



Government of Maharashtra

Directorate of Vocational Education and Training
Craftsman Training Scheme

SPECIFICATION FOR ELECTRONICS TRAINER
Version 4, 2024

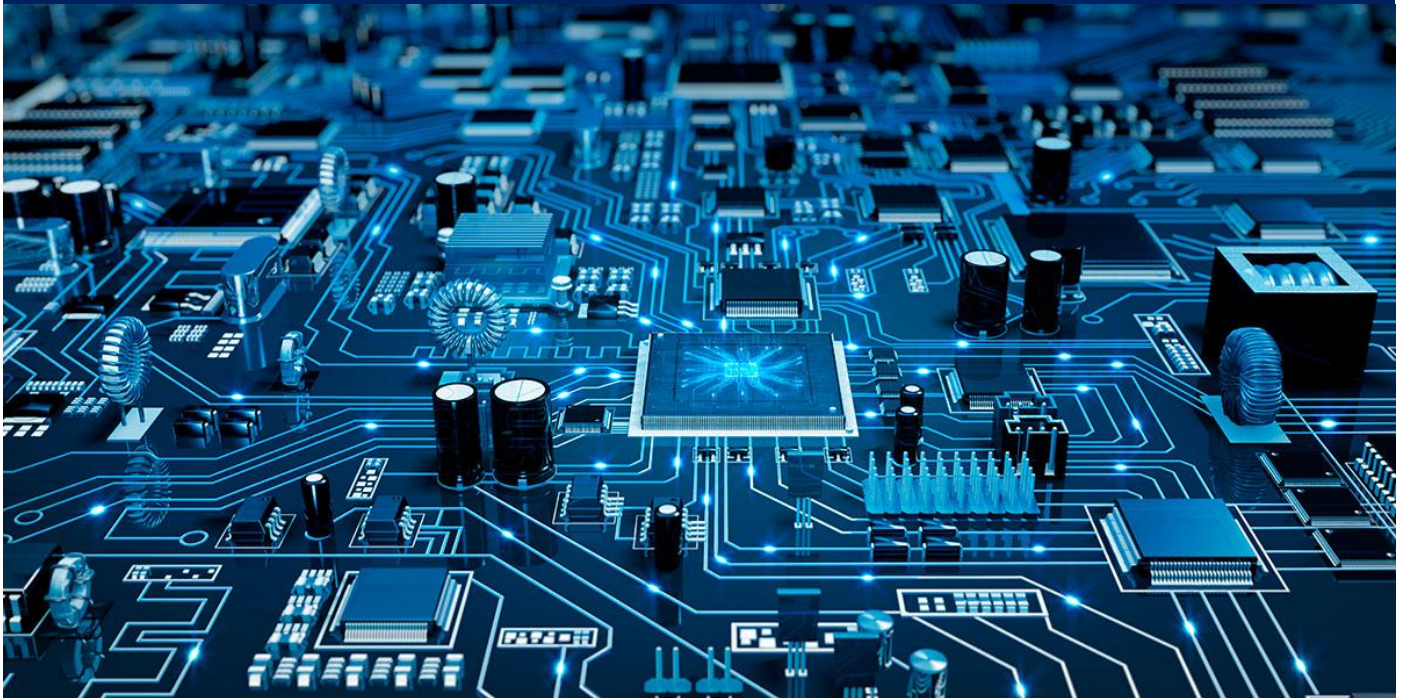


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1 LED Lighting System Trainer

1.1 Basic Indicative Diagram



1.2 Basic Item Specification:

- 1.2.1 The System should be for measurement of Power, Voltage, Current, Power Factor and Light output performance of different lighting products like LED, CFL at variable input voltages.
- 1.2.2 0 to 270 V Variable AC voltage (At 240 V input)
- 1.2.3 LED Lighting System Trainer should be a powder coated metal cabinet of size not be less than 450mm (L) X 280mm (H) X 200mm (D)
- 1.2.4 LED Lighting System Trainer should have the facility of connecting various lighting fixtures like LED lamp, CFL Lamp and 5 pin socket with switches
- 1.2.5 Inbuilt Multi function Meter to measure Current, Voltage, Power and Power Factor
- 1.2.6 Measuring Electricity consumption of different loads
- 1.2.7 Equipped with Automatic dusk to dawn Switch
- 1.2.8 Provided with Light Measurement facility

1.3 Technical Specifications:

- 1.3.1 Variac: 0 to 270 V / 1A (At 240 V input)
- 1.3.2 Multi Para Meter Measurement: LCD based AC Current, AC Voltage, Power Factor, Power (96 X 96)
- 1.3.3 LUX Meter: 0 - 200,000 LUX with data hold facility
- 1.3.4 Input Voltage: 240 V AC, 50 Hz
- 1.3.5 2 X 3 pin Socket with Switch
- 1.3.6 1 X Bulb / Lamp Holder
- 1.3.7 Mains On/ Off and Fuse

1.4 The Training System should come with:

- 1.4.1 20W LED Flood Light: 01 No.
- 1.4.2 Wattage 20W, High Efficiency Aluminum body with weather resistant gasket. Fitted with 1 meter mains cord with 2 pin plug for connecting to the LED Lightning System Trainer
- 1.4.3 20W (4 Feet) LED Tube Light: 01 No.
- 1.4.4 Wattage: 20W, High Efficiency SMD LEDs, Completer with Batten. Diffused Light output for Indoor application. Fitted with 1 meter mains cord with 2 pin plug for connecting to the LED Lightning System Trainer

- 1.4.5 9W LED Bulb (AC): 01 No.
- 1.4.6 Wattage: 9W, High Efficiency SMD LEDs, Wide Light Spread, Hi Lumen Output
- 1.4.7 CFL Lamp (for Comparison): 01 No
- 1.4.8 25 Watt Bulb (For Comparison): 01 No
- 1.5 Standard Accessories:
 - 1.5.1 Operating and Learning manual - printed manual and in CD
 - 1.5.2 Free On-Line Technical support for all registered users
 - 1.5.3 Mains card, Fuse, etc
- 1.6 Space Requirement for Installation:
 - 1.6.1 Overall Length: 450 mm (Approx.)
 - 1.6.2 Overall Width: 200 mm (Approx.)
 - 1.6.3 Overall Height: 285 mm (Approx.)
- 1.7 Electric Supply Specification: 240V AC 50 HZ

2 LED TV Trainer

2.1 Basic Indicative Diagram



2.2 Basic Item Specification:

- 2.2.1 It is to be Ideal training equipment to teach the operation of a LED Colour TV Receiver
- 2.2.2 The complete Colour TV Trainer should be incorporated on a single panel of size not less than 600mm (H) x 585 mm (W) x 75 mm (D)
- 2.2.3 Superior quality LED Color TV with Remote Control
- 2.2.4 Ease in visual observation and identification of the electronic circuit and mechanical parts
- 2.2.5 A multi-coloured layout should be provided on the panel and includes various TV sections, TV screen Section, Faults and Test Points Section, Speakers and block diagram
- 2.2.6 Should have facilities for measurement of voltages and observation of waveforms on test points
- 2.2.7 Soldering free, non-destructive Fault Simulation should be provided by switches to simulate faults
- 2.2.8 The Trainer should works as normal fully functional TV when controls are normal
- 2.2.9 Remote Control (Tx) with batteries to be provided in actual form
- 2.2.10 Wooden/ Plastic Box type construction.

2.3 Technical Specifications

- 2.3.1 Type: TFT HD LED Colour TV Receiver
- 2.3.2 Size: Diagonal 53 cm (21")
- 2.3.3 Display Resolution: 1920 x 1080 Full HD
- 2.3.4 Receiving System: PAL
- 2.3.5 Tuner Channel: 1 - 199
- 2.3.6 Input (Interfaces): RF in, VGA, Audio in, HDMI, USB
- 2.3.7 Audio Output: Stereo (5W X 2)
- 2.3.8 Speaker Type: Down Firing + Full Range
- 2.3.9 Faults: Ten Faults (minimum) Soldering free, non-destructive Faults should be provided
- 2.3.10 Test Points: 15 Test points (minimum) Provided for measurement/ observation of voltages/ waveforms
- 2.3.11 Model with trainer in vertical mode with stand to be kept on table for proper height during experimentation

2.4 Standard Accessories:

- 2.4.1 Fully Functional Remote Control
- 2.4.2 Batteries (for Remote Control)

- 2.4.3 Operation Manual
- 2.4.4 Maintenance Chart / Schedule - NA
- 2.4.5 Training Requirement
- 2.5 Space Requirement for Installation:
 - 2.5.1 Overall Length: 750 mm (Approx.)
 - 2.5.2 Overall Width: 150 mm (Approx.)
 - 2.5.3 Overall Height: 900 mm (Approx.)
- 2.6 Electric Supply Specification: 240V AC 50 HZ

3 Solar Power Generation Trainer

3.1 Basic Indicative Diagram



3.2 The System Should have following Specifications:

- 3.2.1 Training system control panel should have rating of 500 VA and it should be used as solar training system and also power generation.
- 3.2.2 Training system control panel, powder coated MS of size not less than 950 mm(L) x 310 mm (D) x 650 mm (H) and should have built in digital meters of size 96 mm x 96 mm
- 3.2.3 3.5 digit LED DC Digital Voltmeter - 2 Nos. (Bat and Panel)
- 3.2.4 3.5 digit LED DC Digital Ammeter - 2 Nos. (Bat and Panel)
- 3.2.5 3.5 digit LED 3 line multiparameter meter for measuring ACV, ACA, Power and frequency - 01 No.
- 3.2.6 Also 2 separate backlit LCD display are to be provided.
- 3.2.7 16 x 2 alphanumeric LCD for Inverter details such as Vinverter, Vmain, Vbattery, load %, OL/SC; Low Bat; Charging mode status and 20 x 4 alphanumeric LCD for MPPT Charge Controller details such as Vbat, Vpanel, Apanel, Abat charging, Total energy
- 3.2.8 Control panel with BS-10 (10A, 30A) terminals for making the connection and protection for battery and solar panel BNC Output for CRO
- 3.3 Should be able to perform analysis of temperature and dust effect on Solar Power Generation
 - 3.3.1 DSP Microcontroller based inverter technology
 - 3.3.2 Single and dual axis tracking system
 - 3.3.3 Training System includes:
 - 3.3.3.1 250Wp Solar Panel: 2 Nos.
 - 3.3.3.2 Solar Battery (C10 type tubular) 100Ah: 2 Nos.
 - 3.3.3.3 PWM based MPPT Charge Controller: 1 No.
 - 3.3.3.4 Inverter - 500VA: 1 No.
 - 3.3.4 Solar Panel: 250Wp, Voc : 37V, Isc : 7.75A, Vmp : 30V, Imp : 7.14A
 - 3.3.5 Control Panel:
 - 3.3.5.1 Capacity: 500VA,
 - 3.3.5.2 Input Voltage: 120-290V AC

- 3.3.5.3 Output Voltage on Mains mode: Same as Input
- 3.3.5.4 Output Voltage on UPS mode: 210-240V
- 3.3.5.5 Output Frequency on UPS mode: 50Hz \pm 0.1Hz
- 3.3.5.6 Output waveform on Mains mode: Same as Input
- 3.3.5.7 Output waveform on UPS mode: Pure Sine wave (for Silent operation of mixed load)
- 3.3.5.8 Battery Charging Current: 12A
- 3.3.5.9 Charger: 4 Stage
- 3.3.5.10 Efficiency at full load: >80%
- 3.3.5.11 UPS Overload / UPS Short Circuit: Yes
- 3.3.5.12 Technology: DSP Microcontroller Based Design
- 3.3.5.13 MPPT Auto Tracking: Yes
- 3.3.5.14 MPPT Auto select: Battery and Panel
- 3.3.5.15 MPPT Reverse Protection: Battery and Panel
- 3.3.5.16 MPPT High Voltage Protection: Battery and Panel
- 3.3.5.17 MCB: C Type 6A
- 3.3.6 Charge Controller:
 - 3.3.6.1 Solar PV Module: 24-50V
 - 3.3.6.2 Current: 20A
 - 3.3.6.3 Battery Voltage: 24V
 - 3.3.6.4 Technology: PWM based MPPT
 - 3.3.6.5 Charging Stage: Bulk, Absorptions and Float
Automatic panel and battery selection Output and input current limiting at 25A
 - 3.3.6.6 Priority solar charging facility
- 3.3.7 Setup should support to perform following experiments:
 - 3.3.7.1 I-V and P-V Characteristics of P-V Module
 - 3.3.7.2 Vmp, Imp, MPP and Fill factor measurement of Solar PV Module
- 3.4 Protections:
 - 3.4.1 Battery reverse
 - 3.4.2 Panel reverse
 - 3.4.3 Battery high voltage
 - 3.4.4 Panel high voltage
 - 3.4.5 Both battery and panel are high and reverse voltage same time
 - 3.4.6 Overload and Short circuit
 - 3.4.7 No surge current during connection (for zero spark while connecting battery and panel)
- 3.5 Inverter:

Isolated sensing of Mains: This will ensure that even if Phase-Neutral connection is reversed at the input side there will not be any electric shock on the PCB / battery 440V is applied to the AC input, it will not fail. It will indicate high voltage cut-off and restart when voltage is normal if AC mains is given to the inverter output, it will not fail
- 3.6 Standard Accessories:
 - 3.6.1 Operating and Learning manual - printed manual and in CD
 - 3.6.2 System should be provided with all standard accessories to perform the experiments including Gravity Hydrometer and Rheostat (100 ohms / 8 Amp)
 - 3.6.3 Free On Line Technical support for all registered users
 - 3.6.4 Patch cords set of 11, Mains cord, BNC - BNC, Fuses

- 3.6.5 Solar DC Cable (4sq mm) : 4 x 10 meters with Solar connector at one end for Solar Panel and Pin type lug on other end for connecting on panel
- 3.6.6 Battery DC Cable (4sq mm) : 4 x 1 meter with connector at one end for Battery and Pin type lug on other end for connecting on panel
- 3.7 Electric Supply Specification: 240V AC 50 HZ
- 3.8 Space Requirement for Installation:
 - 3.8.1 Overall Length: 900 mm (Approx.)
 - 3.8.2 Overall Width: 285 mm (Approx.)
 - 3.8.3 Overall Height: 600 mm (Approx.)

4 Commercial Radio AM/ FM Trainer

4.1 Basic Indicative Diagram



4.2 Basic Item Features

- 4.2.1 Functional blocks with self explanatory waveforms and technical details indicated on board
- 4.2.2 On board Tuner provided for tuning the AM/FM transmitting stations
- 4.2.3 Interconnections between different section using 2mm patch cords
- 4.2.4 More than 50 test points for waveform observation and analysis
- 4.2.5 12 Switched faults for troubleshooting at different functional blocks
- 4.2.6 Telescopic antenna for reception of AM/FM signal
- 4.2.7 On board audio jack provided for Earphone connection
- 4.2.8 On board Speaker provided for audio communication
- 4.2.9 Trainer should be RoHS compliant

4.3 AM Receiver

- 4.3.1 Construction: Superheterodyne
- 4.3.2 AM Frequency Band: 530 KHz - 1650 KHz
- 4.3.3 Local Oscillator Frequency Range: 980 KHz to 2.060 MHz
- 4.3.4 Intermediate Frequency (IF) : 455 KHz
- 4.3.5 Input Circuits
 - 4.3.5.1 RF amplifier, Mixer, Local oscillator, Beat frequency oscillator, IF amplifier 1, IF amplifier 2 , Automatic Gain Control
- 4.3.6 AM Detectors:
 - 4.3.6.1 Diode detector (for DSB)
 - 4.3.6.2 Product detector (for SSB)

4.4 FM Receiver

- 4.4.1 Construction: Superheterodyne
- 4.4.2 FM Frequency Band: 88 MHz to 108 MHz
- 4.4.3 Tuning Range: 96 MHz to 120 MHz
- 4.4.4 IF Frequency: 10.7 MHz
- 4.4.5 Input Circuits: RF Amplifier, Mixer, Local Oscillator, IF Amplifier 1, IF Amplifier 2, FM Detector, Automatic Frequency Control
- 4.4.6 Audio Output : Amplifier with speaker
- 4.4.7 Tuning: Variable capacitor (ganged) dial marking on board
- 4.4.8 Receiving Media: Telescopic antenna / RF cable
- 4.4.9 Switched Faults: 10 Nos. or more
- 4.4.10 Test Points: 40 Nos. or more
- 4.4.11 Power Supply: 110-220 VAC, 50Hz
- 4.4.12 Interconnections: 12mm Banana sockets

5 Mobile Phone Trainer

5.1 Basic Indicative Diagram



- 5.2 Real time study and operation of Smart Phone
- 5.3 Supports to 4G VoLTE (Cat 4), 3G (UMTS/HSPA+), 2G (GSM/EDGE) Networks
- 5.4 5" Touch screen full HD display
- 5.5 Full understanding of 4G Dual SIM VoLTE Smart Phone working principle and signals
- 5.6 Complete block diagram of a 4G Dual SIM VoLTE Smart Phone on-board
- 5.7 Easy identification of different parts and components of the system at a glance
- 5.8 Easy measurement of voltages and observation of waveforms on test points
- 5.9 Soldering free fault creation and troubleshooting
- 5.10 Android based application development
- 5.11 IoT related application development
- 5.12 Trainer should be RoHS compliant
- 5.13 Trainer should be compact, lightweight and housing should be made of ABS material.
- 5.14 Trainer should come with technical chart pasted on its cover to learn and understand more about applications and technical details.
- 5.15 Cellular system
 - 5.15.1 GSM - Band (2 / 3 / 5 / 8)
 - 5.15.2 WCDMA - Band (1 / 2 / 5 / 8)
 - 5.15.3 4G VoLTE (TDD) - Band (38 / 40 / 41)
 - 5.15.4 LTE (FDD) - Band (1 / 3 / 5 / 7 / 8 / 20)
- 5.16 Tx/Rx Frequency band: GSM/GPRS/EDGE (850, 900, 1800, 1900 MHz)
UMTS/HSPA+ (850, 900, 1900, 2100 MHz)
4G VoLTE (B1, 3, 5, 7, 8, 19, 20, 28, 38, 40)
+5... +33dBm/3.2mW... 2 W
- 5.17 Output power:
- 5.18 OS and Processor Features
 - 5.18.1 Operating system: Android Nougat 7.0
 - 5.18.2 System Architecture: Qualcomm Snapdragon 430
 - 5.18.3 Processor core: Octa Core
 - 5.18.4 Processor clock speed: 1.4 GHz
 - 5.18.5 GPU: Adreno 505 at 450 MHz
- 5.19 Display Features
 - 5.19.1 Display size: 5 inch
 - 5.19.2 Resolution: 1920 x 1080
 - 5.19.3 Resolution type: Full HD, 441 ppi
 - 5.19.4 Other display features: IPS display, 5 point multi-touch
- 5.20 Memory and Storage Features
 - 5.20.1 Internal storage: 16 GB
 - 5.20.2 RAM: 3 GB
 - 5.20.3 Expandable storage: 128 GB

- 5.20.4 Memory card type: Micro SD
- 5.21 Connectivity Features
 - 5.21.1 Supported networks: 4G VoLTE (Cat 4) , UMTS/HSPA+ , GSM/EDGE
 - 5.21.2 Internet connectivity: 4G, 3G, Wi-Fi, EDGE, GPRS
 - 5.21.3 Pre-installed browser: Android
 - 5.21.4 Micro USB port: Yes
 - 5.21.5 Bluetooth support: Yes
 - 5.21.6 Bluetooth version: BR/EDR+BLE 4.2
 - 5.21.7 Wi-Fi version: 802.11 b/g/n , Dual band (2.4GHz and 5GHz)
 - 5.21.8 Wi-Fi hotspot: Yes
 - 5.21.9 Audio Jack: 3.5 mm
 - 5.21.10 OTG compatible: Yes
 - 5.21.11 Location services: GPS, A-GPS and GLONASS
 - 5.21.12 Map support: Google Maps
 - 5.21.13 GPS support: Yes
- 5.22 Camera Features
 - 5.22.1 Primary camera: 13 Megapixel, LED Flash, PDAF with FHD Video Recording, 1080p HD Video
 - 5.22.2 Video resolution: 1920 x 1080
 - 5.22.3 Secondary camera: 5 Megapixel, Display Flash
 - 5.22.4 Secondary camera: Fixed Focus
- 5.23 General Information
 - 5.23.1 Sensors: Finger Print Reader,
 - 5.23.2 Accelerometer
 - 5.23.3 Gyroscope
 - 5.23.4 Ambient Light
 - 5.23.5 Proximity
 - 5.23.6 Gravity
 - 5.23.7 Vibrator
 - 5.23.8 SIM Support: Smart Dual SIM, Dual stand by
 - 5.23.9 SIM Card type: Micro SIM
 - 5.23.10 Battery type: Li-Polymer 2800mAH
 - 5.23.11 Sound: Speaker and Earphone Jack (3.5mm)
 - 5.23.12 On Board Sections: Battery Assembly,
 - 5.23.13 Power Management Unit
 - 5.23.14 Charging Circuit
 - 5.23.15 Touch Display
 - 5.23.16 Dual SIM Interface
 - 5.23.17 User Interface
 - 5.23.18 User interface: Buzzer
 - 5.23.19 Vibrator
 - 5.23.20 Mic
 - 5.23.21 Speaker
 - 5.23.22 Hands Free Port and
 - 5.23.23 Display LEDs
 - 5.23.24 Test Points: More than 40 nos.
 - 5.23.25 Switched Fault: 25 nos.
 - 5.23.26 Power Supply: 100 - 260V AC, 50 Hz
 - 5.23.27 Learning Material: Online including Theory, Procedure, Reference Results, etc.
- 5.24 Standard Accessories
 - 5.24.1 Trainer Power Supply: 1 No.

- 5.24.2 Patch cord 16": 2 Nos.
- 5.24.3 Hands free kit: 1 No.
- 5.24.4 Mains cord: 1 No.
- 5.24.5 Mobile Charger and USB cable: 1 No.
- 5.24.6 Micro SIM Adaptor: 1 No.
- 5.25 The trainer should have to perform following lab experiments:
 - 5.25.1 Tx IQ/ Rx IQ signals and their constellation
 - 5.25.2 Power Management Unit
 - 5.25.3 Battery and Battery charging phenomena
 - 5.25.4 User Interface section: Buzzer, Vibrator, MIC/Speaker, Hands free
 - 5.25.5 Dual SIM interface section, SIM card detection
 - 5.25.6 Touch Screen display section
 - 5.25.7 Switch faults in all section of Smart Phone
 - 5.25.8 Powered On at the alarm set time, Active mode, Acting dead mode, Sleep mode and Partially on mode of a Smart phone
 - 5.25.9 Android based application development
 - 5.25.10 IoT related application development

6 CCTV Set Up Trainer

6.1 Basic Indicative Diagram



- 6.2 Table top 4X3 Aluminum profile flat demo rack with top row fault panels and cameras 4 nos, DVR, Hard disk, LED display and 4 port LAN switch are mounted on PVC composite board to facilitate easily identification of components of CCTV.
- 6.3 Transparent acrylic cover is provided for protection of DVR PCB and hard disk to facilitate easily identification of DVR components.
- 6.4 Non-destructive faults have been implemented through slider switches mounted on 4 panels to teach section wise faults and their troubleshooting.
- 6.5 Set of Instructor Guide and Student Workbook.
- 6.6 Consists of table top aluminium profile rack (45x45) in 4x3 matrix holding various fault panels on the top row and various components on PVC composite board as below
- 6.7 IR Dome Camera: 1 No.
- 6.7.1 1 MP HD IR Dome Camera
 - 6.7.2 720P, Color Dome Camera 1/3 CMOS, 20Mtr IR
 - 6.7.3 Distance, 3.6mm lens, DNR, IP66, 1 MP high performance CMOS, Plastic Body
- 6.8 IR Bullet Camera: 1 No.
- 6.8.1 1 MP HD IR Bullet Camera
 - 6.8.2 720P, Color Bullet Camera 1/3 CMOS, 20Mtr IR
 - 6.8.3 Distance, 3.6MM lens, DNR, IP66, 1 MP high performance CMOS, Plastic Body
- 6.9 IR Varifocal Bullet Camera: 1 No.
- 6.9.1 2 MP HD IR Varifocal Bullet Camera
 - 6.9.2 1080P, Color Bullet Camera 1/3 CMOS, 30-40Meter IR
 - 6.9.3 Distance, 2.8-12mm Motorized Varifocal lens, DNR,
 - 6.9.4 IP66, 2 MP high performance CMOS, True WDR, up to
 - 6.9.5 120DB, OSD Menu, DNR and Smart IR, EXIR Technology
- 6.10 IP Cube Camera: 1 No.
- 6.10.1 1 MP IP Cube Camera
 - 6.10.2 1/3" CMOS, 4mm lens, HD real-time video, PIR detection, IR LED, DWDR and 3D DNR and BLC, Built-in microphone and speaker, SD/SDHC/SDXC card slot,
 - 6.10.3 Support 12V DC and POE, 1.0 MP CUBE CAMERA
- 6.11 Digital Video Recorder (DVR): 1 No.
- 6.11.1 4 Channel HD DVR + 1 LAN port for IP camera
 - 6.11.2 04-ch video and 4-ch audio input, 1 SATA, 1080P
 - 6.11.3 Resolution, 2 USB, 12 VDC, CVBS, HDMI and VGA
 - 6.11.4 Output, connectble HDTVl, analoge and IP cameras. Metal

- 6.11.5 Body, Surveillance WD Hard Disk- 1TB
- 6.12 AC-DC Adaptor for DVR: 1 No.
 - 6.12.1 Rating: 12VDC/1.5A
- 6.13 WiFi Router: 1 No.
 - 6.13.1 Adaptor: 5V DC/3A
- 6.14 SMPS for Cameras: 1 No.
 - 6.14.1 Rating: 12VDC/4A
- 6.15 Monitor 15" LED: 1 No.
- 6.16 Fault Panel: 4 Nos.
 - 6.16.1 4 switches for power supply fault
 - 6.16.2 5 switches for signal fault
 - 6.16.3 6 switches for VGA fault
 - 6.16.4 4 switches for USB fault
 - 6.16.5 4/8 switches for Ethernet fault
- 6.17 List of experiments
 - 6.17.1 To study identification of CCTV trainer components.
 - 6.17.2 To study various faults and their troubleshooting of CCTV trainer.

7 SMPS Trainer

7.1 Basic Indicative Diagram



7.2 Basic Item Specification:

- 7.2.1 In depth elucidation of Switching Transformer, which is one of the most important component of SMPS
- 7.2.2 Facility to connected Variac with the kit
- 7.2.3 Fault identification feature enabled
- 7.2.4 Should designed with considering all safety standards
- 7.2.5 Trainer should be RoHS compliant
- 7.2.6 Trainer should be compact, lightweight and housing should be made of ABS material.
- 7.2.7 Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.

7.3 Technical Specifications:

- 7.3.1 Input: 80 to 230 V AC $\pm 10\%$, 50 / 60 Hz
- 7.3.2 Outputs: +12 V DC regulated
-12 V DC regulated
+5 V DC regulated

7.4 Switching Transformer:

- 7.4.1 Input: 320 V DC switching at 132 KHz
- 7.4.2 Output: 30 V AC (approx)
- 7.4.3 Fuse: 500 mA (Slow blow, spare fuse is given with mains socket)

7.5 The trainer should be able to perform following lab experiments:

- 7.5.1 Study of Primary Rectifier and Filters
- 7.5.2 Study of Switching Transformer
- 7.5.3 Study of PWM switching device
- 7.5.4 Study of Optocoupler
- 7.5.5 Study of Regulation
- 7.5.6 Study of SMPS with Variac input
- 7.5.7 Study of various faults and their removal in SMPS circuit

8 UPS Trainer

8.1 Basic Indicative Diagram



8.2 Basic Item Features:

- 8.2.1 In depth explanation of PWM switching technology, which is one of the most important feature of UPS
- 8.2.2 Provide variable knob to vary duty cycle and test point to observe waveform on CRO
- 8.2.3 Various test points should provide so that user can easily measures the voltages of different sections
- 8.2.4 Should be designed considering all safety standards
- 8.2.5 The trainer should be designed using MOSFET-PWM technology

8.3 Input - Output Voltage:

- 8.3.1 Input: 190 to 260 V, 50 Hz
- 8.3.2 Output: 230 V

8.4 Transformer:

- 8.4.1 Input: 12 - 0 - 12 V
- 8.4.2 Outputs: 0, 190, 220, 240, 260 V
- 8.4.3 18 - 0V AC for battery charging

8.5 The trainer should be able to perform following experiments:

- 8.5.1 Study of PWM Technology
- 8.5.2 To understand the overall functioning of UPS Trainer
- 8.5.3 Study of AVR transformer section of UPS
- 8.5.4 To study the UPS circuit in load condition
- 8.5.5 To identify different faults and to study the systematic procedure of their trouble shooting in UPS circuit

9 ADC to DAC Cards Trainer

9.1 Basic Indicative Diagram



9.2 ADC Trainer Card:

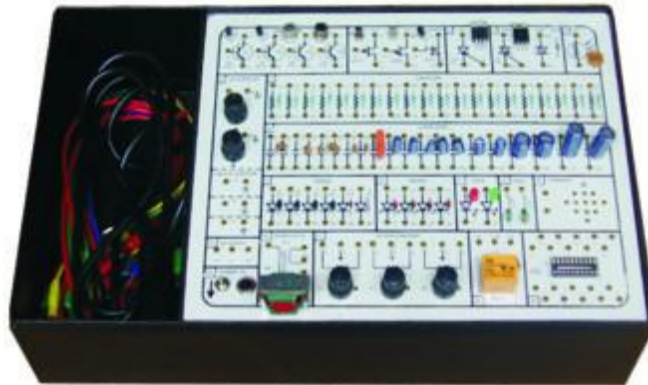
- 9.2.1 4 bit discrete and 8 bit Monolithic converters
- 9.2.2 Unipolar and Bipolar DC voltages
- 9.2.3 O/P status displayed by LED
- 9.2.4 Functional block indicated on board mimic.
- 9.2.5 Built in DC power supply
- 9.2.6 Trainer should be RoHS compliant
- 9.2.7 Trainer should be compact, lightweight and housing should be made of ABS material.
- 9.2.8 Technical chart should be pasted on the trainer to learn and understand more about applications and technical details.
- 9.2.9 A/D Conversion:
 - 9.2.9.1 4 Bit discrete (ramp)
 - 9.2.9.2 8 Bit Monolithic converter
- 9.2.10 Signal source: Unipolar and Bipolar DC voltages
- 9.2.11 O/P Indication: By LEDs separate for each type
- 9.2.12 Inter connections: 2mm banana socket
- 9.2.13 Power Supply: 230 V, 50 Hz.

9.3 DAC Trainer Card

- 9.3.1 4 bit weighted resistor-4 R-2R network
- 9.3.2 10 bit monolithic D/A converters.
- 9.3.3 On board Sine Generator
- 9.3.4 Functional block indicated on board mimics
- 9.3.5 Built in DC power supply
- 9.3.6 Trainer should be RoHS compliant
- 9.3.7 Trainer should be compact, lightweight and housing should be made of ABS material.
- 9.3.8 Technical chart should be pasted on the trainer to learn and understand more about applications and technical details.
- 9.3.9 D/A Conversion:
 - 9.3.9.1 4 Bit weighed resistor
 - 9.3.9.2 4 Bit R-2R ladder network
 - 9.3.9.3 8 Bit Monolithic D/A Converter
- 9.4 Signal: DC supply with toggle switches
- 9.5 O/P indication: On DMM or Oscilloscope
- 9.6 Inter Connections: 2mm. banana sockets
- 9.7 Power Supply: 230V, 50Hz

10 Basic Electronics Trainer

10.1 Basic Indicative Diagram



- 10.2 On Platform Breadboard to design circuits
- 10.3 On board DC Power Supply: +5V/1A (fixed); $\pm 15\text{V}/1\text{A}$ (fixed); $\pm 15\text{V}/200\text{mA}$ (Variable)
- 10.4 On Board AC Supply: 5V-0V-5V; 10V-0V-10V (Provision to use as 5V, 10V, 15V, 20V AC and also as center tap)
- 10.5 Sine/ Square/ TTL Generator: 10Hz to 1MHz in 4 Steps (Variable in between the steps)
- 10.6 Amplitude: Sine (0 to 15Vpp); Square Wave (0 to 10Vpp); TTL-5V (fixed)
- 10.7 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)
- 10.8 Display: LCD
- 10.9 Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt,), Frequency 300Hz to 3.4kHz)
- 10.10 Continuity Tester: For testing the continuity. Provided with Beeper Sound.
- 10.11 Fixed TTL (Clock): 0.1Hz
- 10.12 Data Switches: 8 in Nos (Toggle switches for High/Low TTL levels) with LED indication
- 10.13 LED Display: 8 in Nos (for High/Low TTL levels indication)
- 10.14 Logic Probe: Logic level identifier H/L for TTL level (7 segment display)
- 10.15 Potentiometer: 6mos (100 Ω to 47K Ω)
- 10.16 Speaker: 8 Ω /2W for audio use
- 10.17 Power Supply: 110-220V, 50Hz
- 10.18 Trainer should be RoHS compliant
- 10.19 Trainer should be compact, lightweight and housing should be made of ABS material.
- 10.20 Ready to use experiment board should be fitted in place of bread board to perform following experiments on Rectifier Circuits board:
 - 10.20.1 To study Half wave Rectifier
 - 10.20.2 To study Center tap Full wave Rectifier
 - 10.20.3 To study Bridge Rectifier
- 10.21 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog and Digital Electronic with following key features:
 - 10.21.1 The content should be 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:

10.21.2 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.

11 Discrete Components Trainer

11.1 Basic Indicative Diagram



- 11.2 Flexibility of making circuit connections
- 11.3 Online learning material for step by step procedure to perform the experiment and other details related to theory and experiments.
- 11.4 Trainer should be RoHS compliant
- 11.5 Trainer should be compact, lightweight and housing should be made of ABS material.
- 11.6 DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed), + 12V, 500 mA (Variable), -12V, 500 mA (Variable)
- 11.7 AC Supply: 9V-0V-9V, 500mA
- 11.8 Breadboard: Breadboard for making various circuits and testing them. External components/IC can be fitted conveniently.
- 11.9 Function Generator: Operating modes Sine, Square and Triangular. Frequency range 1 Hz to 100 KHz.
- 11.10 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)
- 11.11 Display: LCD
- 11.12 Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)
- 11.13 Continuity Tester: For testing the continuity. Provided with beeper sound.
- 11.14 Power Supply: 110-220 V, 50Hz.
- 11.15 Ready to use experiment board should be fitted in place of bread board to perform following experiments on Diode Characteristics (Si, Zener, LED)
 - 11.15.1 Study of V-I characteristics of Silicon Diode
 - 11.15.2 Study of V-I characteristics of Zener Diode
 - 11.15.3 Study of V-I characteristics of Light Emitting Diode (LED)
- 11.16 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:
 - 11.16.1 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:
 - 11.16.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm's Law, Kirchoff'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.

12 Digital and Analog Bread Board Trainer

12.1 Basic Indicative Diagram



- 12.2 On Platform Breadboard to design circuits
- 12.3 On board DC Power Supply: +5V/1A (fixed); $\pm 15\text{V}/1\text{A}$ (fixed); $\pm 15\text{V}/200\text{mA}$ (Variable)
- 12.4 On Board AC Supply: 5V-0V-5V; 10V-0V-10V (Provision to use as 5V, 10V, 15V, 20V AC and also as center tap)
- 12.5 Sine/ Square/ TTL Generator: 10Hz to 1MHz in 4 Steps (Variable in between the steps)
- 12.6 Amplitude: Sine (0 to 15Vpp); Square Wave (0 to 10Vpp); TTL-5V (fixed)
- 12.7 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)
- 12.8 Display: LCD
- 12.9 Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt)
- 12.10 Continuity Tester: For testing the continuity. Should provided with beeper sound.
- 12.11 Fixed TTL (Clock): 0.1Hz
- 12.12 Data Switches: 8 in Nos (Toggle switches for High/Low TTL levels) with LED indication
- 12.13 LED Display: 8 in Nos (for High/Low TTL levels indication)
- 12.14 Logic Probe: Logic level identifier H/L for TTL level (7 segment display)
- 12.15 Potentiometer: 6mos (100 Ω to 47K Ω)
- 12.16 Speaker: 8 $\Omega/2\text{W}$ for audio use
- 12.17 Power Supply: 110-220V, 50Hz
- 12.18 Trainer should be RoHS compliant
- 12.19 Trainer should be compact, lightweight and housing should be made of ABS material.
- 12.20 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog and Digital Electronic with following key features:
 - 12.20.1 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:

12.20.2 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 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.

13 Digital IC Trainer

13.1 Basic Indicative Diagram



- 13.2 Trainer should be RoHS compliant
- 13.3 Trainer should be compact, lightweight and housing should be made of ABS material.
- 13.4 Size of Breadboard: 172.5 mm x 68mm
- 13.5 DC Supply: +5 V, 500 mA
- 13.6 Clock Frequency: 1 Hz, 100 Hz, 1 KHz, 100 KHz
- 13.7 Amplitude: 3.3V (TTL)
- 13.8 Duty Cycle: 50 %, TTL output
- 13.9 Pulsar Switches: 2 Nos.
- 13.10 Graphical LCD: 128 X 64 dots (To display pin diagram of various digital ICs so that students can make by their own digital circuits)
- 13.11 Data switches: 8 Nos. (Toggle switches for both TTL modes)
- 13.12 Digital Circuits: Virtual, should be interfaced with real time Inputs/outputs
- 13.13 LED display: 8 Nos. (TTL)
- 13.14 Seven Segment Display: 3 Nos.
- 13.15 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 Cord.
- 13.16 Main Supply: 100V - 240V AC, 50Hz
- 13.17 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Digital Electronic with following key features:
 - 13.17.1 The content should be 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 comprise 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:
 - 13.17.2 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

14 Electronics Sensor Trainer - 10 Sensors

14.1 Basic Indicative Diagram



- 14.2 IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor and DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output.
- 14.3 Ethernet port to connect real world.
- 14.4 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.
- 14.5 Trainer should be RoHS compliant, should be compact, lightweight and made of ABS enclosure.
- 14.6 It should come with technical chart pasted on it to learn and understand more about applications and technical details.
- 14.7 The Trainer should include the following Sensors:
 - 14.7.1 Thermocouple: K Type Thermocouple, -200°C to 1250°C
 - 14.7.2 RTD - Platinum RTD: 100Ω at 0°C (Temp. coefficient 0.385 Ω /°C)
 - 14.7.3 Load Cell/ Strain Gauge
 - 14.7.4 LVDT
 - 14.7.5 Smoke Detector Sensors: Gas(Smoke) : Methane, Butane, LPG, Smoke
 - 14.7.6 Speed Sensor
 - 14.7.7 Limit Switch
 - 14.7.8 Photo sensors: L14G1 Photo Transistor: 500nm - 1100nm
 - 14.7.9 Opto coupler
 - 14.7.10 Proximity Sensor
- 14.8 Trainer should have to perform following experiments:
 - 14.8.1 Learn the detailed fundamentals of signal conditioning.
 - 14.8.2 Learn in-depth study of sensors and it's circuit diagram.
 - 14.8.3 Learn how automation can implement using sensors and actuators.
 - 14.8.4 Testing and understanding graph of Thermocouple and photo transistor .
 - 14.8.5 Testing and understanding the working of Amplifiers like inverting amplifier, Non inverting
 - 14.8.6 Amplifier, Differential Amplifier, Instrumentation Amplifier, Current Amplifier
 - 14.8.7 Testing and understanding the working of Filters like High Pass filter and Low Pass Filter
 - 14.8.8 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.

- 14.8.9 Study of output blocks like LED, Buzzer and LED bar graph.
- 14.8.10 Testing and understanding graph of Gas (Smoke), Limit switch, proximity sensor, Opto coupler sensors.
- 14.8.11 Fault finding to Types of signal conditioning and Sensors.
- 14.8.12 See the sensor real timer graph using computer based software
- 14.8.13 Sensors data logging using computer based software
- 14.8.14 HDMI and Ethernet connectivity.
- 14.9 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:
- 14.10 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:
 - 14.10.1 Sensor, Transducer and actuator
 - 14.10.2 Difference between sensor and transducer
 - 14.10.3 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
 - 14.10.4 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

15 Fiber Optic Communication Trainer

15.1 Basic Indicative Diagram



- 15.2 Full Duplex Analog and Digital Trans-receiver
- 15.3 660 nm and 950 nm Fiber Optic LED channel with Transmitter and Receiver
- 15.4 AM-FM-PWM modulation / demodulation
- 15.5 PC-PC communication with RS232 ports and software
- 15.6 On board Function Generator
- 15.7 Functional blocks indicated on-board
- 15.8 Input-output and test points provided
- 15.9 On board voice link
- 15.10 Built in DC Power Supply
- 15.11 Numerical Aperture measurement jig and mandrel for bending loss measurement
- 15.12 Data Generator with selectable clock (64/ 128/ 256 KHz)
- 15.13 Noise Generator with variable gain
- 15.14 Eye pattern observation and Bit Error Rate measurement
- 15.15 Four digits (Seven segment display)Bit Error Counter
- 15.16 Switched faults on Transmitter and Receiver
- 15.17 Trainer should be RoHS compliant
- 15.18 Trainer should be compact, lightweight and housing should be made of ABS material.
- 15.19 Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
- 15.20 Transmitter: 2 Nos., Fiber Optic LED having peak wavelength of emission 660 nm and 950 nm
- 15.21 Receiver: 2 Nos., Fiber Optic Photo detector
- 15.22 Modulation Techniques: AM, FM, PWM.
- 15.23 Drivers: 1 No. with Analog and Digital modes
- 15.24 AC Amplifier: 2 Nos.
- 15.25 Clock: Crystal controlled Clock 4.096 MHz
- 15.26 PLL detector: 1 No.
- 15.27 Comparator: 2 Nos.
- 15.28 Filters: 2 Nos. 4th order Butterworth, 3.4 KHz cut-off frequency
- 15.29 Analog Band Width: 350 KHz
- 15.30 Digital Band Width: 2.5 MHz
- 15.31 Function Generator: 1 KHz Sine wave (Amplitude adjustable) 1 KHz Square Wave (TTL)
- 15.32 Voice Link: Fiber Optic voice link using microphone and speaker (built in)
- 15.33 PC-PC Communication: Using 2 channel RS232
- 15.34 Port: RS232 (9 Pin)
- 15.35 Baud Rate: 19200
- 15.36 Switched Faults: 4 in Transmitter and 4 in Receiver

- 15.37 Fiber Optic Cable: Connector type standard SMA
- 15.38 Cable Type: Step indexed multimode PMMA plastic
- 15.39 Core Refractive Index: 1.492
- 15.40 Clad Refractive Index: 1.406
- 15.41 Numerical Aperture: Better than 0.5
- 15.42 Acceptance Angle: Better than 60 deg.
- 15.43 Fiber Diameter: 1000 microns
- 15.44 Outer Diameter: 2.2 mm
- 15.45 Fiber Length: 0.5m and 1m
- 15.46 Test Points: 50 nos.
- 15.47 Inter connections: 2 mm sockets
- 15.48 Power Supply: 110 -220 V, 50 Hz
- 15.49 Learning Material: Online including Theory, Procedure, reference results, etc.
- 15.50 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.
- 15.51 Experiments that can be performed
 - 15.51.1 Setting up Fiber Optic Analog and Digital link
 - 15.51.2 AM system using Analog and Digital input signals
 - 15.51.3 Frequency Modulation system and Pulse Width Modulation system
 - 15.51.4 Study of Propagation Loss, Bending Loss and measurement of Numerical Aperture
 - 15.51.5 Characteristics of Fiber Optic communication link
 - 15.51.6 Setting of Fiber Optic voice link using Amplitude, Frequency and PWM Modulation
 - 15.51.7 Study of Switched Faults in AM, FM and PWM system
 - 15.51.8 Full Duplex Computer Communication using RS232 ports and software
 - 15.51.9 V-I characteristics of LED (E - O converter)
 - 15.51.10 Characteristics of Photo Detector
 - 15.51.11 Demonstration of optical wave inside of a fiber using optical waveguides to show losses and total internal reflection in optical cable
 - 15.51.12 Experiments with Eye pattern and BER measurement module
 - 15.51.13 Measurement of Bit Error Rate
 - 15.51.14 Study of Eye pattern
- 15.52 The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Fiber Optics with following key features:
 - 15.52.1 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:
 - 15.52.2 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.

16 Frequency Modulator and Demodulator Trainer

16.1 Basic Indicative Diagram



- 16.2 On-board audio oscillator, 3 types of FM modulators
- 16.3 5 different types of demodulator, amplitude limiter and filter,
- 16.4 Experiment for effect of noise in FM single
- 16.5 Test points 30 nos or more for wave form observation and analysis
- 16.6 Switched faults 10 nos or more to understand working of a block in detail
- 16.7 LED indication for signal flow and Selection.
- 16.8 Experiment for effect of noise on detection of FM Signal
- 16.9 Modulating signal range: 300Hz to 3.4KHz
- 16.10 Carrier frequency Range (Fixed): 455 KHz
- 16.11 Carrier frequency Range (Variable): 10 KHz to 200 KHz
- 16.12 FM Modulator Type: Reactance Modulator, Varactor Modulator, VCO Based Modulator
- 16.13 FM Demodulator type: Detuned Resonant Detector, Quadrature Detector, Foster-Seeley Detector, Ratio Detector, PLL Detector (2 types: IC 4046 and IC 565 based),
- 16.14 Low Pass Filter: 3.4 KHz cut off frequency amplifier (with adjustable Gain)
- 16.15 Trainer should be RoHS compliant
- 16.16 Trainer should be compact, lightweight and housing should be made of ABS material.
- 16.17 Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
- 16.18 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Communication with following key features:
 - 16.18.1 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:
 - 16.18.2 It should help students to analyse and 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

17 Linear IC Trainer

17.1 Basic Indicative Diagram



- 17.2 It should have built-in Function Generator, Continuity Tester, Toggle Switch, Potentiometer, Frequency Measurement, Computer Interface
- 17.3 Functional Blocks indicated on board mimic
- 17.4 On board DC and AC Power Supply, Function Generator, Continuity Tester
- 17.5 On board Toggle Switches and Potentiometers
- 17.6 Solder less Breadboard
- 17.7 On Board Voltage/ Current/Frequency Measurement
- 17.8 Trainer should be RoHS compliant
- 17.9 Trainer should be compact, lightweight and housing should be made of ABS material.
- 17.10 Regulated DC power supplies: +5V-1A (Fixed), $\pm 12\text{V}$ -500mA (Fixed), $\pm 12\text{V}$ -500mA (Variable)
- 17.11 AC supply: 9V-0V-9V/500mA
- 17.12 Function Generator
 - 17.12.1 Operating modes: Sine, Square, Triangular
 - 17.12.2 Frequency range: 1 Hz to 100 KHz
- 17.13 Volt/Current/Frequency Measurement: Voltage Range +12V to -12V DC Current Range 0 to 500mA DC
- 17.14 Display: LCD
- 17.15 Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)
- 17.16 Continuity Tester: For testing the continuity. Provided with Beeper Sound.
- 17.17 The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:
 - 17.17.1 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:
 - 17.17.2 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.

18 Machine Shop Sensor Trainer

18.1 Basic Indicative Diagram



- 18.2 Inductive Sensor, Capacitive Sensor, Magnetic Sensor, Ultrasonic Sensor should be mounted on panel along with DAQ and Counter Box.
- 18.3 Precise Signal conditioning
- 18.4 Real-time DAQ interface with ADC, DAC and digital input/output
- 18.5 Supplied with Dashboard Software for supervisory control of the process with data acquisition
- 18.6 Computer Based Data Logging
- 18.7 Interface with Ethernet based DAQ
- 18.8 Sensitive, linear, stable and accurate
- 18.9 Industrial look and feel
- 18.10 User-friendly, self-explanatory system
- 18.11 Experiments configurable through patch board
- 18.12 Enhanced electrical safety considerations
- 18.13 Practice Troubleshooting skills
- 18.14 Compact tabletop ergonomic design
- 18.15 Ready Experimental details
- 18.16 Robust design and construction
- 18.17 Online Product Tutorial
- 18.18 Data Acquisition System (DAQ):
 - 18.18.1 Analog Inputs: 1 No.
 - 18.18.2 Digital Inputs: 8 Nos.
 - 18.18.3 Digital Outputs: 8 Nos.
 - 18.18.4 ADC Resolution: 24 Bit
 - 18.18.5 RS485 Interface: Yes
 - 18.18.6 USB Interface: Yes
 - 18.18.7 Ethernet Interface: Yes
 - 18.18.8 Data Logging: Yes
 - 18.18.9 Inductive Sensor: 1 No.
 - 18.18.10 Operating input voltage: 10-30 V DC
 - 18.18.11 Sensor type: PNP
 - 18.18.12 Output voltage: 10-30V DC
 - 18.18.13 Sensing Range: 0-5 mm
 - 18.18.14 Switch Type: No
 - 18.18.15 Body: Cubical/Cylindrical
 - 18.18.16 Capacitive Sensor: 1 No.
 - 18.18.17 Operating input voltage: 10-30 V DC
 - 18.18.18 Sensor Type: PNP
 - 18.18.19 Output Voltage: 10-30V DC
 - 18.18.20 Sensing Range: 2-8 mm

	18.18.21	Switch Type:	No
	18.18.22	Body:	Cubical/Cylindrical
18.19		Magnetic Sensor:	1 No.
	18.19.1	Operating input voltage:	10-30 V DC
	18.19.2	Sensor Type:	PNP
	18.19.3	Output Voltage:	10-30V DC
	18.19.4	Sensing Range:	60 mm (approximately)
	18.19.5	Switch Type:	No
	18.19.6	Body:	Cubical/Cylindrical
18.20		Ultrasonic Sensor:	1 No.
	18.20.1	Operating Input Voltage:	10-30 V DC
	18.20.2	Sensor Type:	PNP
	18.20.3	Output Voltage:	10-30V DC
	18.20.4	Sensing Range:	80 - 300 mm (approximately)
	18.20.5	Switch Type:	No
18.21		Connecting Wires:	15 Nos. (Patch cord)
18.22		Motor:	1 No.
	18.22.1	Operating Voltage:	24V DC
	18.22.2	Current Rating:	1A (Approx)
18.23		Motor Driver:	1 No.
18.24		Power Distribution Box:	1 No.
	18.24.1	Operating Voltage:	24V DC
	18.24.2	Current Rating:	4A (approx)
18.25		Counter Box:	1 No.
	18.25.1	Supply Voltage:	90-230V AC
	18.25.2	Display Configuration:	6 Digits Counts, 5 Digits RPM Indicator
	18.25.3	Counting Direction:	Up, Down, Bi directional
	18.25.4	Sensor Type:	PNP
	18.25.5	Sensor Output Voltage:	10-30 VDC
	18.25.6	Current Rating:	0.05A
18.26		Indication Box:	1 No.
	18.26.1	Supply:	24V DC
	18.26.2	Colour:	Green
	18.26.3	Panel:	Vertical Mounting Plate of at least W 600 X H 390 X D 300
18.27		The trainer should support to perform following lab experiments:	
	18.27.1	DAQ Digital Input	
	18.27.2	DAQ Digital Outputs	
	18.27.3	DAQ Analog Inputs	
	18.27.4	Inductive Sensor	
	18.27.5	Capacitive Sensor	
	18.27.6	Magnetic Sensor	
	18.27.7	Ultrasonic Sensor	
	18.27.8	Counter Box	
	18.27.9	RPM Counting of DC Motor using Counter box and Sensors	
	18.27.10	Motor Speed Control using DAQ	

19 Op Amp Trainer

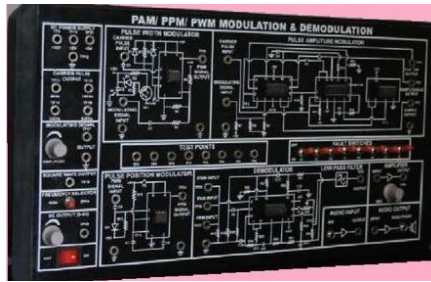
19.1 Basic Indicative Diagram



- 19.2 Study of different configuration of Operational Amplifier
- 19.3 Fixed DC Power Supply: +12V, -12V, +5V and -5V
- 19.4 Variable DC Power Supply: +1.5V to +10V Regulated using LM317; -1.5V to -10V Regulated using LM337
- 19.5 Function Generator: Sine Wave, Square Wave, Triangular Wave (1KHz to 100KHz; 0-5Vpp)
- 19.6 Op Amp IC: IC uA741 (2 Nos.)- All pins terminated by 2mm Banana Socket.
- 19.7 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.)
- 19.8 Diode: Diode 1N 4007
- 19.9 Capacitor Bank: Electrolyte Cap. 1mf/63V, Disc cap. 1nf/63V, Disc cap. 10nf/63V, Disc cap. 100nf/63V
- 19.10 Variable Resistance bank: 1K Ω Single turn Potentiometer (2 Nos.), 10K Ω Single turn Potentiometer (2 Nos.), 100K Ω Single turn Potentiometer (2 Nos.), 1M Ω Single turn Potentiometer (2 Nos.)
- 19.11 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.
- 19.12 The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:
 - 19.12.1 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:
 - 19.12.2 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.

20 PAM, PPM, PWM Trainer

20.1 Basic Indicative Diagram



- 20.2 PAM-PPM-PWM modulation and demodulation techniques,
- 20.3 Natural and flat-top sampling,
- 20.4 On-board filter and ac amplifier,
- 20.5 Selectable 4 different sampling pulse frequencies on board,
- 20.6 Voice communication using dynamic microphone and speaker,
- 20.7 Sample, Sample and hold and Flat-Top O/P in PAM
- 20.8 On Board Sampling Frequencies (Pulse): 8KHz, 16KHz, 32KHz, 64KHz
- 20.9 Low Pass Filter: 4th order BW filter
- 20.10 AC amplifier: With adjustable Gain Control
- 20.11 DC O/P: 0-4 V (Variable)
- 20.12 Test Point: 25nos or more
- 20.13 Trainer should be RoHS compliant
- 20.14 Trainer should be compact, lightweight and housing should be made of ABS material.
- 20.15 Trainer should come with technical chart pasted on its cover to learn and understand more about applications and technical details.
- 20.16 The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Communication with following key features:
 - 20.16.1 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:
 - 20.16.2 It should help students to analyse and 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.

21 Power Electronics Trainer - 06 Application Boards

21.1 Basic Indicative Diagram



- 21.2 On Platform Breadboard to circuit design-2Nos.
- 21.3 On board DC Power Supply: $\pm 5V/500mA$; $\pm 12V/500mA$; $+15V/250mA$; $\pm 35V/250mA$
- 21.4 On board AC power Supply: 18V-0V-18V; 0V-15V
- 21.5 On board firing circuit with Frequency range: 30Hz to 900Hz variable; Amplitude: 12V; PWM control of G1, G2, G3 and G4; Duty cycle control of Gate signal is 0 to 100%
- 21.6 SCR Assembly: 4 SCRs 2P4M, 400V/2A
- 21.7 Power Devices: IGBT-G4BC20S, MOSFET-IRFZ44N, UJT-2N2646, DIAC-DB3, TRIAC-BT136, PUT-2N6027
- 21.8 Circuit Components on Board: Electrolytic Capacitor-10 μ F,63V, 1 μ F,63V; Met. Capacitor 0.33 μ F, 63V; Resistances-1K/1W, 1K/10W, 10K/10W, 120E/5W, 2K2/2W; Diode 1N4007, Inductor 220 μ H, 4.7 μ H, 10mH.
- 21.9 Pulse transformer on board: 2 nos. PT4502 1:1 and one is PT4503 1:1:1
- 21.10 AC power Supply: 220V/110V, 50Hz
- 21.11 Trainer should be RoHS compliant
- 21.12 Trainer should be compact, lightweight and housing should be made of ABS material.
- 21.13 The trainer should be supplied with following application boards:
 - 21.13.1 MOSFET Characteristics: Should have to perform experiment like-To study the characteristics of n channel MOSFET
 - 21.13.2 SCR Characteristics: Should have to perform experiment like:-Study of Characteristics of SCR and Plotting V-I Characteristics
 - 21.13.3 SCR-LAMP Flasher: Should have to perform experiment like:- Study the application of SCR as a lamp flasher measurement of frequency, time, and voltage.
 - 21.13.4 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.
 - 21.13.5 Series Inverter: Should have to perform experiment like:- Study the operation of series inverter and output waveform across the RLC load.
 - 21.13.6 Single Phase PWM Inverter: Should have to perform experiment like:-
 - 21.13.6.1 Study of the single phase PWM firing circuit.
 - 21.13.6.2 Study the operation of single phase PWM bridge inverter using MOSFET.
 - 21.13.6.3 Study the operation of single phase PWM bridge inverter using IGBT.
- 21.14 The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:

- 21.14.1 The content should be 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 advanced technologies, the software should comprise 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:
- 21.14.2 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).

22 Seven Segment DPM Trainer

22.1 Basic Indicative Diagram



22.2 Trainer should be RoHS compliant

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

22.4 Technical Details:

22.4.1 Voltage

22.4.1.1 DC Voltage: 0 - 350V

22.4.1.2 AC RMS Voltage: 0 - 350V

22.4.2 Current

22.4.2.1 DC Current: 0 - 2A

22.4.2.2 AC Current: 0 - 2A

22.4.3 Resistance: 0 - 2MV

22.4.4 On Board Fuse: 200mA, 2A

22.4.5 Mains supply: 230V, 50Hz

22.5 The trainer should be able to perform following experiments:

22.5.1 Study of DC and AC Voltage Measurement

22.5.2 Study of DC and AC Current Measurement

22.5.3 Study of Resistance Measurement Study of Continuity Tester

23 Data Acquisition System

23.1 Basic Indicative Diagram



- 23.2 Should be RoHS compliant
- 23.3 Should be compact, lightweight and housing should be made of ABS material.
- 23.4 Analog Inputs: 4 Inputs with 10 bit resolution
- 23.5 Analog Outputs: 2 Outputs with 10 bit resolution
- 23.6 Digital Inputs: 11 TTL Inputs
- 23.7 Digital Outputs: 11 TTL Outputs
- 23.8 Unity gain amplifiers: 2 (0-5V DC)
- 23.9 Counter: 0 to 6MHz (square wave)
- 23.10 Power Supply: USB Powered
- 23.11 Computer Interface: USB 2.0

24 Analog Component Trainer

24.1 Basic Indicative Diagram



- 24.2 Flexibility of making circuit connections.
- 24.3 Online learning material for step by step procedure to perform the experiment and other details related to theory and experiments.
- 24.4 Trainer should be RoHS compliant
- 24.5 Trainer should be compact, lightweight and housing should be made of ABS material.
- 24.6 DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed), + 12V, 500 mA (Variable), -12V, 500 mA (Variable)
- 24.7 AC Supply: 9V-0V-9V, 500mA
- 24.8 Breadboard: Breadboard for making various circuits and testing them. External components/IC can be fitted conveniently.
- 24.9 Function generator: Operating modes Sine, Square and Triangular. Frequency range 1 Hz to 100 KHz.
- 24.10 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)
- 24.11 Display: LCD
- 24.12 Computer Interface: Acquisition from two Analog input channels (Max. input 1 Volt, Frequency 300Hz to 3.4kHz)
- 24.13 Continuity Tester: For testing the continuity. Should provide with beeper sound.
- 24.14 Power Supply: 110-220 V, 50Hz.
- 24.15 Ready to use experiment board should be fitted in place of bread board to perform following experiments on Zener Voltage Regulator board:
 - 24.15.1 Study of Zener diode as a voltage regulator, when input voltage V_{in} is fixed while Load resistance R_L is variable
 - 24.15.2 Study of Zener diode as a voltage regulator, when input voltage V_{in} is variable while Load resistance R_L is fixed.
- 24.16 The trainer should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:
 - 24.16.1 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:

24.16.2 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.

25 Micro Processor Trainer

25.1 Basic Indicative Diagram



- 25.2 72 I/O lines through 8255
- 25.3 Three channel Timer/Counter using 8253
- 25.4 8 channel ADC with On board DAC
- 25.5 It should support have two modes of operation-Keyboard mode and Serial Mode/
- 25.6 It should have the Facility of downloading and uploading the files from Computer
- 25.7 All Address and Control lines are provided on 50 pin connector
- 25.8 Operating Frequency: 5 MHz
- 25.9 RAM: 16 K
- 25.10 ROM: 16 K
- 25.11 Display: 20 X 2 LCD
- 25.12 Input: ASCII Keyboard
- 25.13 Mains supply: 90 - 230V AC, 50 Hz
- 25.14 The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:
 - 25.14.1 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:
 - 25.14.2 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.

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

26.1 Basic Indicative Diagram



- 26.2 Trainer should be RoHS compliant
- 26.3 Trainer should be compact, lightweight and housing should be made of ABS material.
- 26.4 Trainer should come with technical chart pasted on it to learn and understand more about applications and technical details.
- 26.5 Communication: USB
- 26.6 Programming mode: PC mode, Hex keypad mode
- 26.7 MCU: 8051 core
- 26.8 Crystal Frequency: 11.0592 MHz
- 26.9 DC Power Supplies: +12V, -12V, +5V and - 5V
- 26.10 Programmer: Ready to run programmer will program 8051 devices
- 26.11 Interconnection for modules: 2 mm patch cords and FRC cables
- 26.12 Online Product Manual: Should include Theory, procedure, reference, results etc.
- 26.13 Power Supply: 110V - 260VAC, 50Hz
- 26.14 Accessories: USB cable, Mains cord, Patch cords, 20 Pin FRC Cable and Power Supply
- 26.15 Input Interface Module
 - 26.15.1 Keyboard: ASCII keyboard
 - 26.15.2 LED'S: 12 Nos.
 - 26.15.3 Switches: 4 Nos.
 - 26.15.4 Keypad: 4 X 4 matrix hex keypad
 - 26.15.5 Power Supply: From Microcontroller development platform
 - 26.15.6 Study Material: Online - Include theory, procedure, reference results, etc.
 - 26.15.7 Interface: 20 pin FRC cable
 - 26.15.8 Test points: 2 Nos.
- 26.16 Display Module
 - 26.16.1 Display: 16 x 2 character LCD
 - 26.16.2 Contrast control: 0 - 5 V (Variable)
 - 26.16.3 Backlight control: 0 - 5 V (Variable)
 - 26.16.4 Seven segment display: 4 Nos.
 - 26.16.5 LED bar graph: 1 No.
 - 26.16.6 Interface: 20 pin FRC cable
 - 26.16.7 Test points: 25 Nos. or more
 - 26.16.8 Power Supply: From Microcontroller development platform
 - 26.16.9 Learning Material: Online-include theory, procedure, reference results, etc.
- 26.17 ADC/DAC Module
 - 26.17.1 ADC: ADC0808

- 26.17.2 DAC: DAC0808
- 26.17.3 Power Supply: From Microcontroller development Platform
- 26.17.4 Interface: 20 pin FRC cable
- 26.17.5 Test Points: 25 Nos. or more
- 26.18 Computer Interface Module
 - 26.18.1 Serial Communication: RS232 Port
 - 26.18.2 USB Communication: USB port
 - 26.18.3 Baud Rate: Configurable (Default 9600)
 - 26.18.4 Power Supply: From Microcontroller development platform
 - 26.18.5 Interface: 20 pin FRC cable
 - 26.18.6 Test points: 6 Nos
 - 26.18.7 Banana socket: 15 Nos or more
- 26.19 Motor Drive Module
 - 26.19.1 Stepper Motor: +5 V
 - 26.19.2 DC Motor: +12 V
 - 26.19.3 Servo Motor: +5 V
 - 26.19.4 Interface: 20 pin FRC cable
 - 26.19.5 Test points: 13
 - 26.19.6 Power Supply: From Microcontroller development platform
- 26.20 Data Acquisition System
 - 26.20.1 Analog Inputs: 4 Inputs with 10 bit resolution
 - 26.20.2 Analog Outputs: 2 Outputs with 10 bit resolution
 - 26.20.3 Digital Inputs: 11 TTL Inputs
 - 26.20.4 Digital Outputs: 11 TTL Outputs
 - 26.20.5 Unity gain amplifiers: 2 (0-5V DC)
 - 26.20.6 Counter: 0 to 6MHz (square wave)
 - 26.20.7 Power Supply: USB Powered
 - 26.20.8 Computer Interface: USB 2.0
- 26.21 The training should include online single user Classroom / laboratory teaching, learning and simulation software module with following key features:
 - 26.21.1 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:
 - 26.21.2 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.

27 LAN Protocol Simulation and Analyser Software

27.1 Basic Indicative Diagram



- 27.2 The module should create a virtual environment to implement various LAN configurations and should give results of simulation.
- 27.3 User should be able to simulate LAN to best possible combination before actual implementation.
- 27.4 5 User License
- 27.5 The software module should cover following topics in detail:
 - 27.5.1 Networking: History, Components (NIC, Repeater, HUB, Bridge, Switch, Router, MSAU), Topologies (Bus, Ring, Star, Mesh, Tree), Network Types (LAN, MAN, WAN), VLAN, Internet
 - 27.5.2 Networking Models: OSI Model, TCP/IP Model, IEEE Standards, Protocols
 - 27.5.3 Switching: Circuit Switching, Packet Switching, Message Switching, PSTN, ISDN, DSL
 - 27.5.4 Ethernet: Introduction, Fast Ethernet, Gigabit
 - 27.5.5 Network Security: Introduction, VPN, Firewall
 - 27.5.6 Algorithms: Dijkstra's Algorithm, Bellman Ford Algorithm
 - 27.5.7 Network Design Lab: Bus, Hub, Switch