NATIONAL INFOTECH

BROCHURE **2020**

I –Digital Controller and Add-On Cards
(Microcontroller and Project Lab)

NITech has developed a range of digital controllers and add-on cards to provide student a complete platform to launch their career in embedded systems and power electronics. At entry level, basic and enhanced 8051 microcontroller kits are available. At intermediate level, a lightning fast Silicon Labs 8051 board NIKIT-SI-51 (speed 100 MIPS) is developed. For 32-bit platform at advanced level, we have one of the most promising architecture namely ARM CORTEX M4. This will enable many imaginative experiments with modelling and testing. A range of Power Electronics cards and sensor cards are developed for rapid development of the prototype.

This equipment's can support Basic microcontroller, Advance Microcontroller and Project Lab.

NIC01
8051 Microcontroller Kit with Peripheral Cards

8051 microcontroller kit with peripheral cards consist of NI-KIT-51, 8-bit parallel ADC/DAC card, I2C Card, RTC, EEPROM, Relay Card and matrix keypad.

NIC02
AVR ATMega32 Microcontroller Kit

NI ATMEGA32 is a development kit with AVR microcontroller. AVR controller has up to 32KB flash size and 2KB of internal RAM. All I/O ports of the controller are available on the expansion bus thereby increasing the options for interfacing other devices.

NIC03
SI Labs Advanced 8051 Microcontroller

NI ADV-51 is an advanced Microcontroller Kit developed using Silicon Laboratory's 8051F120 Target Board. All I/O Pins are buffered, keyboard, LCD, DI, DO, AI, AO, LED, Serial Comm., On-chip MAC unit, On-chip 12-bit 8-channel ADC, On-chip 10-bit DAC.

NIC04
ARM Cortex M4 32-bit Microcontroller

NI CM4-ARM is a trainer kit which is based on STM32F407VGT6 device; a member of CORTEX M4 based 32-bit microcontroller family. STM32F407VGT6 is a Flash memory based controller having hardware debugging facility with In-System programming capability, eliminating the need for Universal Programmer to load programs in the controller's memory.

NIC05
8051 Microcontroller Card
## (Loose Card for Student Project Work)

8051 Microcontroller @ 18.432 MHz, Flash Memory, Buffered port pins with indication LEDs, 6 clock mode, and 16x2 LCD Display, 5 keys, RS-232 communication support for ISP. Necessary IDE and ISP utility.

NIAC01
SPI based 12-bit ADC-DAC Card

SPI Based ADC-DAC module is equipped with 13-bit SAR ADC and 12-bit DAC ICs, developed for fast data acquisition applications. The MCP3302 is 13-Bit 4 single ended/2 Differential channel Low Power A/D Converter with High Speed SPI Serial Interface. The module has MCP 4822 12-Bit DAC with Internal Voltage reference and High Speed Serial Peripheral Interface. Data are transferred serially via the 3–wire bidirectional SPI bus.

NIAC02
Stepper Motor Driver Card with Motor
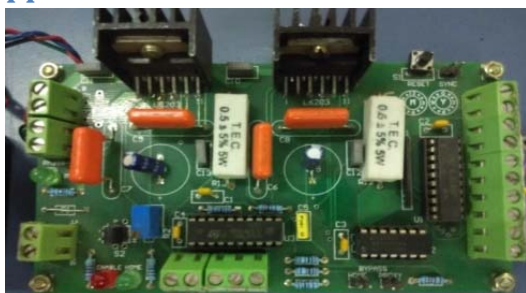
NI SMD card is an industrial grade stepper motor drive which generates four phase drive signals for two phases bipolar and four phase unipolar step motors. The motor can be driven in half step, normal and wave drive modes and on-chip PWM chopper circuits permit switch-mode control of the current in the windings.

NIAC03
Single Phase Thyristor Power and Driver Card

Thyristor Firing Card basically consists of Zero Crossing Detection Circuit and pulse transformer-based Thyristor gate circuit drive. Output of ZCD circuit is given to Microcontroller as input (on Interrupt pin).

Microcontroller will generate two pulses which are given to Thyristor firing card as input to trigger four Thyristors. One pulse is used for firing two Thyristors during +Ve cycle and another pulse for firing two Thyristors during -Ve cycles.

NIAC04
Three Phase Thyristor Power and Driver Card

Three Phase Thyristor Firing Card basically consists of three Zero Crossing Detection Circuit and six pulse transformer based Thyristor gate circuit drive. Three Phase Thyristor Firing Card have two control as Analog control and Digital control.

NIAC05
IGBT/MOSFET Driver Card without Protection
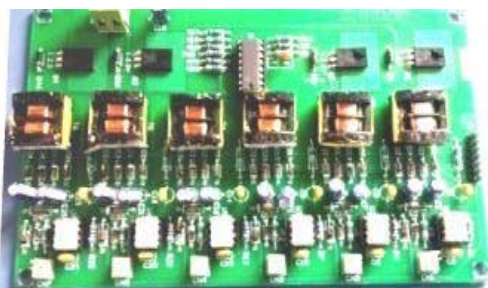
8051 microcontroller kit with peripheral cards consist of NI-KIT-51, 8-bit parallel ADC/DAC card, I2C Card, RTC, EEPROM, Relay Card and matrix keypad.

NIAC06
Three Phase H-Bridge Inverter Card

Three Phase H-Bridge Card is a ready to use hardware with six IGBTs connected in bridge configuration. Six gate pulses generated with microcontroller can be interfaced with this card. This Card can be used for designing applications like ac induction motor drive, BLDC drive or as a standalone three phase inverter. This module is designed with optical isolation between the controller card and the inverter bridge to be used for projects in power-electronics.

NIAC07
Three Phase IGBT Driver and Power Card with Protection

Driver card provides six optically isolated gate pulses. Six gate pulses generated by logic circuit or microcontroller is connected at input and converted into six isolated gate pulses. Bipolar output gate pulses (+16/-8 V) are generated. Six isolated power supply required for driver ICs are provided on driver card. IGBT Power module with inverter capacity of 600V, 10A can be implemented with this driver and power module.

NIAC08
Three Phase SiC MOSFET Inverter with Protection

Driver card provides six optically isolated gate pulses for SiC MOSFETs. Six gate pulses generated by logic circuit or microcontroller is connected at input and converted into six isolated gate pulses. Bipolar output gate pulses (+16V/-4V) are generated. Six isolated power supply required for driver ICs are provided on driver card. Suitable for 600V, 08 A VSI applications 900V, 15 A SiC MOSFETs as switch.

NIAC09
Single Phase IGBT Half-Bridge Driver and Power Card with Protection

Two IGBT driver and power card for half-bridge inverter or DC-DC converter applications. It is suitable for 600 V, 10 A IGBT based applications.

Driver has 2 A rail-to-rail output. Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse). Output pulses: Isolated +16V/-8V. Shoot through, short circuit

protection with DESAT-detection. On board hardware dead-time generator circuit. Power supply board for driver card. On board test points are provided for signals troubleshooting. Many cards can be stack together to form higher leg inverter arrangement.

NIAC10
Single Phase SiC MOSFET Half-Bridge Driver and Power Card with Protection

Two SiC MOSFET driver and power card for half-bridge inverter or DC-DC converter applications. It is suitable for 600 V, 08 A SiC MOSFET based applications.

Driver has 2 A rail-to-rail output. Input pulses: CMOS 0-5 V or 0-3.3 V (Active high pulse). Output pulses: Isolated +16V/-8 V. Shoot through, short circuit protection with DESAT-detection. On board hardware dead-time generator circuit. Power supply board for driver card. On board test points are provided for signals troubleshooting. Many cards can be stack together to form higher leg inverter arrangement. Suitable for 600V, 08 A VSI applications. 900 V, 15 A SiC MOSFETs as switch.

NIAC11
Bidirectional DC-DC Boost Converter

Bidirectional DC-DC Converter for integrating two DC sources. Buck, Boost and Buck-Boost operation possible.
1 kVA Bidirectional Buck-Boost converter
Converter Specification:
- ➢ Input voltage 100 V – 130 V,
- ➢ Output voltage - 250 V,
- ➢ Power – 1 kW
- ➢ Switching Frequency – 50 kHz

NIAC12
16 Channels ADC-DAC card
The SPI Based ADC/DAC card is compatible with all microcontroller, DSP and FPGAs. It contains a Taxes instruments ADS7953, 12-Bit, 16-Channel, 1MHz ADC. It can be configured to measure 16 single-ended AC/DC analog signals. Also, it contains 12-Bit, 4-Channel DAC. A SPI interface allows fast communication to the ADC/DAC.

NISC01
Single Phase Hall-effect Voltage and Current Sensor Card (V3)

Single Phase Sensor card is developed to sense 01 AC/DC Voltage, 01 AC/DC Current Signals. It is possible to add offset voltage for interfacing sensed signal with unipolar ADC, amplitude calibration is also possible. More than Two Single Phase Sensor cards can be cascaded with each other.

NISC02
Three Phase Three Wire Sensor Card (V1)

It senses 03 AC Voltage, 03 AC Current Signals. Also, 01 DC Current and 01 DC Voltage measurement is possible. It is possible to add offset voltage for interfacing sensed signal with unipolar ADC, Amplitude calibration is also possible. Quadrature Encoder Interface section is provided. Hall Sensor or Encoder Interfacing for Three channels to connect either three lines of hall sensor or A-B-Z pulses of encoder is provided.

NISC03
Three Phase Four Wire Sensor Card (V2)

Sensor card V2 is Modified Version of Sensor Card V1 with extra features such as Neutral Current sensing,

Zero Current detection and Over Current Protection Circuit. It senses 04 AC voltage and 04 AC current signals, with Offset addition and Amplitude control port. 01 DC Current and 01 DC Voltage measurement is also possible. Zero crossing detection is also provided. Hall Sensor or Encoder Interfacing to connect either three lines of hall sensor or A-B-Z pulses of encoder is provided.
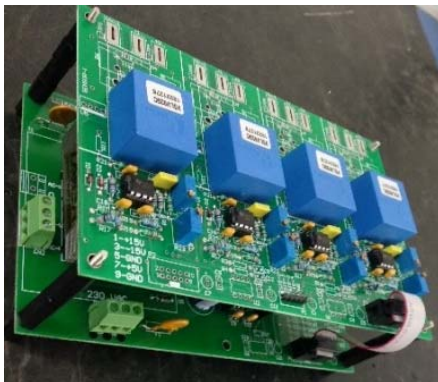
NISC04
04 Channel Hall Current Sensor Card with Power Supply

Four channel sensor card for measuring four AC/DC currents. Hall effect current sensors are used. Outputs are scaled to 0-3.3 V to directly connect ADC of microcontroller. Auxiliary power supply and required connectors for power connections are provided.

NISC05
04 Channel Hall Voltage Sensor Card with Power Supply

Four channel sensor card for measuring four AC/DC voltages. Hall effect voltage sensors are used. Outputs are scaled to 0-3.3V to directly connect ADC of microcontroller. Auxiliary power supply and required connectors for power connections are provided.

NIHPM01
High Power Three Phase Rectifier and IGBT Inverter Module with Protection
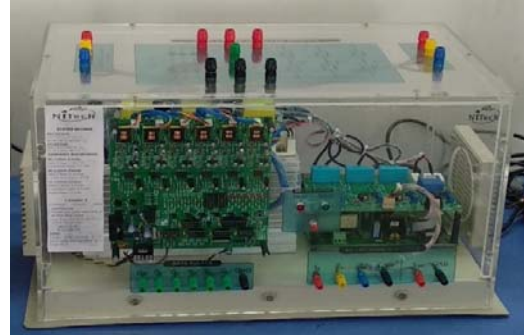
High Power IGBT Inverter Module is developed with Protection and Sensing circuit. High Power Inverter Module is intended to quickly implement a digitally controlled; six switch DC/AC inverter, supporting both solar and renewable energy types of applications as well as standalone Sine Inverter designs. It can also be used for power quality improvement solution like reactive power compensations using different topologies.

1200 V, 25 A diode bridge for AC-DC power conversion with Electrolyte DC capacitor, 03 leg 1200 V, 75 A IGBT power module (SKM75GB12T4) with heat sink and snubber, recommended switching frequency of the inverter 20 kHz, Port for connecting 06 gate pulses to drive IGBTs of the inverter circuit, desaturation protection against overload and short-circuit

NIHPM02
High Power Four Leg IGBT Inverter Module with Protection

High-power four-leg inverter module with independent IGBT, driver circuit, sensor circuit and protection circuit.

DC Link Voltage: 600 V, Output: 400 V/10 A, 1200 V, 25 A diode bridge for AC-DC power conversion with Electrolyte DC capacitor, 04 leg 1200 V, 100 A IGBT power module with heat sink, recommended switching frequency of the inverter 20 kHz, Port for connecting 08 gate pulses to drive IGBTs of the inverter circuit, desaturation protection against overload and short-circuit.

NIHPM03
High Power Diode Clamped Multilevel Inverter Module with Protection

10 kVA, three phase three level diode clamped inverter with independent IGBT, driver circuit, sensor circuit and protection circuit.

Power Circuit Input: 0 – 600 V DC, Output: 415 V / 10 A maximum, 03 leg 1200 V, 100 A IGBT power module (SKM75GB12T4) with heat sink and snubber, recommended maximum switching frequency of the inverter 20 kHz.

NIHPM04
SRM 4-Phase IGBT based Inverter Stack with Rectifier

SRM 4-phase inverter with independent IGBT, driver circuit, sensor circuit and protection circuit.

Power Circuit Input: 0 – 300 V DC, Output: 230 V / 10 A maximum, 1200 V, 100 A IGBT power module (SKM75GB12T4) with heat sink and snubber.

NIHPM05
SiC MOSFET based High Power Module with Rectifier

SiC MOSFET based High Power Module with Rectifier, Power Circuit

Input: 0 – 415 V AC, Output: 415 V / 10 A maximum, recommended maximum switching frequency of the inverter 20 kHz.

NIHPM06
SiC MOSFET based 1 kW Bidirectional DC-DC Converter

1 kVA SiC MOSFET based bidirectional DC-DC converter for integrating two DC sources.

Input voltage 100 V – 130 V, Output voltage - 250 V, Power – 1 kW, Switching Frequency – 50 kHz.

ARM-Cortex M4 microcontroller for generating gate pulses. Sensing circuit for sensing and giving

NIHPM07
High Power Thyristor Module

Three Phase Thyristor Power and Driver Card with Sensing circuit and 1200 V, 30 A Thyristor Modules.

II - Power Electronics Lab

Power Electronics is the art of converting electrical energy from one form to another in an efficient, clean, compact, and robust manner for convenient utilization. Power Electronics involves the study of Power semiconductor devices, power converter topologies and control algorithms. **NITech** has manufactured Basic Power Electronics Trainers to give starting platform for learning power conversion concepts. Trainer kit for learning device characteristics, gate/base drive circuit and different power conversion are available. The unique features of these trainers are:

- • Microcontroller based control circuit.
- • Single unit with inbuilt power supply, power circuit, control circuit and loading arrangement.
- • Many power configuration experimentations in one kit.
- • Isolated waveform observations.

NIPEC01
Device Characteristic Trainer

Trainer for studying characteristics of different types of power semiconductor devices like, SCR, TRIAC, DIAC, MOSFET and IGBT.

NIPEC02
Gate/Base Triggering Circuit Trainer

Trainer for studying gate or base drive circuit for SCR and MOSFET. DC, R, R-C, UJT driving circuit for SCR and optically isolated driving circuit for MOSFET is experimented.

NIPEC03
Single Phase Rectifier Trainer

Trainer for studying different configurations of single phase controlled rectifier with R, R-L, R-L-E, R-L-D load.

NIPEC04
Three Phase Rectifier Trainer

Trainer for studying different configurations of three-phase controlled and uncontrolled rectifier

NIPEC05
Chopper Trainer

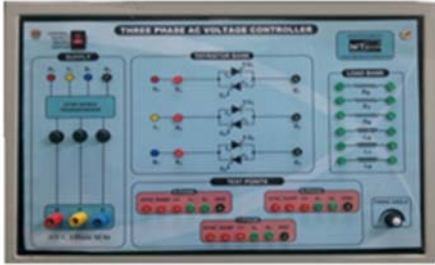Trainer for studying different types of chopper circuits (Type A, B, C, D, E and step-up chopper).

NIPEC06
Single Phase AC Voltage Controller

Trainer for studying different configurations of single-phase AC voltage controller circuits with R, R-L load.

NIPEC07
Three Phase AC Voltage Controller

Trainer for studying different three-phase AC voltage controller configurations. Three wire/ Four wire, Star/ Delta configuration.

NIPEC08
Single Phase Inverter Trainer

Trainer for studying half-bridge and full-bridge single-phase inverter circuits. Triggering scheme like square wave function, square wave sine PWM can be experimented.

NIPEC09
Three Phase Inverter Trainer

Trainer for studying 120 degree, 180 degree, Sine PWM, SVM controlled three-phase inverters. The kit provides platform for various experimentation on three-phase inverters.

NIPEC10
Switched Mode DC-DC Converter

Trainer for studying basic three (buck/boost/buck-boost) topologies of non-isolated switched mode DC-DC conversion.

NIPEC11
Cycloconverter Trainer

Trainer for studying operation of Cycloconverter operation.
Two configurations Bridge and center-tap with f, f/2..............f/10 can be experimented.

NICPEC01
Customised Single and Three Phase Rectifier and AC Voltage Controller

Customised kit to write program, construct power circuit and experiment with different load. The kit includes following three components:
1. ARM Cortex M4 32-bit Microcontroller Kit;
2. Three Phase Thyristor Power & Driver Card; and
3. Step-down source and Load Bank for laboratory experiments

NICPEC02
Customized Chopper and Inverter

Customised kit to write program, construct power circuit and experiment with different load. The kit includes following three components:
1. ARM Cortex M4 32-bit Microcontroller Kit;
2. Three Phase IGBT Power & Driver Card; and
3. Step-down source and Load Bank for laboratory experiments

III–Advanced Power Electronics Lab

Power electronics is the engineering study of converting electrical power from one form to another. World-wide, at an average rate of 12 billion kilowatts of electrical energy is generated in every hour of every day of every year. The power generated is being reprocessed or recycled through some form of power electronic systems. It is expected that this power processing will increase up to 80% in near future. Increased use of Power electronics demanded new power converters which do not pollute the grid. Accordingly many new power converters are developed.

NITech offers a wide range of advance power electronics converter kits for studying new power converters. Kits like multi-pulse converter, PWM rectifier, PFC using boost converter, multi-level inverters are designed. These kits are useful for demonstrating these new concepts to the students.

NIAPE01
Three Phase Diode Clamed Multilevel Inverter

Trainer for studying IGBT based 3 level diode clamped multilevel inverter with popularly used modulation techniques. (i.e. Square wave, SPWM, SVM). Inbuilt DC power supply, isolated driver and power circuit along with R, R-L load bank is provided. Test point to observe gate pulses and isolated current waveform observation is provided.

NIAPE02
Multi Pulse Converter (12 Pulse)

Trainer for studying principle operation of 12-pulse converter. Star-Delta step-down transformer, Uncontrolled and controlled rectifier power configuration is provided. Provision for gate pulse observations and isolated current waveform observation is provided.

NIAPE03
Single Phase Dual Converter

Trainer for studying single-phase dual converter working in circulating and non-circulating current mode of operation. Load bank with R, R-L load bank is provided.

NIAPE04
Isolated DC-DC Converter

Trainer for studying 03 isolated configurations of flyback, forward and push-pull switch mode DC-DC converters. Closed-loop operation with source regulation and load regulation is experimented. Open-loop operation and test point observation is possible.
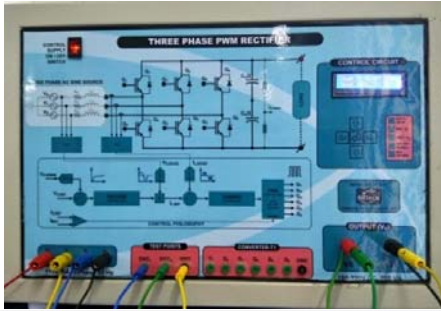
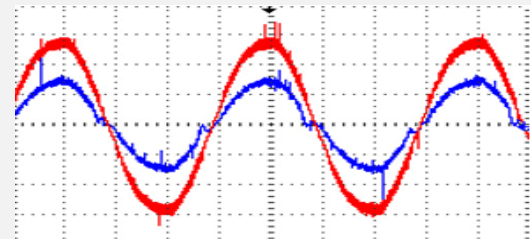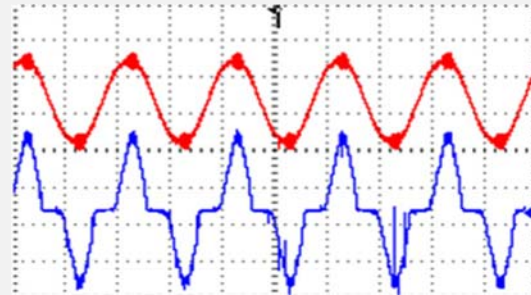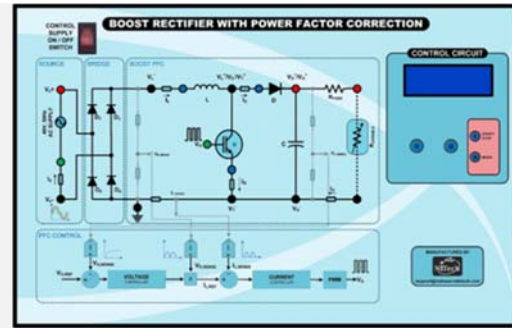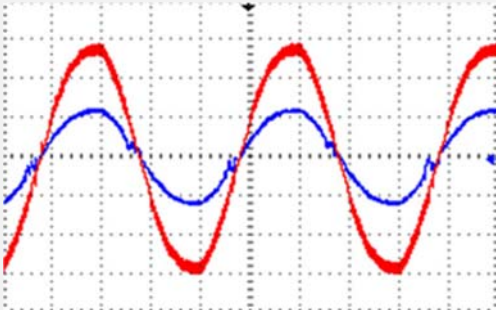## NIAPE05
Isolated DC-DC Bridge Converter

Trainer for studying isolated bridge configurations of switch mode DC-DC converter. Two configurations Half Bridge and Full Bridge is provided. Closed-loop operation with source regulation and load regulation is experimented.

NIAPE06
Three Phase PWM Rectifier

This trainer is for studying Three Phase PWM Rectifier Operation. Experiment setup consists of three-phase PWM rectifier, 32-bit Cortex M4 ARM microcontroller based controller for gate pulse generation, and load. Test points for current and voltage waveform observation across different elements are provided.


NIAPE07
Boost Rectifier with Power Factor Correction (PFC)
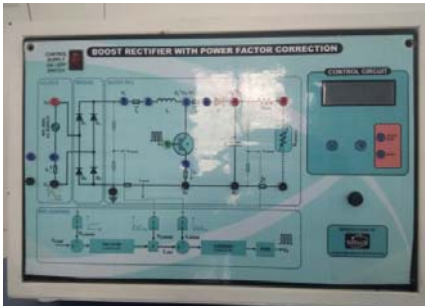
Trainer for studying operation of Boost Rectifier with Power Factor Correction. Experiment setup consists of low voltage boost rectifier with PFC, 32-bit Cortex M4 ARM microcontroller based controller for gate pulse generation, and load. Test points for current and voltage waveform observation across different elements are provided.

NIAPE08
Cascaded Multilevel Inverter
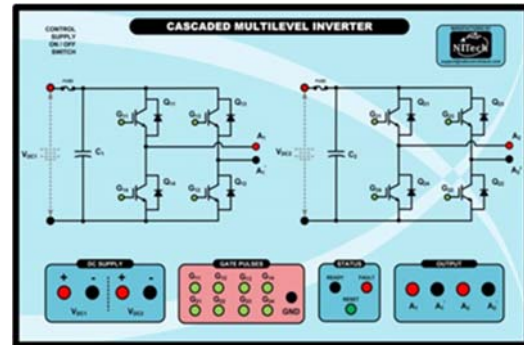
Trainer for studying 5-level cascaded multilevel inverter formed by cascading two H-bridges. The kit includes following three components:
1. ARM Cortex M4 32-bit Microcontroller Kit;
2. Two cascaded H-Bridges with Power & Driver Circuit; and
3. Step-down DC source and R, R-L Load Bank for laboratory experiments.

IV - Electrical Drives Lab

In every industry there are industrial processes where electrical motors are used as a part of process equipment. For many instances the speed, torque or position variable need to be adjusted for the desired optimal operation of the process. With recent advances of power semiconductor and converter topologies, electric variable speed drives are witnessing a revolution. Embedded Controllers are advancing rapidly in features, especially for power Electronics & Drives applications. Most of these controllers are ideal for motor control applications with latest PWM and Control Technique for AC Motor, DC Motor, BLDC Motor, PMSM Motors & Switched Reluctance Motor etc.

NITech offers varies types of Embedded Controllers based Drives for various types of Motors with various types of machines set up for advanced drives laboratory & research purposes.
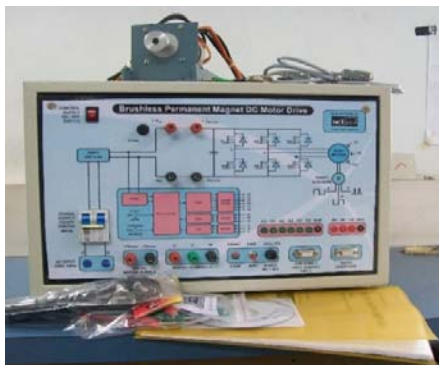
NIED01

Microcontroller based Three Phase Induction Motor Drive
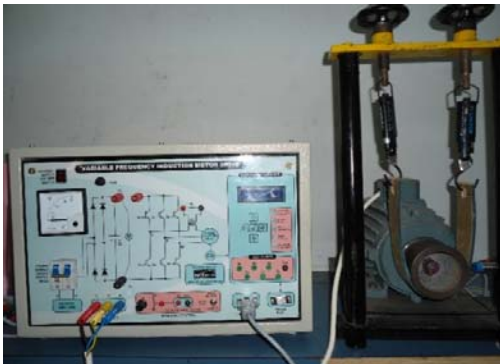
Trainer for studying Sinusoidal Pulse Width Modulated (SPWM) as well as Space Vector Modulated (SVM) inverter fed variable frequency drive operation.

NIED02

Microcontroller based Brushless DC (BLDC) Motor Drive

Trainer for studying Brushless DC (BLDC) drive operation and control.

NIED03

Microcontroller based Permanent Magnet Synchronous (PMSM) Drive

Trainer designed for studying sensored and sensor-less control of Permanent Magnet Synchronous Motor (PMSM) drive operation.

NIED04

Microcontroller based Switched Reluctance Motor Drive

Trainer for studying Switched Reluctance Motor (SRM) drive operation. The kit comprises of power module, 0.5 HP, 3000 rpm SRM motor, 500ppr encoder and 32-bit ARM Microcontroller based digital control circuit.

NIED05

Microcontroller based Chopper fed Separately Excited DC (SEDC) Motor Drive

Trainer for studying chopper fed Separately Excited DC (SEDC) motor drive operation. The kit comprise of a 0.5HP, 180V, 1500RPM SEDC motor, control module consist of IGBT H-Bridge, proximity sensor as speed sensor and microcontroller based digital control circuit.

NIED06

Microcontroller based Control Rectifier fed Separately Excited DC (SEDC) Motor Drive

Trainer for studying controlled rectifier fed Separately Excited DC (SEDC) motor drive operation.

NIED07

Microcontroller based Dual Converter fed Separately Excited DC (SEDC) Motor Drive

Trainer for studying Dual Converter fed Separately Excited DC (SEDC) motor drive operation.

NIED08

Microcontroller based Chopper fed Permanent Magnet DC (PMDC) Motor Drive

Trainer for studying chopper-fed permanent magnet DC (PMDC) motor drive operation.

NIED09

Microcontroller based Controlled Rectifier fed Permanent Magnet DC (PMDC) Motor Drive

Trainer for studying Controlled Rectifier fed permanent magnet DC (PMDC) motor drive operation.

NIED10

Microcontroller based Dual Converter fed Permanent Magnet DC (PMDC) Motor Drive

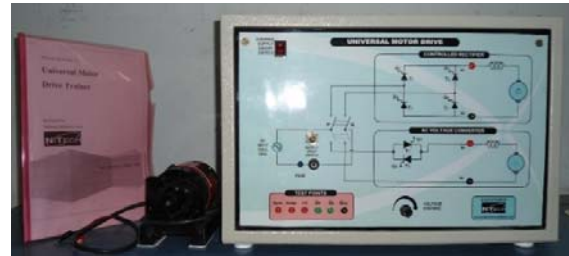Trainer for studying Dual Converter fed permanent magnet DC (PMDC) motor drive operation.

NIED11

Microcontroller based Single Phase Induction Motor Drive

Trainer for studying Sinusoidal Pulse Width Modulated (SPWM) inverter fed variable frequency Single phase Induction motor drive operation.
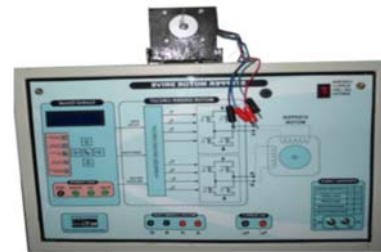
NIED12

Microcontroller based Universal Motor Drive

Trainer for studying Universal motor drive operation.

NIED13

Microcontroller based Stepper Motor Drive

Trainer for studying different modes of controlling stepper motor. Half step, Full step, micro stepping (Quarter step / Sixteen step) mode.

NIED14

Multi-level Inverter based Three Phase Induction Motor Drive

Trainer for studying three phase diode clamed multi-level inverter based, Sinusoidal Pulse Width Modulated (SPWM) as well as Space Vector Modulated (SVM) inverter fed variable frequency drive operation.

NIED15

Servo Motor Trainer

Trainer for studying 400W servo motor control with servo drive. Different way of controlling servo motor is experimented.

NIED16

Three Phase AC Voltage Controller with Induction Motor

Trainer for studying stator voltage control of induction motor drive with AC Voltage Controller.

V–Advanced Electrical Drives Lab

For advanced research purpose, this category of dives provided three components:

(i)   ARM Cortex M-4 Microcontroller;
(ii)   Power Converter Unit; and
(iii)   Motor setup with speed sensors.

All drives are provided with source code develop in MATLAB environment for all basic control schemes.

NIAD01

Performance Investigation of Scalar, Vector and DTC Control of Three-Phase Induction Motor Drive

Unique Features: - Complete advanced learning platform, - Self-written program, - Model based program, - MATLAB/C language coding support, - Rapid development of new control algorithm

Control Methods: - Scalar Control (Open & Closed Loop), - Vector Control, - Direct Torque Control
Controller: ARM Cortex M4 32 bit Microcontrollers

Drives Consist of: - Three phase sq. cage induction motor with mechanical loading, - Digital controller based on STM32F407VG uC, - High power rectifier, DC link capacitor, inverter, - Sensing circuits for AC/DC current, DC voltage and speed

NIAD02

Speed Control of 5 Phase Induction Motor using ARM Cortex 32-bit Microcontroller

Basic algorithm of Scalar Control (Open & Closed Loop)
Controller: ARM Cortex M4 32 bit Microcontrollers
Drives Consist of: - Five phase sq. cage induction motor with mechanical loading, - Digital controller based on STM32F407VG uC, - High power rectifier, DC link capacitor, inverter, - Sensing circuits for AC/DC current, DC voltage and speed

NIAD03

Performance Investigation of Digitally Controlled BLDC Motor Drive

Complete development platform for digitally controlled open and closed loop BLDC Motor Drive

Drives Consist of: - 0.5 HP BLDC motor with mechanical loading, - Digital controller based on STM32F407VG uC, - High power rectifier, DC link capacitor, inverter, - Sensing circuits for AC/DC current, DC voltage and speed

NIAD04
Performance Investigation of Digitally Controlled PMSM Vector Control Drive

Complete development platform for digitally controlled PMSM Drive. Sensored and sensorless vector control is experimented.

Drives Consist of: - 1 HP PMSM with mechanical loading, - Digital controller based on STM32F407VG uC, - High power rectifier, DC link capacitor, inverter, - Sensing circuits for AC/DC current, DC voltage and speed.

NIAD05
Performance Investigation of Digitally Controlled Chopper Fed DC Motor Drive

Digitally controlled Four-Quadrant Chopper fed DC Motor Drive. Open loop and closed loop control.

Control: - Forward and reverse motoring operation with first and third quadrant chopper operation, Open Loop and Closed Loop Control

Drives Consist of: - 1.5 HP, 220V, 1500 rpm, DC Shunt Motor with spring balance load arrangement for loading, - Essential speed and other sensors as per control and feedback requirement, - Digital controller based on STM32F407VG uC, - High power rectifier, DC link capacitor, inverter, - Sensing circuits for AC/DC current, DC voltage and speed.

NIAD06
Performance Investigation of Digitally Controlled DC Motor Drive using 1-Phase Dual Converters with analysis of Circulating and Non Circulating Modes

Digitally controlled DC Motor Drive using 1-Phase Dual Converters with analysis of Circulating and Non Circulating Modes

Control Methods: - Circulating Current Mode of Operation, - Non-Circulating Current Mode of Operation, - Open Loop and Closed Loop Control

Drives Consist of: - 1.5 HP, 220V, 1500 rpm, DC Shunt Motor with spring balance load arrangement for loading, - Essential speed and other sensors as per control and feedback requirement, - Digital controller based on STM32F407VG uC, - High power Thyristor bridge with Inductor, - Sensing circuits for DC current, DC voltage and speed.

NIAD07
Performance Investigation of Digitally Controlled Single Phase Controlled Rectifier Fed DC Motor Drive

Digitally controlled DC Motor Drive using Single Phase Controlled Rectifier fed DC Motor Drive.

Drives Consist of: - 1.5 HP, 220V, 1500 rpm, DC Shunt Motor with spring balance load arrangement for loading, - Essential speed and other sensors as per control and feedback requirement, - Digital controller based on STM32F407VG uC, - High power thyristor bridge with Inductor, - Sensing circuits for DC current, DC voltage and speed

Control Methods: Open Loop and Closed Loop Control

NIAD08
Performance Investigation of Digitally Controlled Switched Reluctance Motor

Digitally controlled Switched Reluctance Motor Drive. Unique Features: - Complete advanced learning platform, - Self-written program, - Model based program, - MATLAB/C language coding support, - Rapid development of new control algorithm

Drives Consist of: - 1 HP, 3000 rpm, 8/6 Switched Reluctance Motor with spring balance load arrangement for loading, - Essential speed and other sensors as per control and feedback requirement, - Digital controller based on STM32F407VG uC, - High power IGBT power module, - Sensing circuits for DC current, DC voltage and speed.

VI –Renewable Energy Lab

Power electronics are extensively used in controlling renewable energy sources. NITech has designed trainers for maximum power point tracking and interfacing generated power in grid or storing in battery.

NIRE01
40 Wp MPPT Boost Converter for Solar PV
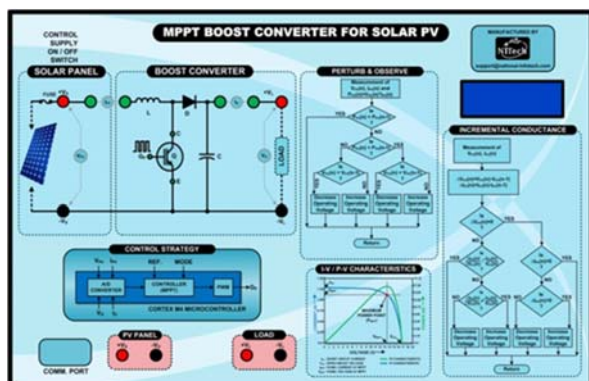
Trainer for studying MPPT boost converter for solar PV module. Boost converter operation in open-loop/ closed-loop. Plotting PV characteristics, MPPT methods can be experimented.

➢ Boost Converter operation in open loop and close loop mode is experimented.
➢ Real time P-V and I-V curve can be captured and can be analyzed.
➢ Two MPPT algorithms: (i) Perturb & Observe; and (ii) Incremental Conductance are experimented.
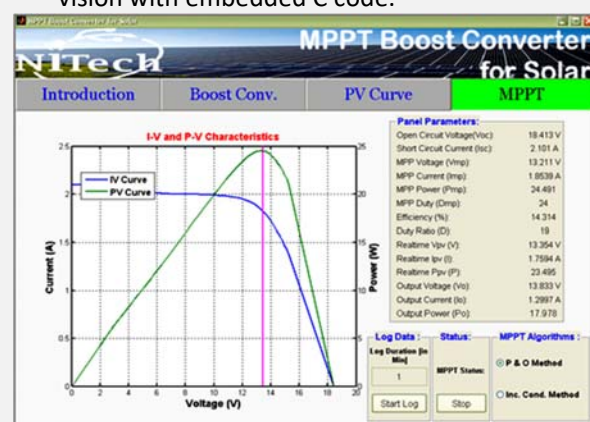
NIRE02
450 Wp MPPT Boost Converter for Solar PV

Trainer for studying MPPT boost converter for solar PV module. 450 W Boost Converter for MPPT.

➢ Boost Converter: 450 W, input 96-120V, output 200-250 V, Switching frequency 40 kHz
➢ MATLAB based serial utility is provided for user interface with the Bench for following purpose
➢ Two MPPT algorithms: (i) Perturb & Observe; and (ii) Incremental Conductance are experimented.
➢ Control algorithms are developed using ARM Cortex M4 series 32-bit Microcontroller from ST Microelectronics under KEIL IDE from micro vision with embedded C code.

NIRE03
900 Wp MPPT Boost Converter for Solar PV

Trainer for studying MPPT boost converter for solar PV module. 900W Boost Converter for MPPT

➢ Boost Converter: 900 W, input 96-140 V, output 200-250 V, Switching frequency 40 kHz.
➢ Solar Panel: 900 Wp: Three numbers of 330 Wp panels connected in series.
➢ Boost Converter operation in open loop and close loop mode is experimented.
➢ Control algorithms are developed using ARM Cortex M4 series 32-bit Microcontroller from ST Microelectronics under KEIL IDE from micro vision with embedded C code.
➢ All measured quantities are accessible by user

NIRE04

450 Wp Two-Stage Solar PV Single Phase Grid Inverter (Boost Converter & Inverter)

450 W single phase grid Synchronised Inverter.

➢ Specifications: AC output voltage: 230 ± 5% V, Single Phase, 50 Hz ± 5 Hz.
➢ Control algorithm development based on instantaneous power theory; and operation of grid synchronised inverter is studied.
➢ PLL development for grid synchronization is studied.

NIRE05

900 Wp Two-Stage Solar PV Single Phase Grid Inverter (Boost Converter & Inverter)

900 W Single phase grid synchronized inverter trainer for studying PV fed solar inverted and for studying intermediate control algorithm development.

➢ 900 Wp solar panels (Three numbers of 330 Wp panels connected in series)

NIRE06

900 Wp Two –Stage Solar PV Three Phase Grid Inverter (Boost Converter & Inverter)

900 W Three phase grid synchronized inverter trainer for studying PV fed solar inverted and for studying intermediate control algorithm development.

NIRE07

900 Wp Single-Stage Solar PV Single Phase Grid Inverter

900W Single Stage Single phase grid synchronized inverter trainer for studying PV fed solar inverter.

➢ 900 Wp solar panels (six numbers of 150 Wp panels connected in series)
➢ NITech STM32F4-WJ Micro-Controller Board.
➢ IGBT based single phase inverter with necessary driver and protection circuit.
➢ Sensing circuit for AC voltage and AC current sensing.
➢ Sensing circuit for DC voltage sensing

NIRE08

900 Wp Single-Stage Solar PV Three Phase Grid Inverter

900W Single Stage Three phase grid synchronized inverter trainer for studying PV fed solar inverted and for studying intermediate control algorithm development.

NIRE09

PMSG based Wind Energy Conversion System

The components of the PMSG based wind energy conversion system are:

➢ DC shunt motor with PMSG as wind source
➢ Controlled rectifier for DC armature control and rheostat for field control
➢ ARM-cortex M4 microcontroller as controller

NIRE10

DFIG based Wind Energy Conversion System

This Module consists of following components:

➢ ARM-cortex M4 microcontroller as Controller
➢ DC Drive and Three phase IGBT power module
➢ DC shunt motor coupled with Slip Ring Induction Motor and additional components

NIRE11

BLDC Machine based Hydro Power System

The components of BLDC machine Hydro energy conversion system are:

➢ DC shunt motor coupled with BLDC Machine
➢ Controlled rectifier for DC armature control and rheostat for field control.
➢ Inverter for BLDC Motor Control

NIRE12

Grid Synchronised Inverter for Integrating Three Energy Sources

The distinct features of the grid synchronised inverter for integrating three different energy sources. DC link voltage: 250 V. Three ports at DC link for connecting different energy source outputs with indicator and sensing circuit to measure input power

NIRE13

Bidirectional Converter for Integrating Battery Energy Storage System

Intelligent Power Module for DC-DC convertor having

Output Power: 1 kW Maximum, Input Voltage: 100-200V, Output Voltage: 300V, Current: 5-10A, Switching Frequency: 50 kHz, Voltage Ripple 5 %, Current Ripple 5%.

VII - Advanced Power System Lab

The use of power electronics in power system control and power quality improvements has increased extensively.

NITech offers a wide range of advance power electronics converter kits for studying application of power electronics in power system. Kits for static var control (SVC), HVDC, STATCOM, DVR and harmonic elimination are also designed.
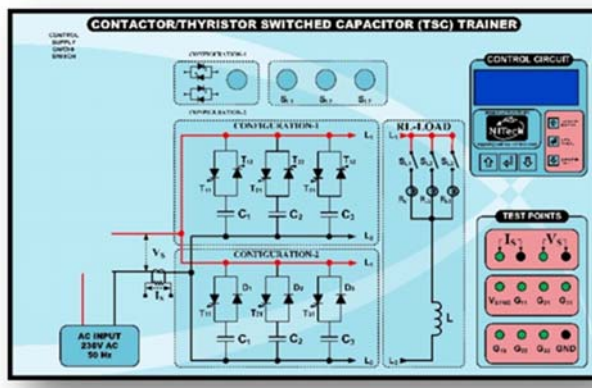
NIAPS01
Single Phase Thyristor Controlled Reactor
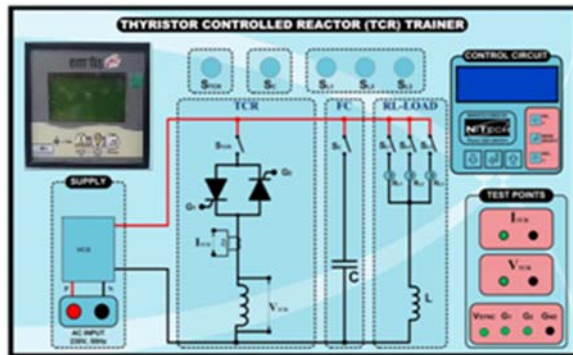
Trainer for studying working principle of single phase Fixed Capacitor Thyristor Controlled Reactor (FC-TCR). It provides inbuilt reactive load arrangement and fixed capacitor firing circuit, loading and power circuit with proper isolation.

NIAPS02
Single Phase Thyristor Switched Capacitor

Trainer for studying working principle of single phase Thyristor Switched Capacitor (TSC). Trainer provides load panel with reactive load arrangement and fixed capacitor banks.
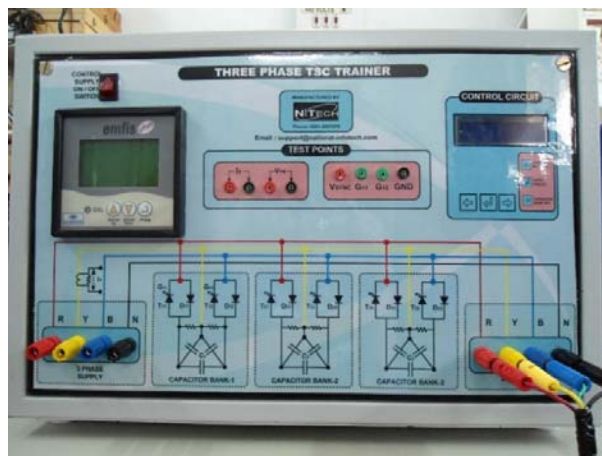
NIAPS03
Three Phase Thyristor Controlled Reactor

Trainer for studying three-phase Thyristor Controlled Reactor working with fixed capacitor (FC-TCR). Reactive load bank with fixed capacitor and Thyristor Controlled Reactor is provided.
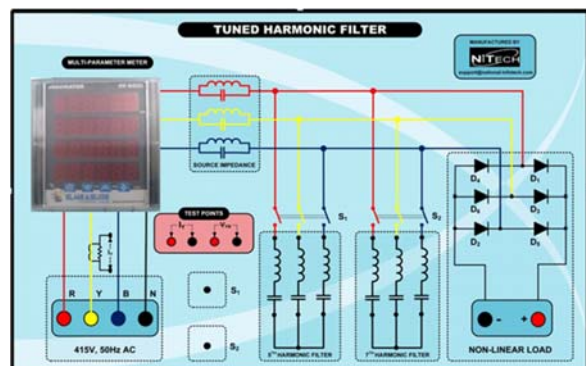
NIAPS04
Three Phase Thyristor Switched Capacitor

Trainer for studying three-phase Thyristor Switched Capacitor (TSC) operation. 3 banks of Thyristor switched capacitor with matching reactive load, AC switch (Thyristor-diode) for connecting and disconnecting capacitor banks.

## NIAPS05
Tuned Harmonic Passive Filter

Trainer for studying tuned harmonic shunt passive power filter operation. Non-linear load along with bank of 5th and 7th harmonic is provided.

Multi-parameter meter for observing supply current THD in different conditions is provided. 01 CT and 01 PT is provided for isolated current and voltage waveform observations.
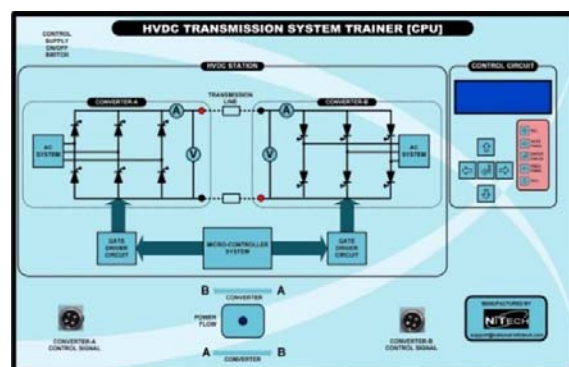
NIAPS06
Dynamic Voltage Regulator (DVR)
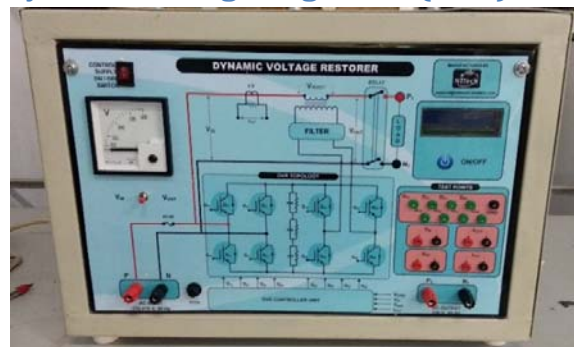
Trainer for studying static voltage regulation using dynamic voltage regulator (DVR). Power configuration of single phase voltage source inverter to inject voltage in series. Isolated observation of injected voltage, load voltage and load current waveform impossible.
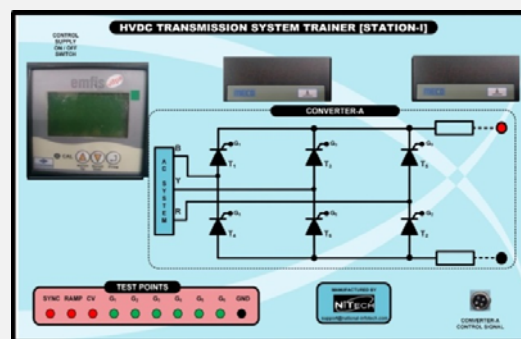
NIAPS07
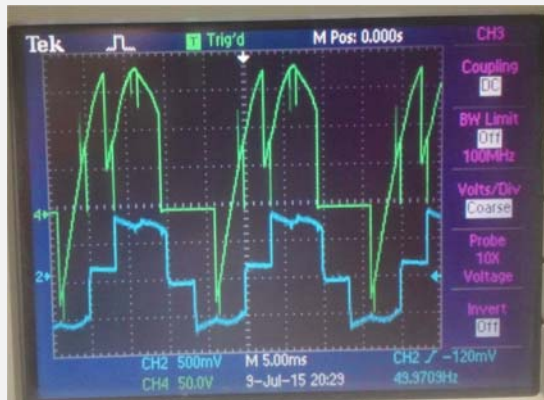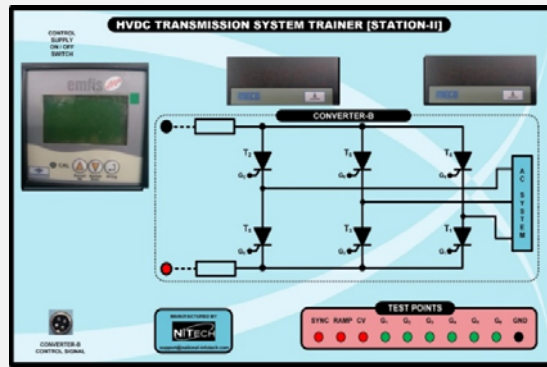### HVDC Trainer with 6 Pulse Converter

Trainer to demonstrate principle of operation of HVDC transmission system. The experiment setup consists of converter station and inverter stations, made using six-pulse converters for making bipolar configuration of HVDC. Bidirectional control of power can be experimented

Converter Station:

Inverter Station:

NIAPS08

Instantaneous VAR Compensator (STATCOM)

Trainer for studying instantaneous VAR compensator (STATCOM). Variable reactive power compensation with STATCOM. [Instantaneous power theory based algorithm along with provision to see intermediate variable is provided.

- ➢ 110 V, 50 Hz, Three phase supply,
- ➢ 500 VAR reactive load (leading and legging),
- ➢ 1 kVA three phase STATCOM IGBT based power converter for compensation
- ➢ Multi-parameter for measuring supply voltage, current and other parameters.

NIAPS09

Shunt Active Power Filter (SAPF)

Trainer for studying shunt active power filter (SAPF). Non-linear load compensation using shunt active power filter. Instantaneous power theory based algorithm along with provision to see intermediate variable is provided.

- ➢ 110V, 50 Hz, Three phase supply
- ➢ 500 VA harmonic producing load,
- ➢ 1 kVA three phase IGBT based power converter for compensation
- ➢ Multi-parameter for measuring supply voltage, current and other parameters.

NIAPS10

VSC based FACTS Controller (STATCOM, SSSC and UPFC) with Transmission Line and Different Loading

VSC-based FACTS controllers having -
- ➢ System voltage 120V, 50 Hz, three-phase provided through 415:120 V three-phase transformer
- ➢ Transmission line with three PI sections
- ➢ Four stage Three load banks (i) R load; (ii) R-L load and (iii) R-C load are provided for experimenting their effect on transmission line.
- ➢ Maximum loading is up to 1 kVA.
- ➢ Three multi parameter energy meters are at sending end, receiving end and load end.
- ➢ FACTS controller with shunt compensator (STATCOM), series compensator (SSSC) and shunt-series compensation (UPFC operation) is provided.

VIII –Sensor Trainers

Microcontroller based sensor trainers manufactured by NITech are as following.

NISE01
RTD Trainer

Trainer kit is for study of 2 wire and 3 wire RTD temperature sensor. The Trainer kit includes two modes of RTD experimentation.

NISE02
Thermocouple Trainer

Trainer kit is for study of Thermocouple as temperature sensor. Two modes of Thermocouple experimentation. (1) thermocouple using cold junction compensation; and (2) thermocouple without cold junction compensation. Instrumentation amplifier (INA121) is used for signal conditioning and amplifying. LM35 IC is used to measure the temperature of cold junction. 32 Bit microcontroller based card is used for sensing, processing and display of temperature.

NISE03
Thermistor and LM 35 Trainer

Trainer kit for study thermistor and LM 35 temperature sensors. Trainer kit includes analogue buffer circuit for Thermistor and LM 35 output signals.

NISE04
Capacitive Type Pressure Transducer

Pressure control trainer is designed for experimentation on pressure measurement. Signal from pressure transmitter (capacitive type) is transmitted as 4-20 mA signal. The signal is converted to equivalent voltage signal for measurement and display with the help of 32 Bit microcontroller card.

NISE05
Instrumentation Amplifier, Isolation Amplifier, V to I converter Trainer

Trainer kit for study of (1) Instrumentation Amplifier (INA121), (2) Isolation Amplifier (ISO124), and (3) V to I converter.

NISE06
Strain Gauge / Load Cell Trainer

Trainer kit is for study of strain measurement using load cell. The load cell is excited with 12 V dc. Unbalanced voltage of load cell Bridge is amplified with using instrumentation amplifier (INA121).

NISE07
Proximity Sensors Trainer

Trainer kit is for study of speed sensing using inductive, capacitive and magnetic proximity sensors.

IX - Automation and Automation Trainer

Industrial Automation has spread everywhere. The skill in this field has become pre-requisite for the students of Electrical /Electronics /Instrumentation discipline to fetch a good job.

NITech offers varies types of Automation and Instrumentation Trainers for teaching Instrumentation, Automation, PLC, HMI, SCADA and VFD concepts to students. With these trainers, it is possible to experiment basic to advance level concept of Instrumentation and Automation Process.

[I] Basic PLC Trainer

Basic PLC Trainer with one of following make and programming software having:

- All Digital Inputs with on panel toggle switch with external/internal signal selection
- All Digital Outputs with on panel LED indicator and potential free relay contacts
- All analog inputs with on panel potentiometer / external signal handling capability
- All analog outputs on panel connectors

NI-BPT-SI
Basic PLC Trainer - Siemens

NI-BPT-SC
Basic PLC Trainer - Schneider

NI-BPT-DE
Basic PLC Trainer - Delta

[II] Advanced PLC Trainer

Advanced PLC Trainer with PLC, HMI, and Programming Software. One of following make can be considered.

NI-APT-SI
Advance PLC Trainer - Siemens

NI-APT-SC
Advance PLC Trainer – Schneider

NI-APT-DE
Advance PLC Trainer - Delta

[III] SCADA Software

NI-SC-WI
SCADA- Wonderware Intouch

Wonderware InTouch software is an open and extensible Supervisory HMI and SCADA solution that enables you to quickly create standardized, reusable visualization applications.

NI-SC-CI
SCADA- Citect

SCADA software VIJEO Citect LITEis the operating and monitoring component with its powerful display capabilities and its operational features.

[IV] VFD Trainer

Professional VFD Trainer having VFD drive of one of following make with Induction Motor and DC Generator having encoder speed sensor.

NI-VT-SC
VFD Trainer - Schneider

NI-VT-YA
VFD Trainer - Yaskawa

NI-VT-DE
VFD Trainer - Delta

[V] Servo Motor Trainer
NI-SD-DE
Servo Motor Drive - Delta

NI-SD-SC
Servo Motor Drive - Schneider

[VI] Instrumentation Trainer
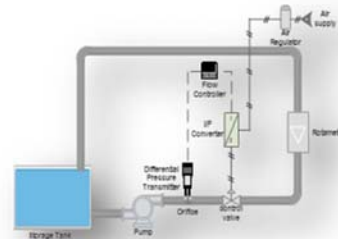### NI-LCT
Level Control Trainer
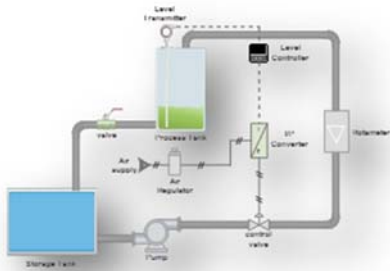
A level control trainer is designed for student's demonstration on level measurement as well as to provide them with hands on experience on how a level loop can be controlled using microprocessor based controller.
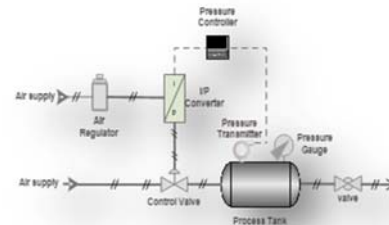
NI-FCT
Flow control Trainer

A flow control trainer is designed for student's demonstration on flow measurement as well as to provide them with hands on experience on how a level loop can be controlled using microprocessor based controller
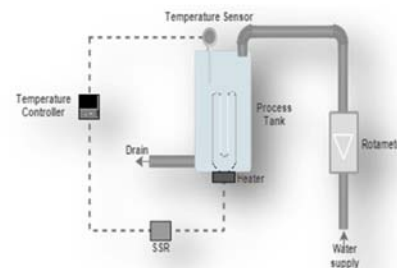
NI-PCT
Pressure control Trainer

A Pressure control trainer is designed for student's demonstration on pressure measurement as well as to provide them with hands on experience on how a pressure loop can be controlled using microprocessor based controller.

NI-TCT
Temperature control Trainer

A Temperature control trainer is designed for student's demonstration on Temperature measurement as well as to provide them with hands on experience on how a temperature loop can be controlled using microprocessor based controller.

Advantages of working with NITech

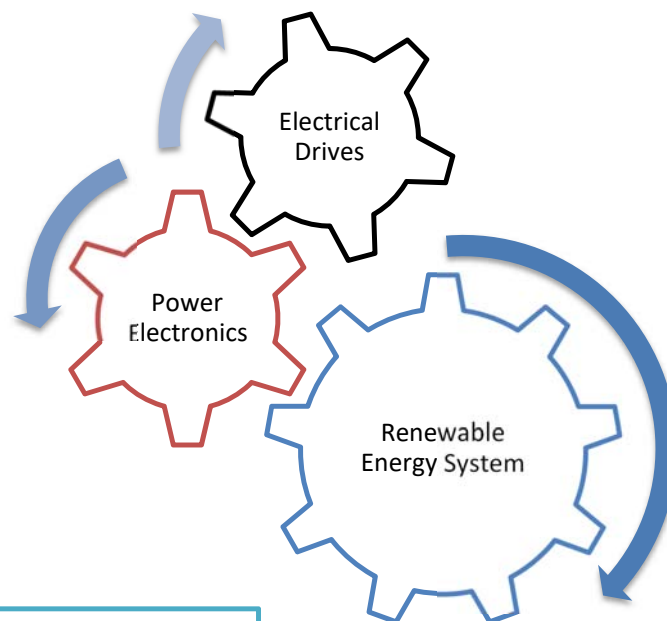Best match with the theoretical concepts.

Highly customized solutions for different requirements

Best after sales remote support and on site demonstration

Connected with faculties from NIT & IITs.

Theory - Practice

Electrical Drives

Power Electronics

Renewable Energy System

Authorised Distributor

NITech