC
11.28.2	Colour:	Green
11.28.3	Panel:	Vertical Mounting Plate of at least W 600 X H 390 X D 300
11.29	**The trainer should support to perform following lab experiments:**	

- 11.29.1 DAQ Digital Input
- 11.29.2 DAQ Digital Outputs
- 11.29.3 DAQ Analog Inputs
- 11.29.4 Inductive Sensor
- 11.29.5 Capacitive Sensor
- 11.29.6 Magnetic Sensor
- 11.29.7 Ultrasonic Sensor
- 11.29.8 Counter Box
- 11.29.9 RPM Counting of DC Motor using Counter box and Sensors
- 11.29.10 Motor Speed Control using DAQ

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

12   Op Amp Trainer

12.1   Basic Indicative Diagram

12.2   Study of different configuration of Operational Amplifier

12.3   Fixed DC Power Supply: +12V, -12V, +5V and -5V

12.4   Variable DC Power Supply: +1.5V to +10V Regulated using LM317; -1.5V to -10V Regulated using LM337

12.5   Function Generator: Sine Wave, Square Wave, Triangular Wave (1KHz to 100KHz; 0-5Vpp)

12.6   Op Amp IC: IC uA741 (2 Nos.)- All pins terminated by 2mm Banana Socket.

12.7   Resistor Bank: SMD Resistance 1KV 1% 1/4W (5 Nos.), SMD Resistance 10KV 1% 1/4W (5 Nos.), SMD Resistance 100KV 1% 1/4W (5 Nos.)

12.8   Diode: Diode 1N 4007

12.9   Capacitor Bank: Electrolyte Cap. 1mf/63V, Disc cap. 1nf/63V, Disc cap. 10nf/63V, Disc cap. 100nf/63V

12.10   Variable Resistance bank: 1KΩ Single turn Potentiometer (2 Nos.), 10KΩ Single turn Potentiometer (2 Nos.), 100KΩ Single turn Potentiometer (2 Nos.), 1MΩ Single turn Potentiometer (2 Nos.)

12.11   Trainer should be RoHS compliant. Trainer should be compact, lightweight and housing should be made of ABS material. Trainer should come with technical chart pasted on its cover to learn and understand more about applications and technical details.

12.12   The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:

12.12.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Analog Electronics, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:

12.12.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff`s Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

13   PAM, PPM, PWM Trainer

13.1   Basic Indicative Diagram

13.2   PAM-PPM-PWM modulation & demodulation techniques,

13.3   Natural & flat-top sampling,

13.4   On-board filter and ac amplifier,

13.5   Selectable 4 different sampling pulse frequencies on board,

13.6   Voice communication using dynamic microphone & speaker,

13.7   Sample, Sample & hold & Flat-Top O/P in PAM

13.8   On Board Sampling Frequencies (Pulse): 8KHz, 16KHz, 32KHz, 64KHz

13.9   Low Pass Filter: 4th order BW filter

13.10   AC amplifier: With adjustable Gain Control

13.11   DC O/P: 0-4 V (Variable)

13.12   Test Point: 25nos or more

13.13   Trainer should be RoHS compliant

13.14   Trainer should be compact, lightweight and housing should be made of ABS material.

13.15   Trainer should come with technical chart pasted on its cover to learn and understand more about applications and technical details.

13.16   The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Communication with following key features:

13.16.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Analog Communication, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Communication with following topics:

13.16.2 It should help students to analyse & design different analog communication schemes. It should consist of fundamental concepts of analog communication, performance analysis of modulated signals. This module should also cover Fourier analysis, Amplitude Modulation: Standard Amplitude Modulation, DSBSC Modulation, SSB Modulation.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

14   Power Electronics Trainer - 06 Application Boards

14.1   Basic Indicative Diagram

14.2   On Platform Breadboard to circuit design-2Nos.

14.3   On board DC Power Supply: ±5V/500mA; ±12V/500mA; +15V/250mA; ±35V/250mA

14.4   On board AC power Supply: 18V-0V-18V; 0V-15V

14.5   On board firing circuit with Frequency range: 30Hz to 900Hz variable; Amplitude: 12V; PWM control of G1, G2, G3 & G4; Duty cycle control of Gate signal is 0 to 100%

14.6   SCR Assembly: 4 SCRs 2P4M, 400V/2A

14.7   Power Devices: IGBT-G4BC20S, MOSFET-IRFZ44N, UJT-2N2646, DIAC-DB3, TRIAC-BT136, PUT-2N6027

14.8   Circuit Components on Board: Electrolytic Capacitor-10µF,63V, 1µF,63V; Met. Capacitor 0.33uF, 63V; Resistances-1K/1W, 1K/10W, 10K/10W, 120E/5W, 2K2/2W; Diode 1N4007, Inductor 220uH, 4.7uH, 10mH.

14.9   Pulse transformer on board: 2 nos. PT4502 1:1 and one is PT4503 1:1:1

14.10   AC power Supply: 220V/110V, 50Hz

14.11   Trainer should be RoHS compliant

14.12   Trainer should be compact, lightweight and housing should be made of ABS material.

14.13   The trainer should be supplied with following application boards:

   14.13.1   MOSFET Characteristics: Should have to perform experiment like-To study the characteristics of n channel MOSFET

   14.13.2   SCR Characteristics: Should have to perform experiment like:-Study of Characteristics of SCR and Plotting V-I Characteristics

   14.13.3   SCR-LAMP Flasher: Should have to perform experiment like:- Study the application of SCR as a lamp flasher measurement of frequency, time, and voltage.

   14.13.4   SCR Alarm Circuit: Should have to perform experiment like:- study the application of SCR in alarm circuit and measurement of gate current and gate voltage.

   14.13.5   Series Inverter: Should have to perform experiment like:- Study the operation of series inverter and output waveform across the RLC load.

   14.13.6   Single Phase PWM Inverter: Should have to perform experiment like:-
      14.13.6.1 Study of the single phase PWM firing circuit.
      14.13.6.2 Study the operation of single phase PWM bridge inverter using MOSFET.
      14.13.6.3 Study the operation of single phase PWM bridge inverter using IGBT.

14.14   The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

14.14.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various technologies in electronics including advance technologies, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. with following topics:

14.14.2 Introduction, Definition, Insulators, Semiconductors and Conductors, Types of Semiconductors, PN Junction Diode, Transistor PNP and NPN, Power Electronics Devices. Triggering and Commutation: Turn-ON Method of a Thyristor, Gate Triggering Methods, Turn-OFF Method. Gate Firing Circuits: General Firing Circuit, Resistance Firing Circuit, Resistance-Capacitance Firing Circuit for Half and Full Wave, UJT Oscillator, Synchronized UJT Triggering (Ramp Triggering), Ramp and Pedestal Triggering. Phase Controlled Rectifier: Introduction, Classification, Uncontrolled Rectifiers (Half Wave, Full Wave and Bridge).

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

15   Seven Segment DPM Trainer

15.1   Basic Indicative Diagram

15.2   Trainer should be RoHS compliant
15.3   Trainer should be compact, lightweight and housing should be made of ABS material.
15.4   Technical Details:

    15.4.1   Voltage

        15.4.1.1   DC Voltage: 0 - 350V
        15.4.1.2   AC RMS Voltage: 0 - 350V

    15.4.2   Current

        15.4.2.1   DC Current: 0 - 2A
        15.4.2.2   AC Current: 0 - 2A

    15.4.3   Resistance: 0 - 2MV
    15.4.4   On Board Fuse: 200mA, 2A
    15.4.5   Mains supply: 230V, 50Hz

15.5   The trainer should be able to perform following experiments:

    15.5.1   Study of DC and AC Voltage Measurement
    15.5.2   Study of DC and AC Current Measurement
    15.5.3   Study of Resistance Measurement Study of Continuity Tester

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

16 Data Acquisition System

16.1 Basic Indicative Diagram

16.2 Should be RoHS compliant

16.3 Should be compact, lightweight and housing should be made of ABS material.

16.4 Analog Inputs: 4 Inputs with 10 bit resolution

16.5 Analog Outputs: 2 Outputs with 10 bit resolution

16.6 Digital Inputs: 11 TTL Inputs

16.7 Digital Outputs: 11 TTL Outputs

16.8 Unity gain amplifiers: 2 (0-5V DC)

16.9 Counter: 0 to 6MHz (square wave)

16.10 Power Supply: USB Powered

16.11 Computer Interface: USB 2.0

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

17   Analog Component Trainer

17.1   Basic Indicative Diagram

17.2   Flexibility of making circuit connections.

17.3   Online learning material for step by step procedure to perform the experiment and other details related to theory and experiments.

17.4   Trainer should be RoHS compliant

17.5   Trainer should be compact, lightweight and housing should be made of ABS material.

17.6   DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed), + 12V, 500 mA (Variable), -12V, 500 mA (Variable)

17.7   AC Supply: 9V-0V-9V, 500mA

17.8   Breadboard: Breadboard for making various circuits and testing them. External components/IC can be fitted conveniently.

17.9   Function generator: Operating modes Sine, Square and Triangular. Frequency range 1 Hz to 100 KHz.

17.10   Volt/Current/Frequency Measurement: Voltage Range +12V to -12V DC, Current Range 0 to 500Ma DC, Frequency Range DC to 100KHz (All with respect to Ground)

17.11   Display: LCD

17.12   Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)

17.13   Continuity Tester: For testing the continuity. Should provide with beeper sound.

17.14   Power Supply: 110-220 V, 50Hz.

17.15   Ready to use experiment board should be fitted in place of bread board to perform following experiments on Zener Voltage Regulator board:

17.15.1 Study of Zener diode as a voltage regulator, when input voltage V_{in} is fixed while Load resistance R_L is variable

17.15.2 Study of Zener diode as a voltage regulator, when input voltage V_{in} is variable while Load resistance R_L is fixed.

17.16   The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:

17.16.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Analog Electronics, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

17.16.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff's Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton`s, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

18   Micro Processor Trainer

18.1   Basic Indicative Diagram

18.2   72 I/O lines through 8255
18.3   Three channel Timer/Counter using 8253
18.4   8 channel ADC with On board DAC
18.5   It should support have two modes of operation-Keyboard mode and Serial Mode/
18.6   It should have the Facility of downloading and uploading the files from Computer
18.7   All Address and Control lines are provided on 50 pin connector
18.8   Operating Frequency: 5 MHz
18.9   RAM: 16 K
18.10   ROM: 16 K
18.11   Display: 20 X 2 LCD
18.12   Input: ASCII Keyboard
18.13   Mains supply: 90 - 230V AC, 50 Hz
18.14   The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

18.14.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of various technologies in electronics including advance technologies, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. with following topics:

18.14.2 Embedded System: Module on Embedded system should cover following topics: Basics: Definition, Characteristics, Architecture, Applications, Categories: Stand Alone Embedded System, Real-Time Embedded System, Network Information Appliances, Mobile Devices; Digital Primer and Components: Numbering and Coding System, Digital Gates, Basic Components-Transistor, Diode, Resistance, Capacitance, Seven Segment Display, Power Supply. 8051 Microcontroller: Microcontroller, Architecture, Features, 8051 Pinout and Details, Registers and SFR, Memory Map, Instruction Set, Addressing Mode, Timer and Counters, Interrupts, Serial Communication. 8051 Peripheral Interfacing: Switch Interface, Seven Segment Display Interface, LED interface, LCD Interface.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

19   Microcontroller Trainer (8051) with Programming Software and 6 Applications

19.1   Basic Indicative Diagram

19.2   Trainer should be RoHS compliant
19.3   Trainer should be compact, lightweight and housing should be made of ABS material.
19.4   Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
19.5   Communication: USB
19.6   Programming mode: PC mode, Hex keypad mode
19.7   MCU: 8051 core
19.8   Crystal Frequency: 11.0592 MHz
19.9   DC Power Supplies: +12V, -12V, +5V & - 5V
19.10   Programmer: Ready to run programmer will program 8051 devices
19.11   Interconnection for modules: 2 mm patch cords and FRC cables
19.12   Online Product Manual: Should include Theory, procedure, reference, results etc.
19.13   Power Supply: 110V - 260VAC, 50Hz
19.14   Accessories: USB cable, Mains cord, Patch cords, 20 Pin FRC Cable and & Power Supply
19.15   Input Interface Module
          19.15.1 Keyboard: ASCII keyboard
          19.15.2 LED'S: 12 Nos.
          19.15.3 Switches: 4 Nos.
          19.15.4 Keypad: 4 X 4 matrix hex keypad
          19.15.5 Power Supply: From Microcontroller development platform
          19.15.6 Study Material: Online - Include theory, procedure, reference results, etc.
          19.15.7 Interface: 20 pin FRC cable
          19.15.8 Test points: 2 Nos.
19.16   Display Module
          19.16.1 Display: 16 x 2 character LCD
          19.16.2 Contrast control: 0 - 5 V (Variable)
          19.16.3 Backlight control: 0 - 5 V (Variable)
          19.16.4 Seven segment display: 4 Nos.
          19.16.5 LED bar graph: 1 No.
          19.16.6 Interface: 20 pin FRC cable
          19.16.7 Test points: 25 Nos. or more
          19.16.8 Power Supply: From Microcontroller development platform
          19.16.9 Learning Material: Online-include   theory,   procedure,   reference results, etc.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

19.17   ADC/DAC Module
    19.17.1 ADC: ADC0808
    19.17.2 DAC: DAC0808
    19.17.3 Power Supply: From Microcontroller development Platform
    19.17.4 Interface: 20 pin FRC cable
    19.17.5 Test Points: 25 Nos. or more

19.18   Computer Interface Module
    19.18.1 Serial Communication: RS232 Port
    19.18.2 USB Communication: USB port
    19.18.3 Baud Rate: Configurable (Default 9600)
    19.18.4 Power Supply: From Microcontroller development platform
    19.18.5 Interface: 20 pin FRC cable
    19.18.6 Test points: 6 Nos
    19.18.7 Banana socket: 15 Nos or more

19.19   Motor Drive Module
    19.19.1 Stepper Motor: +5 V
    19.19.2 DC Motor: +12 V
    19.19.3 Servo Motor: +5 V
    19.19.4 Interface: 20 pin FRC cable
    19.19.5 Test points: 13
    19.19.6 Power Supply: From Microcontroller development platform

19.20   Data Acquisition System
    19.20.1 Analog Inputs: 4 Inputs with 10 bit resolution
    19.20.2 Analog Outputs: 2 Outputs with 10 bit resolution
    19.20.3 Digital Inputs: 11 TTL Inputs
    19.20.4 Digital Outputs: 11 TTL Outputs
    19.20.5 Unity gain amplifiers: 2 (0-5V DC)
    19.20.6 Counter: 0 to 6MHz (square wave)
    19.20.7 Power Supply: USB Powered
    19.20.8 Computer Interface: USB 2.0

19.21   The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

    19.21.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Microcontroller, Embedded and its Applications, the software should comprises simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. with following topics:

    19.21.2 Embedded System: Module on Embedded system should cover following topics: Basics: Definition, Characteristics, Architecture, Applications, Categories: Stand Alone Embedded System, Real-Time Embedded System, Network Information Appliances, Mobile Devices; Digital Primer and Components: Numbering and Coding System, Digital Gates, Basic Components-Transistor, Diode, Resistance, Capacitance, Seven Segment Display, Power Supply. 8051 Microcontroller: Microcontroller, Architecture, Features, 8051Pinout and Details, Registers and SFR, Memory Map, Instruction Set, Addressing Mode, Timer and Counters, Interrupts, Serial Communication. 8051 Peripheral Interfacing: Switch Interface, Seven Segment Display Interface, LED interface, LCD Interface.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
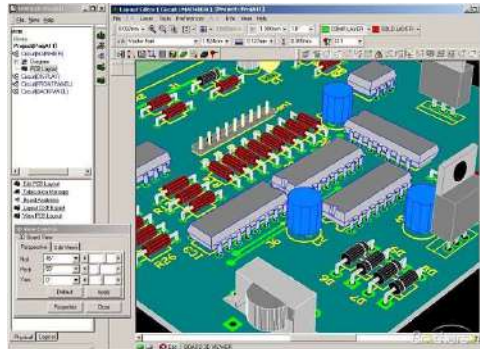**2019 - 20**

20   Hardware and Network Trainer

20.1   Basic Indicative Diagram

20.2   This training system should help to understanding of Local Area Network (LAN) including fundamentals of networking.

20.3   It should assist for knowledge of all network layers, cable designing and building of a complete network of computers.

20.4   Students can study of various topologies using different standards given by IEEE with actual connections made in different topologies and data can be transferred.

20.5   It should have provision to understand protocols, topologies used in networking, measurement of error rate, throughput and effect of errors on protocols.

20.6   It should have PC to PC using RJ-45 Connector, Star topology using RJ45 Connector, Ring topology using DB9 Connector.

20.7   This training system should have software by which student can study Star & Ring selection, Protocols: CSMA /CD, CSMA /CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring, Packet size: 128, 256, 512, 1024, 2048, 4096, 8192, 16384Inter Packet delay: 1000 − 5000 ms, Error generation: Acknowledgment lost, bad packet, auto error generation, Complete analysis of Network & Protocols, Real time Graphic representation of data on s/w screen with packet details, Network details like, Indication of computer name, IP address, MAC address, Port number, status of network, Network & protocol analysis like Indication of packet serial number, file name, file size, file number, receiver name, receiver IP address, total packets, packet length, time out, protocol, topology, receiver, MAC address, port number, file send start time, file sent completion time, transmission time data rate(Mbps),percentage error.

20.8   Trainer should be RoHS complained. It should be compact, lightweight and housing should be made of ABS material.

20.9   It should come with technical chart pasted on it to learn and understand more about applications and technical details.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

21   Electronics Circuit Simulation Software - 6 User License

21.1   Basic Indicative Diagram

21.2   The software should have facility of circuit simulation and PCB design of analog, digital and mixed electronic circuits with their PCB layouts.

21.3   It should have a library of at least 20 thousand components.

21.4   It should support Spice, VHDL, Verilog, Verilog AMS and System C, Create Digital filters in System C and run in software, add MCUs in System C to the software.

21.5   It should also have facility to analyse SMPS, RF, Communication, Power Electronics and Optoelectronic circuits.

21.6   The software must be able to simulate PIC, AVR, 8051, ARM and Arduino MCUs, in digital or mixed circuit environment.

21.7   It should have features to generate and debug MCU code using the integrated flow chart tool and test microcontroller applications in a mixed circuit environment.

21.8   The software should have facility of fault creation in the components, automatic calculation of the component value for the optimization of designed circuit.

21.9   It should support digital circuit simplification of digital logics and the implementation of logic gates using Quine-Mccluskey method and Karnaugh-Map.

21.10   The software should support. symbolic analysis: automatic creation of closed form expressions and for DC, AC and Transient analysis of linear circuits.

21.11   The software should support ADCs, DACs with SPI, I2C, SPI bus simulation, PM bus, SM bus simulation.

21.12   It should also provide facility to study two-port parameters of networks (S, Z, Y and H), DC Transfer Characteristic with Nested sweep option and Parameter Sweeping function to study the response of components. Functions to plot the frequency response, Phasor Diagram, Nyquist Diagram and Noise Analysis. *Linux* simulation on ARM MCU should be possible.

21.13   Pre-recorded (.wav) files can be used as input in circuits and transient analysis results can be converted to .wav files or played using the sound system of computers.

21.14   All six user perpetual license of the software should support either the digital online access, and simulation or the license protection should be supported through USB hardware dongle and have facility to upgrade in future.

21.15   Should create Multilayer PCB layouts of circuits, with automatically placed and routed components. All components in software should be "PCB-ready" and have associated footprints which user can review and change on a component spreadsheet.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

21.16 It should also have 3D capability to preview the physical parts already on the schematic diagram with run time animation in 2D and 3D view, visualizations of PCB design with Enclosures in 3D, 3D printer support, Importing Footprints in 2D and 3D in industry standard formats. PCB design software should support both G code and Gerber generation of the data.

Government of Maharashtra
Directorate of Vocational Education and Training, Maharashtra State
SPECIFICATION FOR ELECTRONICS TRAINERS

Version 4
2019 - 20

22   LAN Protocol Simulation and Analyser Software

22.1   Basic Indicative Diagram

22.2   The module should create a virtual environment to implement various LAN configurations and should give results of simulation.

22.3   User should able to simulate LAN to best possible combination before actual implementation.

22.4   5 User License

22.5   The software module should cover following topics in detail:

22.5.1   Networking: History, Components (NIC, Repeater, HUB, Bridge, Switch, Router, MSAU), Topologies (Bus, Rig, Star, Mesh, Tree), Network Types(LAN, MAN, WAN), VLAN, Internet

22.5.2   Networking Models: OSI Model, TCP/IP Model, IEEE Standards, Protocols

22.5.3   Switching: Circuit Switching, Packet Switching, Message Switching, PSTN, ISDN, DSL

22.5.4   Ethernet: Introduction, Fast Ethernet, Gigabit

22.5.5   Network Security: Introduction, VPN, Firewall

22.5.6   Algorithms: Dijkstra's Algorithm, Bellman Ford Algorithm

22.5.7   Network Design Lab: Bus, Hub, Switch