Ref. No.: IIIT-A/SP/NIT/612/1145/2020
Date: Nov 24, 2020

NOTICE INVITING TENDER (E-PROCUREMENT MODE)

1. E-bids are invited through **Central Public Procurement Portal (CPPP)** under two-bid system for the "**Establishment of Power Electronics Laboratory**" at Indian Institute of Information Technology, Allahabad (IIITA). The detailed specifications, termsand conditions are given in Annexure I through IX.The complete Bid document may be downloaded from CPPP and IIITAwebsite. Physical bids will not be accepted.

TENDER SCHEDULE

Date of issue/publishing	:	25/11/2020
Document download/sale start date	:	25/11/2020
Document download/sale end date	:	16/12/2020 (till 12.00 Noon)
Last date and time for online bid submission	:	16/12/2020 (till 12.00 Noon)
Last date and time for receipt of queries	:	**11/12/2020 (till 10.00 am)**
Date of issuing corrigendum, if any	:	**14/12/2020**
Date and time of Technical Bid opening	:	17/12/2020 (04.00 PM)
Date and time of Price Bid opening	:	Will be informed later
Bid Security (Earnest Money)	:	• Bid Security fee is Rs.60,000/-(Rupees Sixty Thousand only)(see Bid Security details given below). • Any bid without Bid Security will not be considered unless it qualifies for exemption (see **Details of Bid Security** given below). • Proof of remittance with transaction number/ Exemption certificate should be attached with the Annexure – II of the tender document.
Performance Security	:	10% of Purchase Order amount/ contract value
Warranty	:	See Technical Specifications
Number of covers	:	2
Bid validity period	:	90 days from the date of opening of Technical Bid
Address for communication	:	Store and Purchase Section IIITAllahabad, Deoghat Jhalwa, Prayagraj – 211015
Contact number	:	Tel: 0532-2922061
Email address	:	Bidder may submit their Queries/Clarification**, if any, latest by 11/12/2020 (till 10.00 am)** through Cpp portal. Queries/Clarification sent to any other Email ID will not be entertained**.**

Note: If any of the above days happens to be anIIITA'sholiday, the next working day shall be implied.

2. **Details of Bid Security**:
   a. Bid Security may be provided through direct transfer (RTGS/NEFT), Account Payee Demand Draft, Fixed Deposit Receipt, Banker's cheque or Bank Guarantee from any of the Commercial Banks. If Bid Security has been submitted by any other mode than NEFT/ RTGS, then hard copy of the Bid Security has to be sent by Registered Post. It should reach IIITA Campus before the bid submission deadline to the name of Jt. Registrar (Store & Purchase), Indian Institute of Information Technology Allahabad, Deoghat, Jhalwa,Prayagraj,and Pincode-211015. In envelope super scripted the tender Id or tender reference Number and with company full address.
   b. The details for payment are as follows:

Account Name	:	**IIIT A EMD and Security Deposit Account**
Bank Name	:	**Punjab National Bank**
Address	:	**Pipalgaon Branch, Allahabad, Prayagraj**
Account number	:	**8636000100031943**
IFSC Code	:	**PUNB0863600**
Validity	:	The Bid Security is to remain valid for a period of 45 days beyond the final bid validity period.

   c. **Exemption for Bid Security:** Micro and Small Enterprises (MSEs) as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprise (MSMEs) or are registered with the Central Purchase Organization or Concerned Ministry or Department or Startups as recognized by Department of Industrial Policy and Promotion are exempted from BID SECURITY. Such bidder needs to submit relevant certificate issued by competent authority along with technical bid of tender.

   The Bidders will be defined his exemption certificate which is relevant to our Tender category for EMD exemption, If the bidder will not provide the relevant category of certificate then exemption will not be applicable.
3. Complete Bidding document is available in Government of India's E-tender website. The bids should besubmitted through the same website (https://eprocure.gov.in/eprocure/app). All amendments, time extension, clarifications etc. will be uploaded in the CPPP website and www.iiita.ac.in and it will not be published in newspapers.
4. Bidders should regularly visit the above websites to keep themselves updated.
5. Bidder may note that Bid shall be submitted on the basis of "ZERO DEVIATION" and shall be in full compliance to the requirements of Bidding Document, failing which bid shall be considered as non-responsive and may be liable for rejection.
6. The Director of IIIT-Allahabad reserves the right to reject any or all the bids, or cancel the tender, without assigning any reason and the decision of the Director; IIIT-Allahabad shall be final and binding.

Store & Purchase Section

Contents

1 INSTRUCTIONS FOR ONLINE BID SUBMISSION

As per the directives of Department of Expenditure, this tender document has been published on the Central Public Procurement Portal (URL:**http://eprocure.gov.in/eprocure/app**). The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidder in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal. More information useful for submitting online bids on the CPP Portal may be obtained at: **http://eprocure.gov.in/eprocure/app**.

1.1 REGISTRATION

1.1.1 Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: http://eprocure.gov.in/eprocure/app) by clicking on the link "Click here to Enroll". Enrolment on the CPP Portal is free of charge.

1.1.2 As part of the enrolment process, the bidder will be required to choose a unique username and assign a password for their accounts.

1.1.3 Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.

1.1.4 Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / TCS / nCode / eMudhra / Capricon etc.), with their profile.

1.1.5 Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse.

1.1.6 Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

1.2 SEARCHING FOR QUOTATION /TENDER DOCUMENTS

1.2.1 There are various search options built in the CPP Portal, to facilitate bidder to search active Tender by several parameters. These parameters could include tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tender, wherein the bidder may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal.

1.2.2 Once the bidder has selected the tender they are interested in, they may download the required documents schedules. These tender can be moved to the respective 'My Tender' folder. This would enable the CPP Portal to intimate the bidder through SMS / e-mail in case there is any corrigendum issued to the Tender document.

1.2.3 The bidder should make a note of the unique Tender ID assigned to each Tender, in case they want to obtain any clarification / help from the Helpdesk.

1.3 PREPARATION OF BIDS

1.3.1 Bidder should take into account any corrigendum published on the Tender document before submitting their bids.

1.3.2 Please go through the Tender/Tender advertisement and the Tender document carefully to understand the documents required to be submitted as part of the bid. Please note

the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

1.3.3 Bidder, in advance, should get ready the bid documents to be submitted as indicated in the Quotation document / schedule and generally, they can be in PDF / XLS / RAR / DWF formats. Bid documents may be scanned with 100 dpi with black and white option.

1.3.4 To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidder. Bidder can use "My Space" area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

1.4 SUBMISSION OF BIDS

1.4.1 Bidder should log into the site well in advance for bid submission so that he/she upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

1.4.2 The bidder has to digitally sign and upload the required bid documents one by one as indicated in the Tender document.

1.4.3 A standard BoQ format has been provided with the Tender document to be filled by all the bidder. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. Bidder are required to download the BOQ file, open it and **complete the white colored (unprotected) cells** with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BOQ file is found to be modified by the bidder, the bid will be rejected.

OR

In some cases, Financial Bids can be submitted in RAR format as well (in lieu of BOQ).

1.4.4 The server time (which is displayed on the bidder' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidder, opening of bids etc. The bidder should follow this time during bid submission.

1.4.5 All the documents being submitted by the bidder would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128bit encryption technology. Data storage encryption of sensitive fields is done.

1.4.6 The uploaded Tender documents become readable only after the Tender opening by the authorized bid openers.

1.4.7 Upon the successful and timely submission of bids, the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

1.4.8 Kindly add scanned PDF of all relevant documents in a single PDF file of compliance sheet.

1.5 ASSISTANCE TO BIDDER

1.5.1 Any queries relating to the Tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a Tender or the relevant contact person indicated in the Tender.

1.5.2 Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact number for the helpdesk is 1800 233 7315.

1.6 GENERAL INSTRUCTIONS TO THE BIDDER

1.6.1 The Tender will be received online through portal http://eprocure.gov.in/eprocure/app. In the Technical Bids, the bidder is required to upload all the documents in .pdf format.

1.6.2 Possession of a Valid Class- III Digital Signature Certificate (DSC) in the form of smart card/e- token in the company's name is a prerequisite for registration and participating in the bid submission activities through https://eprocure.gov.in/eprocure/app. Digital Signature Certificates can be obtained from the authorized certifying agencies, details of which are available in the web site https://eprocure.gov.in/eprocure/app under the link "Information about DSC".

1.7 COST OF BIDDING DOCUMENTS

1.7.1 The vendor (bidder) shall bear all costs associated with the preparation and submission of its bid and IIITA will in no case be held responsible or liable for the costs, regardless of the conduct or outcome of the bidding process.

2 INVITATION FOR TENDER FOR ESTABLISHMENT POWER ELECTRONICS LAB

Indian Institute of Information Technology, Allahabad invites online Bids (Technical bid and Commercial/Financial bid) from eligible and experienced Original Equipment Manufacturer (OEM) or Authorized Dealer/Reseller/Distributor/System Integrator/Company/Firm of the OEM of the offered product for "**ESTABLISHMENT POWER ELECTRONICS LAB"** with onsite 3 Years comprehensive warranty at IIITA campus as per Terms & Conditions specified in the tender document, which is available on CPP Portal https://eprocure.gov.in/eprocure/app as well onIIITA websitehttps://www.iiita.ac.in.

3 TECHNICAL SPECIFICATIONS

The following are the technical specifications of the **ESTABLISHMENT POWER ELECTRONICS LAB** to be supplied as per the tender. The Annexure III should be used to specify compliance with these requirements. In case there is no deviation of the corresponding item, 'NO' should be written in the complied and a brief description should be given otherwise.

3.1 Specification Establishment Power Electronics Lab $

Sr. No	Item Specifications	Quantity	Compliance Yes/No
1	**1-Phase half and full controlled converter** **Tender specifications** Aesthetically designed injection molded electronic desk. Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope :** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Master Unit** **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. •Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondary's: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for Variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half	**03**	

	bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconvertor, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel** •Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No. •Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconvertor, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **CON / INV Panel** •SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety. •Half Wave & Full Wave Fully Controlled converter •AC Voltage Controller using Lamp •SCR Controlled Converter 1 phase with R-L Load •Effect of Free Wheeling Diode on SCR converter performance with Inductive load. •Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters •Effect of Source Impedance on performance of SCR converters. •Study of closed loop SCR converters with Resistive Load. •Study of closed loop SCR converters with Motor Load. Select motor types from. •Study of full wave -half controlled SCR bridge. •Resonant DC- DC converter. •Advanced firing Schemes •Study of H.F. gate type SCR triggering. •Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent). •Study of Linear relation between control voltage and SCR converter output- using cosine firing scheme.		

	•SCR forced Commutation Techniques •Study of forced commutation techniques for SCR, Class A,B,C,D,E,F •SCR based Inverters •SCR based Parallel Inverter. •SCR based series Inverter . •SCR based Bridge Inverter. •SCR based Mcmurray Bedford half bridge inverter. •Cycloconverter •SCR Based cycloconverter •SCR based Chopper •SCR based buck (step dn), boost (set up), buck boost chopper **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
2	**3 Phase Thyristor converter circuits** **Features:** •Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrangements for high voltage circuits •Each panel has ABS molded plastic sturdy enclosure & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection 4. Set of Instructor Guide & Student Workbook •Set of Instructor Guide & Student Workbook. •Supplied with power scope attachment to any lab CRO for H V Differential voltage off- ground measurements. •Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there&shrouded 4 mm banana patch cords&shrouded sockets arrangements for the safety of the students **Technical Specifications** **Input 3 phase DOL Starter panel** •4 Pole MCB of 415V/4A. •DOL 9A contactor with 230V/50Hz/11VA COIL. •Bimetallic thermal O/L relay with range 1.4A-2.3A. **DC voltmeter & DC ammeter panel** •DC voltmeter (0-600V) •DC Ammeter (0-5A) with polarity protection diode **Lamp Load** 230V/15/40/60/100W X3 bulbs with individual ON/OFF using 6A toggle switch. **Inductive (L) Load** •Inductive load=0.75W/3H/300mAX3Nos. **3 Ph. Bidirectional power cum Energy meter panel** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V CT Input 5A • LCD/LED display, Aux. supply 230V, 45-65 Hz, 5W • V, I, Hz, Pf, KVA, KW, KWh •Modbus RTU RS 485 **6 SCR Firing/Synchronizing Panel** •Mode selection switches (3 nos) to select cyclo converter, converter or disable. •Cosine firing scheme to facilate linear control for better harmonic ripple control. •Cyclo converter frequency generator 25Hz/12.5Hz/6.25Hz •Mode selection switched (3 Nos.) to select Cyclo converter	**02**	

	frequencies, converter mode or disable. •In built firing angle control pot. •Facility to apply external 0 to 2.5V signal from DAC to control firing angle. **6 SCR/Diode Power Module** •Consist of 6 SCR [Anode to body type] with PIV rating 1200V/25A. •6 Diode with PIV rating of 1200V/16Amp •6 No. of uncommitted Snubbers for protection of thyristors consisting of capacitor 0.1uF/1000V & 100E/5Wceramic resistors. **External Interface : I/P Fault Switches :** 3 Nos. PTs arranged in circuit 230V: 12-0-12@50mA **List ofExperiment** **1) Working with 3 Phase HVDC** : a)3 Ph. half wave uncontrolled converter with Resistive load using diodes. b)3 Ph. full wave diode bridge (uncontrolled converter) with Resistive load. c) Study of SCR firing circuits in 3-ph. converter environment. d) 3 Ph. half / fully wave fully controlled / half controlled SCR converter with Resistive Load & motor load. 2**) Working with 3 Phase AC Voltage Control** : a)Study of SCR firing circuits in 3 ph. AC voltage control. b) 3 Ph. AC voltage controller with resistive load using SCRs. c) 3 Ph. Induction motor speed control using SCR based AC voltage controller. d. 3 Ph. AC voltage controller fed Induction motor Drive. **3) Working with 3 Ph. Cyclo-Converter** : a) Study of SCR firing circuits in 3 ph. Cyclo converter. b) 3 ph. Cyclo converter with resistive & motor load. **4) Closed loop control** of 440V DC separately excited DC shunt motor using either built in P/PI or Ext. Digital PID (using CIP card & PID Software). **DC Shunt Motor** (1 HP, 1500RPM, 440V armature, 220V field with spring balance loading arrangement **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
3	**Familiarization with PE components** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel. •Set of Users Guide provided with each Unit. **Specifications**	**03**	

	•**Built in Power Supply :** DC Supply **:**5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. •**Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Power Semiconductor Application Experiment Panel** : Triac lamp dimmer, AC fan regulator, SCR/DIAC operated light sensitive switch using LDR, SCR/DIAC operated temperature sensitive switch using thermistor, UJT relaxation oscillator, Half & full wave [Phase shift controlled] rectifier using SCR, Timer using SCR & UJT. **Power Semiconductor Application Experiment Panel** :SCR phase shift controlled converter using IC555 through opto isolator (Potentiometric), Triac AC power control using IC 555 (Potentiometric) (optoisolated), SCR AC power control using UJT/PUT (Potentiometric) Triac AC power control using UJT/PUT (Potentiometric), SCR/Triac temperature control using thermister, SCR/Triac intensity control using LDR, Opto isolated DC switch & Photo relay & thermal relay (street light control). **JFET, MOSFET &IGBT Expt. Panel : MOSFET** : Drain characteristics of MOSFET, MOSFET, Amplifier, MOSFET Switch, JFET :		

	Characteristics of JFET, JFET amplifier, JFET, Crystal oscillator, Phase shift osc. Using FET, Phase splitter using FET, FET Analog switch, IGBT : Characteristics of IGBT, IGBT as switch. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
4	**DC Chopper Circuits** **Features** • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement to try out different topologies for high voltage circuits. •Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding, connections & servicing by swapping at site. •Study of different types of choppers i.e. Type-A, Type-B, Type-C,Type-D & Type-E (first quadrant to fourth quadrant). •Set of Instructor Guide & Student Workbook. •Inbuilt IC based PWM control with variable duty cycle & variable frequency (1-20KHz). •4 independent IGBTs with built in driver & 2KV isolation provided for TTL level driver. Thus easy for site servicing, 2 hall current sensors one for load & one for source supplied. **Technical specifications:** A] Aluminum profile modular flat demo panel rack (4X2) system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **Instrumentation Power supply cum MultichannelDPM panel** •±12V/500 mA, +5V/300mA, Unregulated 17V dc/750 mA, line synchronizing signal, 13V / 3 Amp. •Multi channel DPM for digital display of parameters. •20 pin FRC power bus to supply power to neighboring panel. **4 IGBT/MOSFET power & sensing panel** •1200V/40A IGBT with isolated (IV) TTI compatible isolated driver circuit & individual heat sink 4 nos. •Current measurement DC (2 nos.) 0.5E/5W series resistor default or using hall sensors (Max I/P up to 20A, 50/60Hz), isolation up to 2KV, O/P =0-3V for controller feedback. •Voltage measurement DC (1 no.) MC DC meter / ammeter default or using hall sensor (Max I/P 10-500V, 50/60Hz), isolation up to 2KV, O/P =0-3V for controller feedback. •IC3525 based PWM control with variable duty cycle (5%-90%) & variable frequency (1-20KHz) •Power supplies isolated 2 nos. 24V@3A & 12V@750mA with loading resistors provided to prevent voltage built up. •2.5mH@5A inductor as load supplied. • Panel consist of diode bridge (1000V/35A), capacitors (0.1 & 2.5µF)& resistors (0.5E/5W & 5E/20W). **DC Voltmeter & Ammeter panel** •Voltmeter (300V-0-300V) & Ammeter (2A-0-2A) **DC Voltmeter & Ammeter panel** •Voltmeter (30V- 0-30V) & Ammeter (2A-0-2A) **PMDC motor with loading arrangement** **PMDC Motor Specifications:** •200V/200W/2000RPM Chasis mounted table top with spring balance loading arrangement [10kg] 10V/1000RPM. Weight : 12 Kg.	**03**	

	Variable AC & DC supply panel: Variable output : AC 0-270V/3A Variable output : DC 0-250V/3A **Resistive load:** **DC Resistors:** 750E/600E/300E/212E/162E/125E/112E/100E/400W/8taps+OFF+separate 60E tap for DC series Gen. **List of Experiment:** 1. Study of first quadrant chopper or Type-A chopper. 2. Study of second quadrant chopper or Type-B chopper. 3. Study of two quadrant type-A chopper or Type-C chopper. 4. Study of two quadrant type-B chopper or Type-D chopper. 5. Study of fourth quadrant chopper or Type-E chopper. 6. Four quadrant 200V/200W PMDC motor chopper drive. 7. Resonant converter **Accessories** 1) Single IGBT module mounted on 140x40mm heat sink. 2) Single phase rectifier pack mounted on heat sink. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
5	**Study of 3 Phase PWM and non PWM inverter** **Features** • includes reconfigurable hardware modules & individually replaceable power modules, which may be interconnected to construct 3 phase/ 1 phase inverter topologies. Moreover, the FPGA controller board is accessible to user, thereby facilitating quick verification & testing of new ideas. • Use of hall sensors for voltage/current measurements. • Light weight yet sturdy, table top Aluminum profile modular flat demo panel setup, carrying various high voltage components housed in plastic modular panels with colorful overlays to minimize shock possibility & easy servicing. • Facilitates easy & safe wiring by students due to use of 4mm Shrouded banana patch cords for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connections, experiments also set of Instructor Guide & Student Workbook. • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications** Aluminum profile modular flat demo panel rack (5X2) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility.0000000000 **Instrumentation Power supply cum Multichannel DPM panel** • ±12V/500 mA, +5V/300mA, Unregulated 17V dc/750 mA, line synchronizing signal, 13V / 3 Amp. • Multi channel DPM for digital display of parameters. • 20 pin FRC power bus to supply power to neighboring panel. **8 IGBT Power & sensing panel** Consisting of • 1200V/40A IGBT with opto isolated (LV) TTL compatible driver	**02**	

	circuit & individual heat sink with built in isolated DC power supply for gate drive - 8 nos. • Current measurement AC (12 nos) & DC (1no) using Hall sensors (Max I/P up to 20A, 50/60Hz), Isolation up to 2KV, O/P = 0-3V for controller feedback. • Voltage measurement AC (3 nos) & DC (1no) using hall sensors (Max I/P 10-500V, 50/60Hz), Isolation up to 2KV, O/P = 0-3V for controller feedback. • 2 nos of relays for ON/OFF control of I/P & O/P under /uc control. • DC link supply for inverter 300V/5A. • May be used in manual mode using SG3525 PWM controller (1 phase application) as well as from DSP/FPGA controller (User selectable choice of controller). **FPGA based controller panel SPARTAN III (XC3S50AN)** • 16MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, Timer/Counter etc. • 6 LVTTL gate drive outputs to & 6 status feedback inputs from 6 nos IGBT power modules through 26 pin FRC cable. • 2 digital outputs for ON/OFF Relay control & one for controller ON led. • opto isolated 3 inputs for encoder/ hall sensors from PMSR/BLDC & 1 input for DC bus fault interrupt. **AC voltmeter panel** • Voltmeter range: 500V • 1 pole 4 way switch to select line voltage for three phase **Dual range AC ammeter panel** • Current range: 2A/6A selectable • 1 pole 7 way switch to select phase current to three phases **Variable AC & DC supply panel** • Variable O/P: AC 0-270V/3A for V/F manual setting Resistive load panel • DC resistors: 750E/600E/300E/212E/162E/125E/112E/100E /400W/8 taps + OFF + separate 60E tap for DC series Gen. **3 phase Induction motor specs :** 3 phase induction motor, ½ HP, 1500RPM, 3 terminal (star 440Vac/0.5A) motor with Hand held Tachometer for speed measurement **Accessories:** Power scope, BNC to BNC cables x 2 nos., Tachometer **List of Experiments** : 1) Speed control of 3 Ph. Induction motor by varying frequency (0 to 70 Hz) & Voltage **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
6	**3 Phase variable frequency Drive** **Salient Features** • Easy&safe wiring by students due to 4mm sturdy shrouded banana patch cords&shrouded socket arrangement for high voltage circuits. • Facilitates easy learning about operative characteristics of ubiquitous squirrel cage induction motor. • Each panel has ABS molded plastic sturdy enclosure,&colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding&connections.	**02**	

	• Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile sturdy Modular flat demo panel system (table top), carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **1) 1 ph. Motor, Alternator & Sync. Motor Panel** 1 ph. MCBs of 4A/1.6A - 2nos, bulb load. **2) Integrated AC (1 phase) measurement panel** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **3) AC voltmeter panel** • Voltage range : 300V • 1 pole 4 way switch to select line voltage for three phase **4) Dual range AC ammeter panel** • Current range:2A/6A selectable . • 1 pole 7 way switch to select phase current for three phase **5) IGBT Controlled AC Drive panel** 1) Input voltage: 230VAC. 50Hz 2) Output voltage: 3 phase 200 to 230VAC 3) Range (Frequency Control) : 0.1 Hz to 100 (400)Hz 4) Control Mode :Sine Wave PWM 5) Capacity : ½ HP 6) With Reverse&Forward Direction 7) Mech: single width for ½ HP **6) Motor specifications :** 3 phase squirrel cage induction motor, ½ HP 4 pole, 1500RPM, 6 terminal (delta 220Vac/star 440Vac) motor with Hand held Tachometer for speed measurement **7) Accessories:** Eddy brake for loading with the panels for DC measurement, Torque & Speed measurement, Hand held digital tachometer **8) List of Experiments :** • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f ratio • [VFD I/P = 230VAC L-N, O/P=220VAC L-L] • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f • Study of efficiency of AC motor. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
7	**Speed control of DC motor** **DC Shunt/Series/Compound Motor** **The Trainer should have following features :** • Following trainer may need a few set of associated panels (4 nos. typically) which are mounted in a light weight sturdy aluminum flat demo panel system. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuit diagram & its connection tag	**03**	

	numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook **Technical specifications:** It should consists of : **1] Instrumentation Power supply cum Multi- channel DPM panel** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) Line synchronizing signal. (e) Multi channel DPM for digital display of speed, etc. **2] SCR Actuator (variable DC) cum sensor signal conditioning panel** 1. Full bridge SCR based 0V-195V / 12 Amp cosine firing with linear characteristics. 2. Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS). 3. 2 Nos. of these supplies required for DC Armature & DC motor field. **3] DC voltmeter&DC ammeter panel** a) DC voltmeter (0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. **4] DC Integrated Motor Specifications** 180V/300W/1500RPM with series shunt & compound windings, Chasis mounted table top with spring balance loading arrangement [10kg] & Electronic Tacho:1V/1000RPM. Electrical Tacho :10V/1000RPM. **List of Experiments** 1. Open loop torque speed characteristics. 2. Closed loop speed control using Armature voltage / speed feed back using P/PI mode. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
8	**Basic DC-DC converters with MOSFET switch** **Tender specifications** Aesthetically designed injection molded electronic desk**.** Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope :** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Master Unit** **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.	**03**	

	•Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondaries: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel** •Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No. •Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconverters, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **IGBT / MOSFET Inverter Panel** •Provided with uncommitted MOSFET (800V/7.8A, 2No.) IGBT (600V/6.5A, 2 No.) brought out on Banana sockets, LM3525 based PWM converter to generate 200-2000Hz inverter frequency as well as duty cycle control, 1 No. optoisolated driver & 1 no. additional opto Drive provided on Topboard for Chopper etc. •Switching characteristics of MOSFET / IGBT •MOSFET / IGBT based 4 types of Chopper - Buck, Boost, Buckboost, Cuck. •MOSFET / IGBT push pull&half bridge inverter 200/2000Hz. •Open&close loop DC motor (200V/200W) PWM speed control, P/PI closed loop control PMDC. PMDC DC Motor (200V/200W/2000RPM with built in tacho generator & loading for closed loop Control **Inclusive of 3 year of onsite warranty and trainer should be safety**		

	aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).		
9	**Advance DC to DC Converter Panel** : Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter (Buckboost), Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter, CukConverterm, Various SMPS topologies in standalone panel with built in Power supply. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**	**03**	
10	**Study of a single phase PWM AC to DC converter** **Tender specifications** Aesthetically designed injection molded electronic desk**.** Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope :** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Master Unit** **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. •Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondaries: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25	**03**	

	Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel** •Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No. •Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconverters, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **IGBT / MOSFET Inverter Panel** •Provided with uncommitted MOSFET (800V/7.8A, 2No.) IGBT (600V/6.5A, 2 No.) brought out on Banana sockets, LM3525 based PWM converter to generate 200-2000Hz inverter frequency as well as duty cycle control, 1 No. optoisolated driver & 1 no. additional opto Drive provided on Topboard for Chopper etc. •Switching characteristics of MOSFET / IGBT •MOSFET / IGBT based 4 types of Chopper - Buck, Boost, Buckboost, Cuck. •MOSFET / IGBT push pull&half bridge inverter 200/2000Hz. •Open&close loop DC motor (200V/200W) PWM speed control, P/PI closed loop control PMDC PMDC DC Motor (200V/200W/2000RPM with built in tacho generator & loading for closed loop Control **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
11	**Study of 1-phase ASCI current source inverter** **The Trainer should consists of following Electrical Specification :** •Input range is 170-270V A.C./50Hz. •Output (Input present) 195-250V sine. •Output (Input unhealthy / absent) •230 V + 5% Quasi-sine. •Capacity 200W lamp load on AVR. •Battery 12V / 7Ah, 'Panasonic' (Maintence free lead acid) •Bkup of 5 mins on 200W lamp load •17 test points are provided. **The Trainer should consists of following Panels :** • Input / Output Module •Battery / Transformer Module •AVR / Charger Module •Inverter Module **The Trainer should cover following Experiments:** •Study of AVR charger	**03**	

	•Study of change over logic •Study & working of typical offline UPS **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
12	**Switching Characteristics of MOSFET and IGBT** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure,&has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel. •Set of Users Guide provided with each Unit. **Specifications** •**Built in Power Supply :** DC Supply **:**5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. •**Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET,	**03**	

	IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
13	**Study of ZVS and ZCS buck converter** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure,&has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel. •Set of Users Guide provided with each Unit. **Specifications** •**Built in Power Supply :** DC Supply **:**5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. •**Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac,	**03**	

	bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Discrete Component Panel** : Panel with following discrete components : 7 Resistors, 5 diodes, 1 LDR, 1 Zener, 3 NPN transistors, 1 PNP transistors,1 UJT, 4 Capacitors, 1 HV Capacitors, 2 SCR, 2 FET & MOSFET, 1 12V RELAY, 3 Inductors,1 Linear pot, 1 Triac, 1 Audio transformer, 1 PUT, 1 HW Resistor, 1 DIAC, 92 Banana sockets for patch cording to construct various circuits. **Advance DC to DC Converter Panel** : Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter (Buckboost), Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter, CukConverterm, Various SMPS topologies. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
14	**Digital Storage Oscilloscope 25 MHZ** **Band with : 25MHz** Sampling Rate : 500MSa/s Equivalent Sampling Rate- 1GSa/s C + Series: Single Channel : 32 Kpts; Double Channels: 16Kpts Memory Depth CA Series ohm Single channel: 40 Kpts; Double Channels : 20Kpts CM Series : Single Channels: 2Mpts; Double Channels; 1Mpts Rise Time : <14ns I/P impedance : 25ns/div-50s/div Sec/div Range Scan: 100ms-50s/div Horizontal Scan Range: 25ns/div-50s/div Analog Bandwidth (at input BNC) : 25 MHz **Input** In PUT Coupling: AC, DC, GND Input Impedance : DC: 1M +/-2% || 17pF +/-3pF AC: 1.2Mohm+/-2% || 17pF +/-3pF, <=100m V/div 1.0Mohm+/-2% || 17pF +/-3pF, >100mV/div Maximum Input Voltage: +400V PK-PK CATI Probe attenuator: 1X, 10X **Vertical System** Vertical Sensitivity: 2mV-10/div at input BNC (1-2-5 order) Vertical Resolution: 8 bit Channels : 2 Math operation : +, -, *, FFT FFT Window mode: Hanning, Hamming, Blackman, Rectangular Sampling points 1024 **Trigger System** Trigger Types Edge, Pulse Width, Video, Slope, Alternative Trigger Modes : Auto, Normal, Single Trigger Sources : Ch1-2, EXT, EXT/5, AC Line Trigger Coupling : AC, DC, LF, rej, HF rej **Control Panel Function** Auto Set Auto adjusting the vertical, Horizontal system&Trigger position Save/Recall:Support 2 Group referenced Waveforms, 20 Group	**03**	

	setups, 20 Group capture Waveforms internal Storage/Recall function&USB flash driver storage function. **Measure System** Auto Measure FPRE Shoot, Rise time, Fall time, Freq, Period, +Wid, -Wid, Dut, -Dut, Bwid, Phase, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF Cursor Measure: Manual mode, Track mode&Auto mode. **Display** Display Mode Color TFT 5.7in. (145mm) diagonal Liquid Crystal Display Resolution : 320 horizontal by 234 vertical pixels Display color: 64K color Interface : USB Host, USB Device, RS232, Pass/Fail output **Environments** Temperature Operating:100C to +400C Not operting:- 200C to + 600C **Power Supply** Input Voltage 100-240 VAC, CAR II, Auto selection Frequency Scope: 45Hz to 440Hz Power :50VA Max. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		

4 GENERAL CONDITIONS OF CONTRACT

4.1 Bidder must fill the Letter of Undertaking (Annexure-IV) and Declaration Performa (Annexure-V) complete in all respect.

4.2 Bidder must quote their rates exclusive of all taxes and duties. Taxes applicable may be quoted separately giving full details.

4.3 "The Contract" means the agreement entered into between the Owner and the Bidder, as recorded in the contract form signed by the parties, including all the attachments and appendices there to and all documents incorporated by reference therein.

4.4 "The Contract Value" means the amount payable to the Bidder under the contract for the full and proper performance of its contractual obligations.

4.5 "The Work" means all labour, materials, tools and plant, equipment including government taxes and transport, that may be required in preparation of and for and in the full and entire execution and completion of "theWork".

4.6 "Services" means services ancillary to the execution of the work such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training and other obligations of the Bidder covered under thecontract.

4.7 For the Bidding/ Tender Document Purposes, Indian institute of information Technology, Allahabad shall be referred to as 'Institute' and the Bidder/ Successful Bidder shall be referred to as 'Contractor and / or Bidder or Tenderer / Supplier/ Vendor'.

4.8 While all efforts have been made to avoid errors in the drafting of the tender documents, the Bidder is advised to check the same carefully. No claim on account of any errors detected in the tender documents shall be entertained.

4.9 All Bidders are hereby explicitly informed that conditional offers or offers with deviations from the conditions of Contract, the bids not meeting the minimum eligibility criteria, Technical Bids not accompanied with Bid Security receipt of RTGS/NEFT of requisite amount

or the proof of exemption from Bid Security and an Undertaking In lieu of Bid Security, or any other requirements stipulated in the tender documents are liable to be rejected.

4.10 The Bid Security shall be returned through electronic transfer if submitted online to the bidder(s) bank account as provided by the bidder(s) or it will be returned by post whose offer is not accepted by the Institute within 15 days after finalization and award of the contract without any interest. If the return of Bid Security is delayed for any reason, no interest/penalty shall be payable to the bidder.

4.11 The Parties to the Contract/Agreement shall be the successful bidder (to whom the Services or Supply has been awarded) and the Institute, IIIT-Allahabad.

4.12 For all purposes of the contract including arbitration there under, the address of the bidder mentioned in the bid shall be final unless the bidder notifies any change of address by a separate letter sent by registered post with acknowledgement due to IIIT-Allahabad. The bidder shall be solely responsible for the consequences of any omission or error to notify any change of address in the aforesaid manner.

4.13 Each page in the bid document must be numbered properly and duly signed & sealed by the bidder. Submit the tender document as per Instruction for Online Bid Submission.

4.14 **MAKE IN INDIA** : Bidder quoting lowest total price among the technically successful bidders will qualify for the award of contract, Subject to the following Order of Government of India in respect of Preference to Make in India:

Preference to Make in India Pursuant to Government of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion Order No. P-45021/2/2017-B.E.-II Dated 15th June, 2017 with subject Public Procurement (Preference to Make in India), Order 2017 –

(a) (i) Among all qualified bids, the lowest bid will be termed as L1. If L1 is from a local supplier, the contract will be awarded to L1.

(ii) If L1 is not from a local supplier, the lowest bidder among the local suppliers will be invited to match the L1 Price subject to local supplier's quoted price falling within margin of purchase preference, and the contract shall be awarded to such local supplier subject to matching the L1 price.

(iii) In case such lowest eligible local supplier fails to match the L1 price, the local supplier with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the local suppliers within the margin of purchase preference matches the L1 price, then the contract will be awarded to the L1 bidder. (Para 3c of the above order dated 15th June 2017)

(b) The minimum local content shall ordinarily be 50%. (Para 5 of the above order dated 15th June 2017)

(c) The margin of Purchase Preference shall be 20%. (Para 6 of the above order dated 15th June 2017)

(d) In case of procurement for a value in excess of Rs. 10 Crores, the local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant and practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content. (Para 9b of the above order dated 15th June 2017)

(e) False declarations will be a breach of code of integrity under Rule 175(1)(i)(h) of the General Financial Rules 2017 for which the bidder or its successors can be debarred for upto two years as per Rule 151 (iii) of the General Financial Rules 2017 along with such further actions as may be permissible under law. (Para 9f of the above order dated 15th June 2017)

(f) No provision whatsoever in this document shall prevent the purchaser from implementing the Government of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion Order No. P45021/2/2017-B.E.-II Dated 15th June, 2017 with subject Public Procurement (Preference to Make in India), Order 2017

4.15 The date fixed for opening of bids, if subsequently declared as holiday by the Government, the revised date of schedule will be notified. However, in absence of such notification, the bids will be opened on next working date, the time remaining unaltered.

4.16 In preparing the financial bids, bidders are expected to take into account the requirements and conditions laid down in this Tender document. The financial bids should be uploaded online as per the specified ".xls" format i.e. Price Bid in Excel sheet attached as '.xls' with the tender and based on the scope of work, service conditions and other terms of the Tender document. It should include all costs associated with the Terms of Reference/Scope of Work of the assignment.

4.17 Quoted rate should be valid as asked in "Tender Schedule".

4.18 All figures etc. must be in English Language only.

4.19 The lowest rate will not be the basis of claim to get the order.

4.20 Director, Indian Institute of Information Technology, Allahabad, Prayagraj reserves the right to reject or accept any tender.

4.21 Director, Indian Institute of Information Technology, Allahabad, Prayagraj will be the sole arbitrator of all the disputes and his decision will be binding on both the parties.

4.22 Director, Indian Institute of Information Technology, Allahabad, Prayagraj reserves the right to alter/modify any or all conditions of this tender notice.

4.23 **Consignee**: Dr. Seema Shah, Jt. Registrar (Stores& Purchase), IIITA (Ph: 0532-2922081, 2922143). Except under specific instructions, delivery to Stores& Purchase Section (if applicable) is restricted between 9:30 A.M to 5.30 P.M. on all working days except Saturday & Sunday.

4.24 **Any conditional tender will not be accepted.**

4.25 **Tenderer should take into account any corrigendum published on the tender document before submitting their bids. All such corrigendum will be placed on Central Public Procurement Portal as well as IIIT-A website www.iiita.ac.in. Intending tenderers are advised to visit www.iiita.ac.in and https://eprocure.gov.in for regular update, if any, till the closing date of tender for any corrigendum/addendum/amendment. IIITA will not be responsible for ignorance of corrigendum.**

4.26 Rate should be quoted in BOQ in Cover 2(price offer or schedule of rate).

4.27 ANTI COMPETITIVE AGREEMENTS/ABUSE OF DOMINANT POSITION: The Competition Act, 2002 as amended by the Competition (Amendment) Act, 2007 (the Act), prohibits anti-competitive practices and aims at fostering competition and at protecting Indian markets against anti- competitive practices by enterprises. The Act prohibits anti- competitive agreements, abuse of dominant position by enterprises, and regulates combinations

(consisting of acquisition, acquiring of control and M&A) wherever such agreements, abuse or combination causes, or is likely to cause, appreciable adverse effect on competition in markets in India. IIITA reserves the right to approach the Competition Commission established under the Act of Parliament and file information relating to anti-competitive agreements and abuse of dominant position. If such a situation arises, then Vendors are bound by the decision of the Competitive Commission and also subject to penalty and other provisions of the Competition Act.

4.28 The tenderer who submits false, forged or fabricated documents or conceals facts with intention to win over the tender or procure purchase order; Bid Security of such tenderer firm shall be forfeited and firm shall be liable for blacklisting for a period of not Less than 2 years. The firm shall also be liable for Legal action depending on the facts & circumstances of the case.

4.29 If the supplier fails to execute the purchase order and informs IIITA about its inability to execute the order and non-compliance of the purchase order, firm shall be liable for blacklisting for a period of not less than 2 years.

4.30 Indian Institute of Information Technology reserves the right to amend or withdraw any of the terms and conditions contained in the Tender Document or to reject any or all tenders without giving any notice or assigning any reason or to cancel the tender. The decision of Director – IIIT-Allahabad shall be final and binding on all.

4.31 All disputes are subject to Jurisdiction of Allahabad Courts.

5 PREQUALIFICATION CRITERIA FOR BIDDER

5.1 The Bidder should be Original Equipment Manufacturer (OEM) or Authorized Dealer/Reseller/Distributor/System Integrator/ Company/Firm of the OEM of the offered product. If not OEM then Bidder has to submit anAuthorization letter from manufacturer or OEM for tender specific.

5.2 In case of bidder being an authorized business partner, an authorization letter from manufacturer or OEM must be submitted. In case bidder is sourcing items from other manufacturers, an authorization letter for supply and servicing the same assuring full guarantee and warranty obligations shall be obtained and attached from the principal supplier/ manufacturer.

5.3 Bidder should have experience of having successfully completed similar project during the last 3 financial years ending 31st march 2020 separately (i.e. 2017-18, 2018-19 & 2019-20)should be either of the following:

5.3.1 One similar order having worth not less than 15Lakh.

OR

5.3.2 Two similar orders each costing not less than 9.5Lakh.

OR

5.3.3 Three similar orders each costing not less than 7.6 Lakh.

(Attested copies of all the above Project Completion certificates should be submitted along with the proposal).

5.4 Bidder should have a registered office in India. Furnish address and registration details.

5.5 Any IIT/IIIT/NIT/ Government Department/PSU/PSU Banks/Autonomous Bodies/Statutory Bodies in India should not have blacklisted the Bidder at any stage. Self-declaration to that effect should be submitted along with the technical bid.

5.6 The Bidder is required to provide the Technical Compliance with detailed model number and specification of his offered product on his company letter head.

5.7 The Bidder is required to quote for the complete BOQ. Partial quote is liable to be rejected.

5.8 The firm must possess valid GST Registration number.(Provide the certificate)

5.9 The bidder should have minimum Rs. 7 LakhAverage annual turnover for the Last 3 financial years ending 31st march 2020(2017-18, 2018-19 & 2019-20) .Audited and certified copies of balance sheet, letter mentioning turnover and profit and loss statement of these three years duly certified by chartered accountant should be submitted.

5.10 Bidder/OEM must provide Escalation matrix of Telephone numbers for Service support.

Note: Bidder must provide necessary supporting documents (duly signed and sealed) as proof in respect of the eligibility criteria mentioned above.

6 SPECIAL CONDITIONS OF CONTRACT

6.1 These instructions are over and above the instructions contained in the enclosed set of tender documents and **override** instructions in case of conflict.

6.2 Detailed specifications, catalogue/literature of all the items quoted should be attached with the technical bid.

6.3 **Demonstration**:

I. After the Bid End date/ Time received bids will be evaluated. Technically qualified bidders will be informed through email to demonstrate the items offered within the next 7 days from the date of email sent to them for this purpose, to assess its usability and accessibility.

II. Based on the demonstration report by the standing technical committee, received bids will finally be technically accepted/rejected. Accordingly, financial bid of the techno-commercially compliant offers will be opened for further ranking and placement of contract. Arrangements for the demonstration shall be borne by the bidder.

6.4 **ONE BID PER BIDDER: -** Each Bidder shall submit only one Bid, either individually or as a partner in a joint venture. A Bidder who submits or participates in more than one Bid (other than as a sub –contractor) shall cause all Bids with the Bidder's participation to be disqualified.In a tender, either the Indian agent on behalf of the Principal / OEM or Principal / OEM itself can bid but both cannot bid simultaneously for the same item / product in the same tender. If an agent submits bid on behalf of Principal / OEM, the same agent shall not submit a bid on behalf of another Principal / OEM in the same item / product.In case a bidder not doing business within India, he shall furnish the certificate to the effect that the bidder is or will be represented by an agent in India equipped and able to carry out the supply, maintenance, repair obligations etc. during the warranty and post warranty period or ensure a mechanism at place for carrying out the supply, maintenance, repair obligations etc. during the warranty and post warranty period.

6.5 **Pre bid Qualification:** It is proposed kindly incorporate – Any pre-bid clarifications if required, then same may be obtained online through the tender site, or through the contact details given in the tender document.

6.6 Order of Acceptance: - It is proposed kindly incorporate that the successful bidder should submit Order Acceptance within 7 days from the date of order.

6.7 Rate Quoted: The currency of all quoted rates shall be Indian Rupees. All the payment shall be made in Indian Rupees only. The rates are to be quoted by the bidders in Indian Rupees only and payment shall be made to successful bidders in Indian Rupees only. Any statutory applicable taxes such as applicable Tax, etc. should be mentioned separately in the Financial Bid. However, quote should be inclusive of all other levies, statutory taxes and charges such as Octroi, Packaging & Forwarding charges etc. and should be delivered at the premises. All prices shall be fixed and shall not be subject to escalation of any description. The rates must be quoted strictly as per the 'Financial Bid Format' provided.

6.8 Extension in delivery: Delivery of completion of systems/ components/ Items is delayed for reasons of force majeure such as acts of God, Acts of Public enemy, acts of Government, fires, floods, epidemics, quarantine restrictions, illegal strikes and freight embargoes, the Contractor shall within 3 days from the date of such occurrence, give notice to IIIT Allahabad, Prayagraj in writing of his claim for extension of delivery period. IIIT Allahabad, Prayagrajon receipt of such notice may agree to extend the supply/contract delivery date as may be reasonable but without prejudice to other terms and conditions of the contract. Unless the extended delivery period is agreed by IIIT Allahabad, Prayagrajin writing, Tenderer cannot claim the extension of delivery time as a matter of right. IIIT Allahabad, Prayagraj shall have the right to cancel/ extend the order validity/ levy Liquidated Damage (LD) as appropriate.

6.9 Liquidated Damages: -If the supplier shall fail to deliver the systems/ components/ Items within the time specified in the Contract, IIIT Allahabad, Prayagrajshall recover from the Contractor as liquidated damages a sum of **0.5%** of the contract price of the undelivered systems /components/Items for each week of delay (or) part thereof. The total liquidated damages shall not exceed **10%** of the contract price of the unit or units so delayed. Systems/ components/Items will be deemed to have been delivered only when all essential components parts are also delivered. If any essential components are not delivered in time, the entire system / components/ Items will be considered as delayed until such time the missing parts are delivered.

6.10 The time of delivery including testing and handing over in satisfactory condition is the essence of the contract and the shipment should be affected as per the schedule. In the event of part supply, IIIT Allahabad, Prayagraj shall withhold the entire payment until the whole of the supply as per the order is delivered. In case the delivery schedule is not stipulated as essential criteria, Contractor may indicate the period of delivery required for them.

6.11 Insurance of goods: - The requisite goods supplied under the contract shall be fully insured against loss or damage to manufacture or acquisition, transportation, storage and delivery.

6.12 Warranty: All the required quantity of Electronics item will be covered with warranty mentioned in the technical specification from the date of satisfactory delivered in IIIT-Allahabad, Prayagraj report.

6.13 No Advance Payment: IIIT Allahabad, Prayagraj does not make any advance payment. Payments for services made should be released only after the services have been rendered or supplies made.

6.14 Experience of Firms/ Contractors: The firm should have minimum 03 years of experience of selling IT/ Electronics products & services, system integration and service provider in the field of Electronics items.

6.15 DETERMINATION OF THE SUCCESSFUL BIDDER: -The Bidder meeting the minimum eligibility criteria with the lowest bid price in the respective category of OEM, subject to arithmetical correction, shall be deemed as the successful Bidder. In the event of more than one bidder with the lowest price bids (say equal), the bidder with the highest 'cumulative annual turnover of the last 3 financial year would be deemed as 'Successful Bidder' on the basis of the documents already submitted by the bidder.

6.16 Performance Security: L1 bidder will have to submit an irrevocable performance security in the form of a demand Draft/ Bank guarantee (Annexure IX) of 10% of total contract value from Nationalized Bank within 15 days from the notification of the award of contract, and it should remain valid for a period of 60 days beyond the date of completion of all contractual obligation of the supplier, including warranty obligation. Bid Security will be released after receiving of Performance security in the form Performance Bank Guarantee/Demand Draft.

6.17 Delivery Schedule: The Delivery period shall commence from the date of issue of purchase order and completion period for Supply, Installation and Commissioning of Digital Storage Oscilloscope shall be strictly 8 weeks.

6.18 Payment:

6.18.1 It is suggested that 90% payment after successful supply, installation, commissioningand balance 10% will release after 15 days of receiving final invoice and submission of successfully working and satisfactory report by the end user.(bidder must confirm the acceptance on payment terms).

6.18.2 Applicable TDS will be recovered (deducted) from the payment(s).

6.18.3 At the time of submitting the bill and/or request for part payment vendor has to provide an undertaking that, **"It is certified that there has been no decrease in the price of price variation indices and, in the event of any decrease of such indices during the currency of this contract, we shall promptly notify this to the purchaser and offer the requisite reduction in the contract rate".**

6.19 Exemption: The institute is exempted from custom in terms of notification No. 51/96-custom dated 23/07/96 and is a University established under M.H.R.D. Govt. of India. Certificate to this, if required, shall be provided by the Institute.

6.20 GST Exemption: The buyer organization is an eligible for concessional rates of GST as notified by the government of India. The goods for which bids have been invited fall under classification of GST concessional and the conditions for eligibility of eligibility of concession are meet by the institution. A certificate to this effect will be issued by buyer to the seller after award of the contract. Sellers are requested to submit their bids after accounting for the concessional rate of GST. Applicable concessional rate of GST: 5%

Notification No.and date: 45/2017 – central Tax (Rate) dated 14/11/2017

6.21 Transit Permit (E-way bill): The bidder should generate E-way bill in its own accountability. Transit road permit in the prescribe proforma shall be made available as per rule by the Institute on the request of the supplier, if required.

6.22 Forfeiture of bid security: Bid security of a tenderer will be forfeited, if the tenderer withdraws or amends its tender or depreciates from the tender in any respect within the period of validity of its tender. Further, if the successful tenderer fails to furnish the required performance security within the specified period, its bid security will be forfeited.

6.23 Timely Servicing /rectification of defects during warranty period: After having been notified of the defects / service requirement during warranty period, seller has to complete the required service / rectification within 3 days time limit. If the seller fails to complete service / rectification with defined time limit, a penalty of 0.5% of unit price of the product shall be charged as penalty for each week of delay from the seller. Seller can deposit the penalty with the buyer directly else the buyer shall have a right to recover all such penalty amount from the performance security (PBG). Cumulative penalty cannot exceed more than 10% of the total contract value after which the buyer have the right to get the services / rectification done from alternate sources at the risk and cost of the seller besides forfeiture of PBG. Seller is liable to re-imberse the cost of such service/ rectification to the buyer.

6.24 Option Clause: The purchaser reserves the right to increase or decrease the quantity to be ordered up to 25% at the time of placement of contract. The purchaser also reserves the right to increase the ordered quantity by up to 25% of the contracted quantity during the currency of the contract at the contracted rates. Bidders are found to accept the orders accordingly.

6.25 Penalty:

6.25.1 Applicable penalty will / may be recovered from the payment(s).

6.25.2 The Penalty of minimum of Rs. 1000/- per week from the day of complains subject to maximum of may be levied for delay in resolution beyond resolution time permission downtime during warranty.

6.25.3 The above-mentioned penalty may / will be deducted (recovered) from the balance 10% amount of submitted performance security. However, the penalty may / will be waived off for non-performance due to reasons mentioned in the Force Majeure or because of IIITA.

6.25.4 In such case(s) the vendor should notify and produce / bring the relevant communication and proof to IIITA promptly of any failure to perform or delay in performing due to any of the above reasons for the penalty to be waived off.

6.25.5 If the supplier/vendor fails to provide satisfactory services during warranty period or 20% or more supplied quantity faces sustained issues, then concerned Vendor/Bidder shall be liable for blacklisting for a period of not less than 2 years and performance security will be forfeited.

6.25.6 **Penalty for delay in supply**: If the supply beyond the stipulated of completion penalty of 1% per week of delay as pert thereof or max 10% of total cost may be imposed at the discretion of competent authority.

6.26 Price Basis and applicable Tax claim: Vendor should clearly mention the Rate of applicable GST separately, if firm will not mention the Taxes clearly on their Price Quotation, IIIT – Allahabad, Prayagraj will assume that the quoted price is inclusive of all and no extra amount in later stage shall be paid by IIIT, Allahabad, Prayagraj on account of Taxes. In case of tax exemption or lower TDS, vendor has to submit letter from Government Authority for tax exemption or lower TDS (to be submitted along with each of the invoice(s).

6.27 Any variation in statutory levies and taxes within the contractual delivery period shall be borne by the IIITA. Beyond the delivery period, the upward variation of levies and taxes shall be borne by the vendor.

6.28 If it is found that items are fake or of sub-standard quality and not conforming to the required specifications, the firm will have to replace the fake/ sub-standard items with genuine ones immediately but they will also be liable to be blacklisted.

6.29 If the supplied material by the bidder is not found acceptable, IIIT Allahabad has the complete right to reject the same without giving any compensation.

6.30 **Force Majeure**: The vendor (bidder) will not be held responsible for breach of executing any obligation or delay in executing any obligations during below given circumstances / conditions.

6.30.1 War, Riots, Strike, Fire, Flood, Earthquake, Storm, Epidemic breakout, Power failure, Theft etc.

6.30.2 Any Governmental priorities (Necessary proof for validation viz. Govt. Gazette notifications, Leading Newspaper reports, etc. should be made available).

6.31 Rate quoted by the firm should not be higher than the MRP/ prevailing market rate.

6.32 **Dispute Resolution:** In the event of any dispute arising out of or in connection with this Order, the parties shall use their best endeavor to resolve the same amicably AND if the dispute could not be settled amicably, the matter shall be settled in the court under Prayagraj (Allahabad) jurisdiction only. The final payment will be released only after the vendor (bidder) complies with above-mentioned clause.

6.33 **Right to alter Tender:**

6.33.1 IIITA reserves the right to alter the Tender terms and conditions at any time before submission of the bids.

6.33.2 IIITA reserves the right to modify, amend, alter and/or cancel the entire RFP at any stage without assigning any reason whatsoever. IIITA's decision in this regard will be final and binding on all vendors (bidders).

6.34 Conditional quotations are liable to be rejected. In the event of acceptance, Director's decision will be final. The rates should be quoted as per our required specifications.

6.35 The rates should be quoted in Indian rupees.

6.36 The right to accept or reject any tender/ quotation, partially or wholly, including lowest quotation without assigning any reason whatsoever thereof or incurring any liability thereby is reserved with the Director, IIIT Allahabad, Prayagraj. The Director, also reserves the right to split the tender and place the orders for supply of item(s), mentioned in the enquiry letter on one or more tenderer. The decision of the Director, with regard to enforcement of these terms and conditions herein contained, as a result of breach of these conditions by successful Tenderer/s, shall be final and the Director, shall not be liable for any damage/liability put forth by the Tenderers at any stage of the transaction arising out of the enforcement of any or all herein contained terms and conditions.

6.37 The quantity shown in this tender is only approximate requirement and is subject to alteration at the time of placing the supply order and during the pendency of the quotation it will be binding on the part of the successful Tenderers to honour and comply with such orders placed by this Institute.

6.38 All the documents submitted must be legible and self-attested and stamped. Otherwise it is likely to be rejected.

6.39 The Bid Security shall be returned to the bidder(s) whose offer is not accepted by the Institute within 15 days after finalization and award of the contract without any interest. Unsuccessful bidders may collect the Bid Security (within next 10 days after finalization & award of the contract) from Store and Purchase Section, IIIT-A between 3PM and 5PM on

any working day after providing a copy of authorization letter and any Photo Identity Card. After these 10 days Bid Security will be sent by registered post to the postal address provided by the firm/bidder as mentioned in the tender document. Representative may also collect the EMD on behalf of the bidder, after providing an authorization letter from the bidder along with a copy of his photo identity card. If the return of Bid Security is delayed for any reason, no interest/penalty shall be payable to the bidder.

6.40 Tenderers responding to this enquiry shall be deemed to be agreeable to the terms and conditions herein contained. These terms and conditions shall be binding on the part of the successful tenderer. Tender must be quoted in prescribe format on the company/firm letter head.

6.41 Tenderer should take into account any corrigendum published on the Tender document before submitting their bids. All such corrigendum will be placed on CPP Portal (https://eprocure.gov.in/eprocure/app) and IIIT-A website (www.iiita.ac.in). Intending tenderers are advised to visithttps://eprocure.gov.in/eprocure/appand www.iiita.ac.in for regular update, if any, till the closing date of tender for any corrigendum/ addendum/ amendment**. IIITA will not be responsible for ignorance of corrigendum.**

6.42 If any defect is found in transit it will be the sole responsibility of the suppler to get it corrected and installed as desired by the user.

6.43 Quotation should be addressed to Jt. Registrar (Store & Purchase), Indian Institute of Information Technology, Deoghat, Jhalwa, Prayagraj-211015 (U.P.) India.

(Store &Purchase Section)

I/We duly certified that the information provided in the proforma is true. I/We agree to the contents of terms & condition of the quotation/tender.

Seal and Signature of the Proprietor/Authorized Representative

7 AWARD OF CONTRACT

7.1 Two-part bid system shall be adopted, i.e., **Cover 1(Techno-Commercial Offer or technical bid) and Cover 2 (Price Offer or schedule of rate).**

7.2 In the first stage, the Techno-Commercial Offers shall be opened at the stipulated time as mentioned in tender notice. The Price Offers of only those parties who qualify in the first stage shall be opened.

7.3 IIIT-Allahabad, Prayagraj shall award the contract to the eligible Bidder whose bid has been determined as the lowest evaluated Financial Bid. If more than one Bidder happens to quote the same lowest price, IIITA reserves the right to award the contract to more than one Bidder or any Bidderwith the lowest price bids (say equal), the bidder with the highest 'cumulative annual turnover of the last 3 financial year would be deemed as 'Successful Bidder' with respect to the submission of proof of documents as submitted by the bidder.

7.4 The lowest rate will not be the only basis of claim to get the order.

7.5 The price bid comparison will be done based on the rates quoted against technical specification.

8 SCOPE OF WORK

The scope of work for this tender includes the "Establishment Power Electronics Lab" as per the specification at the office of Indian Institute of Information Technology, Allahabad.

8.1 Vendor/OEM/Channel Partner should assign a single point of contact for attending to all software/ hardware problems during warranty period. Service Engineer/Technical Expert will visit customer's premise and arrange all spare parts within a maximum of 72 hours.

8.2 Vendor (bidder) will provide their support service contact numbers, escalation matrix (designation, contact numbers & emails).

9 ANNEXURES

9.1 ANNEXURE – I:LETTER OF BID

(To be submitted along with Technical Bid)

Dated: ...../...../ 2020

To,
Jt. Registrar (Store & Purchase)
Indian Institute of Information Technology
Deoghat, Jhalwa
Prayagraj - 211015

Sub: Submission of Bids against Tender Ref. No.: IIIT-A/SP/612 / / 2020

We, the undersigned, declare that:

1. I/We have examined and accepted all the terms and conditions of the tender reference number _____ and ready to offer the required services accordingly required in tender document.
2. I/We offer to execute in conformity with the Bidding Documents for "**Establishment Power Electronics Lab"** at IIIT-Allahabad.
3. Our bid shall be valid for a period of 90 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents and shall remain binding upon us and maybe accepted at any time before the expiry of the period.
4. If our bid is accepted, we commit to submit a Performance Security within 15 days from the date of issuance of the work/supply order.
5. I/We also declare that the Government of India / any other Government body/ any other organization has not declared us ineligible or blacklisted us on charges of engaging in corrupt, fraudulent, collusive or coercive practices or any failure/lapses of serious nature.
6. I/We also accept all the terms and conditions of this bidding document and undertake to abide by them, including the condition that you are not bound to accept highest ranked bid/ lowest bid or any other bid that you may receive.

Yours sincerely,

Authorized Signatory

(Authorized person shall attach a copy of Authorization for signing on behalf of biddingcompany)

Full Name and Designation

(To be printed on Bidder's letterhead)

9.2 ANNEXURE – II: CHECKLIST FOR BID SUBMISSION

SL. NO.	COMPLIANCE STATEMENT/QUERY	BIDDER'S CONFIRMATION, WITH CLARIFICATION/DETAILS (Mention YES/NO in each cell)	Page No. (To be filled by the vendor) As per bidding documents.
1	**2**	**3**	
1.	**Confirm that you have submitted your bid for "Establishment Power Electronics Lab".**	CONFIRMED / NOT QUOTED [Strike out whichever is not applicable] All the documents should be signed and sealed properly. Page number should be mentioned in his whole bidding documents.	
2.	**Confirm that you have attached the documentary evidence as desired in Pre-Qualification Criteria refer to point no. 5.1**	CONFIRMED (YES/NO)	
3.	Confirm that a copy of authorization letter of guarantee and warranty obligation as mention in special condition contract shall be obtained and attached from the principal supplier /manufacturer. Referred to point no. 5.2	CONFIRMED (YES/NO)	
4.	Confirm that the copy of project completion certificate of last three financial years ending 31st march 2019.Refer to point no. 5.3	CONFIRMED (YES/NO)	
5.	**Confirm that you have attached the documentary evidence as desired in Pre-Qualification Criteria refer to point no. 5.4**	CONFIRMED (YES/NO)	
6.	**Confirm that the bidder must not have been blacklisted by any IIT/IIIT/NIT/ Government Department/PSU/PSU Banks/Autonomous Bodies/Statutory Bodies in India at the time of submission of bid. [Attach an undertaking to this effect] Refer to point no. 5.5**	CONFIRMED (YES/NO)	
7.	**Confirm that you have attached the documentary evidence as desired in Pre-Qualification Criteria refer to point no. 5.6**	CONFIRMED (YES/NO)	
8.	**Confirm that the BOQ, duly filled in, indicating the percentage of applicable Taxes & Duties with prices submitted. Refer to point no. 5.7**	CONFIRMED (YES/NO)	
9.	Confirm that the company must have its GST Registration certificate. Refer to point no. 5.8	CONFIRMED (YES/NO)	
10.	**The bidder should have minimum Rs. 7 Lakh Average annual turnover for the Last 3 financial years (2017-18, 2018-19, 2019-20). Audited and certified copies of balance sheet, letter mentioning turnover and profit and loss statement of these three years duly certified by chartered accountant should be submitted. Refer to point no. 5.9.**	CONFIRMED (YES/NO)	
11.	**Confirm that the bidder must provide the**	CONFIRMED (YES/NO)	

SL. NO.	COMPLIANCE STATEMENT/QUERY	BIDDER'S CONFIRMATION, WITH CLARIFICATION/DETAILS (Mention YES/NO in each cell)	Page No. (To be filled by the vendor) As per bidding documents.
	escalation matrix of telephone numbers for services support. Refer to point no. 5.10		
12.	Confirm that quoted price of the prescribed Supply, Installation, material is on FOR / designated IIIT, ALLAHABAD office/store, including transportation charges, taxes etc. all complete as defined in complete RFQ. Refer to point no. 6.26	CONFIRMED (YES/NO)	
13.	Confirm **there is no deviation/ clarification/ cutting/ overwriting in Price Schedule.**	CONFIRMED (YES/NO)	
14.	**Confirm the delivery period of Delivery schedule is accepted as per Tender Documents provision.**	CONFIRMED (YES/NO)	
15.	Copy of PAN, Income Tax Return certificate submitted.	CONFIRMED (YES/NO)	
16.	HSN CODE(If Applicable)	CONFIRMED (YES/NO)	
17.	Confirm that the duly filled and scanned copy of all ANNEXURES FROM I TO IX submitted.	CONFIRMED (YES/NO)	
18.	Confirm that the **quoted price is firm and fixed** for entire contract period till completion of work unless there is separate provision in the RFQ document.	CONFIRMED (YES/NO)	
19.	Confirm that Bidder's Bid is based on **total compliance to the provisions of Tender document** and subsequent amendment and corrigendum, if any, **without any deviations and the quoted price is based on all the terms and conditions and specifications of Tender document.**	CONFIRMED (YES/NO)	
20.	**Confirm that the Price Reduction Schedule (PRS) as per Tender provision is acceptable and certify that there has been no decrease in the price of price variation indices and, in the event of any decrease of such indices during the currency of this contract, we shall promptly notify this to the purchaser and offer the requisite reduction in the contract rate.**	CONFIRMED (YES/NO)	
21.	Contract Awarded Agency shall deposit 10% of total contract value from Nationalized Bank within 15 days from the notification of the award of contract, and it should remain valid for a period of 60 days beyond the date of completion of all contractual obligation of the supplier, including warranty obligation. Refer to point no.6.18	CONFIRMED (YES/NO)	
22.	Confirm that the bidder accept all the terms and condition, methodology, GCC, SCC and all Annexure of entire tender documents.	CONFIRMED (YES/NO)	

SL. NO.	COMPLIANCE STATEMENT/QUERY	BIDDER'S CONFIRMATION, WITH CLARIFICATION/DETAILS (Mention YES/NO in each cell)	Page No. (To be filled by the vendor) As per bidding documents.
23.	**Functional Guarantee:** If the Product is found not genuine or authentic due to reasons entirely attributable to the bidder, the IIIT, ALLAHABAD may consider termination of the Contract and forfeiture of **Performance Security** in Compensation for the extra Costs and delays likely to result from this failure.	CONFIRMED (YES/NO)	
24.	Confirm that **proof of remittance with transaction number/ exemption certificate** is attached.	CONFIRMED (YES/NO)	
25.	Confirm that you are agreed with the **demonstration** condition.	CONFIRMED (YES/NO)	

9.3 ANNEXURE – III: TECHNICAL COMPLIANCE SHEET

9.3.1Technical Compliance for Establishment Power Electronics Lab

Sr. No	Item Specifications	Quantity	To be filled by the bidder(Yes/No)
1	**1-Phase half and full controlled converter** **Tender specifications** Aesthetically designed injection molded electronic desk. Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope :** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Master Unit** **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. •Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondary's: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for Variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconvertor, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel**	**03**	

	•Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No. •Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconvertor, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **CON / INV Panel** •SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety. •Half Wave & Full Wave Fully Controlled converter •AC Voltage Controller using Lamp •SCR Controlled Converter 1 phase with R-L Load •Effect of Free Wheeling Diode on SCR converter performance with Inductive load. •Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters •Effect of Source Impedance on performance of SCR converters. •Study of closed loop SCR converters with Resistive Load. •Study of closed loop SCR converters with Motor Load. Select motor types from. •Study of full wave -half controlled SCR bridge. •Resonant DC- DC converter. •Advanced firing Schemes •Study of H.F. gate type SCR triggering. •Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent). •Study of Linear relation between control voltage and SCR converter output- using cosine firing scheme. •SCR forced Commutation Techniques •Study of forced commutation techniques for SCR, Class A,B,C,D,E,F •SCR based Inverters •SCR based Parallel Inverter. •SCR based series Inverter . •SCR based Bridge Inverter. •SCR based Mcmurray Bedford half bridge inverter. •Cycloconverter •SCR Based cycloconverter		

	•SCR based Chopper •SCR based buck (step dn), boost (set up), buck boost chopper **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
2	**3 Phase Thyristor converter circuits** **Features:** •Facilitates easy&safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords&shrouded socket arrange-ments for high voltage circuits •Each panel has ABS molded plastic sturdy enclosure,&colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding&connection 4. Set of Instructor Guide & Student Workbook •Set of Instructor Guide & Student Workbook. •Supplied with power scope attachment to any lab CRO for H V Differential voltage off- ground measurements. •Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there&shrouded 4 mm banana patch cords&shrouded sockets arrangements for the safety of the students **Technical Specifications** **Input 3 phase DOL Starter panel** •4 Pole MCB of 415V/4A. •DOL 9A contactor with 230V/50Hz/11VA COIL. •Bimetallic thermal O/L relay with range 1.4A-2.3A. **DC voltmeter&DC ammeter panel** •DC voltmeter (0-600V) •DC Ammeter (0-5A) with polarity protection diode **Lamp Load** 230V/15/40/60/100W X3 bulbs with individual ON/OFF using 6A toggle switch. **Inductive (L) Load** •Inductive load=0.75W/3H/300mAX3Nos. **3 Ph. Bidirectional power cum Energy meter panel** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V CT Input 5A • LCD/LED display, Aux. supply 230V, 45-65 Hz, 5W • V, I, Hz, Pf, KVA, KW, KWh •Modbus RTU RS 485 **6 SCR Firing/Synchronizing Panel** •Mode selection switches (3 nos) to select cyclo converter, converter or disable. •Cosine firing scheme to facilate linear control for better harmonic ripple control. •Cyclo converter frequency generator 25Hz/12.5Hz/6.25Hz •Mode selection switched (3 Nos.) to select Cyclo converter frequencies, converter mode or disable. •In built firing angle control pot. •Facility to apply external 0 to 2.5V signal from DAC to control firing angle.	**02**	

	6 SCR/Diode Power Module •Consist of 6 SCR [Anode to body type] with PIV rating 1200V/25A. •6 Diode with PIV rating of 1200V/16Amp •6 No. of uncommitted Snubbers for protection of thyristors consisting of capacitor 0.1uF/1000V & 100E/5Wceramic resistors. **External Interface : I/P Fault Switches :** 3 Nos. PTs arranged in circuit 230V: 12-0-12@50mA **List ofExperiment** **1) Working with 3 Phase HVDC** : a)3 Ph. half wave uncontrolled converter with Resistive load using diodes. b)3 Ph. full wave diode bridge (uncontrolled converter) with Resistive load. c) Study of SCR firing circuits in 3-ph. converter environment. d) 3 Ph. half / fully wave fully controlled / half controlled SCR converter with Resistive Load & motor load. 2**) Working with 3 Phase AC Voltage Control** : a)Study of SCR firing circuits in 3 ph. AC voltage control. b) 3 Ph. AC voltage controller with resistive load using SCRs. c) 3 Ph. Induction motor speed control using SCR based AC voltage controller. d. 3 Ph. AC voltage controller fed Induction motor Drive. **3) Working with 3 Ph. Cyclo-Converter** : a) Study of SCR firing circuits in 3 ph. Cyclo converter. b) 3 ph. cycloconverter with resistive & motor load. **4) Closed loop control** of 440V DC separately excited DC shunt motor using either built in P/PI or Ext. Digital PID (using CIP card & PID Software). **DC Shunt Motor** (1 HP, 1500RPM, 440V armature, 220V field with spring balance loading arrangement **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
3	**Familiarization with PE components** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure,&has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel. •Set of Users Guide provided with each Unit. **Specifications** **•Built in Power Supply :**	**03**	

	DC Supply:5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. •**Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Power Semiconductor Application Experiment Panel** : Triac lamp dimmer, AC fan regulator, SCR/DIAC operated light sensitive switch using LDR, SCR/DIAC operated temperature sensitive switch using thermistor, UJT relaxation oscillator, Half & full wave [Phase shift controlled] rectifier using SCR, Timer using SCR & UJT. **Power Semiconductor Application Experiment Panel** :SCR phase shift controlled converter using IC555 through opto isolator (Potentiometric), Triac AC power control using IC 555 (Potentiometric) (optoisolated), SCR AC power control using UJT/PUT (Potentiometric) Triac AC power control using UJT/PUT (Potentiometric), SCR/Triac temperature control using thermister, SCR/Triac intensity control using LDR, Opto isolated DC switch & Photo relay & thermal relay (street light control).		

	JFET, MOSFET &IGBT Expt. Panel : MOSFET : Drain characteristics of MOSFET, MOSFET, Amplifier, MOSFET Switch, JFET : Characteristics of JFET, JFET amplifier, JFET, Crystal oscillator, Phase shift osc. Using FET, Phase splitter using FET, FET Analog switch, IGBT : Characteristics of IGBT, IGBT as switch. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
4	**DC Chopper Circuits** **Features** • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement to try out different topologies for high voltage circuits. •Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding, connections & servicing by swapping at site. •Study of different types of choppers i.e. Type-A, Type-B, Type-C,Type-D & Type-E (first quadrant to fourth quadrant). •Set of Instructor Guide & Student Workbook. •Inbuilt IC based PWM control with variable duty cycle & variable frequency (1-20KHz). •4 independent IGBTs with built in driver & 2KV isolation provided for TTL level driver. Thus easy for site servicing, 2 hall current sensors one for load & one for source supplied. **Technical specifications:** A] Aluminum profile modular flat demo panel rack (4X2) system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **Instrumentation Power supply cum MultichannelDPM panel** •±12V/500 mA, +5V/300mA, Unregulated 17V dc/750 mA, line synchronizing signal, 13V / 3 Amp. •Multi channel DPM for digital display of parameters. •20 pin FRC power bus to supply power to neighboring panel. **4 IGBT/MOSFET power & sensing panel** •1200V/40A IGBT with isolated (IV) TTl compatible isolated driver circuit & individual heat sink 4 nos. •Current measurement DC (2 nos.) 0.5E/5W series resistor default or using hall sensors (Max I/P up to 20A, 50/60Hz), isolation up to 2KV, O/P =0-3V for controller feedback. •Voltage measurement DC (1 no.) MC DC meter / ammeter default or using hall sensor (Max I/P 10-500V, 50/60Hz), isolation up to 2KV, O/P =0-3V for controller feedback. •IC3525 based PWM control with variable duty cycle (5%-90%) & variable frequency (1-20KHz) •Power supplies isolated 2 nos. 24V@3A & 12V@750mA with loading resistors provided to prevent voltage built up. •2.5mH@5A inductor as load supplied. • Panel consist of diode bridge (1000V/35A), capacitors (0.1 & 2.5µF) &	**03**	

	resistors (0.5E/5W & 5E/20W) . **DC Voltmeter & Ammeter panel** •Voltmeter (300V-0-300V) & Ammeter (2A-0-2A) **DC Voltmeter & Ammeter panel** •Voltmeter (30V- 0-30V) & Ammeter (2A-0-2A) **PMDC motor with loading arrangement** **PMDC Motor Specifications:** •200V/200W/2000RPM Chasis mounted table top with spring balance loading arrangement [10kg] 10V/1000RPM. Weight : 12 Kg. **Variable AC & DC supply panel:** Variable output : AC 0-270V/3A Variable output : DC 0-250V/3A **Resistive load:** **DC Resistors:** 750E/600E/300E/212E/162E/125E/112E/100E/400W/8taps+OFF+separate 60E tap for DC series Gen. **List of Experiment:** 1. Study of first quadrant chopper or Type-A chopper. 2. Study of second quadrant chopper or Type-B chopper. 3. Study of two quadrant type-A chopper or Type-C chopper. 4. Study of two quadrant type-B chopper or Type-D chopper. 5. Study of fourth quadrant chopper or Type-E chopper. 6. Four quadrant 200V/200W PMDC motor chopper drive. 7. Resonant converter **Accessories** 1) Single IGBT module mounted on 140x40mm heat sink. 2) Single phase rectifier pack mounted on heat sink. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
5	**Study of 3 Phase PWM and non PWM inverter** **Features** • includes reconfigurable hardware modules & individually replaceable power modules, which may be interconnected to construct 3 phase/ 1 phase inverter topologies. Moreover, the FPGA controller board is accessible to user, thereby facilitating quick verification & testing of new ideas. • Use of hall sensors for voltage/current measurements. • Light weight yet sturdy, table top Aluminum profile modular flat demo panel setup, carrying various high voltage components housed in plastic modular panels with colorful overlays to minimize shock possibility & easy servicing. • Facilitates easy & safe wiring by students due to use of 4mm Shrouded banana patch cords for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connections, experiments also set of Instructor Guide & Student Workbook. • Trainer should be modular panels for easy site servicing not close control;	**02**	

	panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications** Aluminum profile modular flat demo panel rack (5X2) system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility.0000000000 **Instrumentation Power supply cum Multichannel DPM panel** • ±12V/500 mA, +5V/300mA, Unregulated 17V dc/750 mA, line synchronizing signal, 13V / 3 Amp. • Multi channel DPM for digital display of parameters. • 20 pin FRC power bus to supply power to neighboring panel. **8 IGBT Power & sensing panel** Consisting of • 1200V/40A IGBT with opto isolated (LV) TTL compatible driver circuit & individual heat sink with built in isolated DC power supply for gate drive - 8 nos. • Current measurement AC (12 nos) & DC (1no) using Hall sensors (Max I/P up to 20A, 50/60Hz), Isolation up to 2KV, O/P = 0-3V for controller feedback. • Voltage measurement AC (3 nos) & DC (1no) using hall sensors (Max I/P 10-500V, 50/60Hz), Isolation up to 2KV, O/P = 0-3V for controller feedback. • 2 nos of relays for ON/OFF control of I/P & O/P under /uc control. • DC link supply for inverter 300V/5A. • May be used in manual mode using SG3525 PWM controller (1 phase application) as well as from DSP/FPGA controller (User selectable choice of controller). **FPGA based controller panel SPARTAN III (XC3S50AN)** • 16MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, Timer/Counter etc. • 6 LVTTL gate drive outputs to & 6 status feedback inputs from 6 nos IGBT power modules through 26 pin FRC cable. • 2 digital outputs for ON/OFF Relay control & one for controller ON led. • opto isolated 3 inputs for encoder/ hall sensors from PMSR/BLDC & 1 input for DC bus fault interrupt. **AC voltmeter panel** • Voltmeter range: 500V • 1 pole 4 way switch to select line voltage for three phase **Dual range AC ammeter panel** • Current range: 2A/6A selectable • 1 pole 7 way switch to select phase current to three phases **Variable AC & DC supply panel** • Variable O/P: AC 0-270V/3A for V/F manual setting Resistive load panel • DC resistors: 750E/600E/300E/212E/162E/125E/112E/100E /400W/8 taps + OFF + separate 60E tap for DC series Gen. **3 phase Induction motor specs :** 3 phase induction motor, ½ HP, 1500RPM, 3 terminal (star 440Vac/0.5A) motor with Hand held Tachometer for speed measurement **Accessories:** Power scope, BNC to BNC cables x 2 nos., Tachometer **List of Experiments** :		

	1) Speed control of 3 Ph. Induction motor by varying frequency (0 to 70 Hz) & Voltage **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
6	**3 Phase variable frequency Drive** **Salient Features** • Easy&safe wiring by students due to 4mm sturdy shrouded banana patch cords&shrouded socket arrangement for high voltage circuits. • Facilitates easy learning about operative characteristics of ubiquitous squirrel cage induction motor. • Each panel has ABS molded plastic sturdy enclosure,&colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding&connections. • Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile sturdy Modular flat demo panel system (table top), carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **1) 1 ph. Motor, Alternator & Sync. Motor Panel** 1 ph. MCBs of 4A/1.6A - 2nos, bulb load. **2) Integrated AC (1 phase) measurement panel** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **3) AC voltmeter panel** • Voltage range : 300V • 1 pole 4 way switch to select line voltage for three phase **4) Dual range AC ammeter panel** • Current range:2A/6A selectable . • 1 pole 7 way switch to select phase current for three phase **5) IGBT Controlled AC Drive panel** 1) Input voltage: 230VAC. 50Hz 2) Output voltage: 3 phase 200 to 230VAC 3) Range (Frequency Control) : 0.1 Hz to 100 (400)Hz 4) Control Mode :Sine Wave PWM 5) Capacity : ½ HP 6) With Reverse&Forward Direction 7) Mech: single width for ½ HP **6) Motor specifications :** 3 phase squirrel cage induction motor, ½ HP 4 pole, 1500RPM, 6 terminal (delta 220Vac/star 440Vac) motor with Hand held Tachometer for speed measurement **7) Accessories:** Eddy brake for loading with the panels for DC measurement, Torque & Speed measurement, Hand held digital tachometer	**02**	

	8) List of Experiments : • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f ratio • [VFD I/P = 230VAC L-N, O/P=220VAC L-L] • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f • Study of efficiency of AC motor. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**		
7	**Speed control of DC motor** **DC Shunt/Series/Compound Motor** **The Trainer should have following features :** • Following trainer may need a few set of associated panels (4 nos. typically) which are mounted in a light weight sturdy aluminum flat demo panel system. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook **Technical specifications:** It should consists of : **1] Instrumentation Power supply cum Multi- channel DPM panel** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) Line synchronizing signal. (e) Multi channel DPM for digital display of speed, etc. **2] SCR Actuator (variable DC) cum sensor signal conditioning panel** 1. Full bridge SCR based 0V-195V / 12 Amp cosine firing with linear characteristics. 2. Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS). 3. 2 Nos. of these supplies required for DC Armature & DC motor field. **3] DC voltmeter&DC ammeter panel** a) DC voltmeter (0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. **4] DC Integrated Motor Specifications** 180V/300W/1500RPM with series shunt & compound windings, Chasis mounted table top with spring balance loading arrangement [10kg] & Electronic Tacho:1V/1000RPM. Electrical Tacho :10V/1000RPM. **List of Experiments** 1. Open loop torque speed characteristics. 2. Closed loop speed control using Armature voltage / speed feed back using P/PI mode. **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be**	**03**	

	there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.		
8	**Basic DC-DC converters with MOSFET switch** **Tender specifications** Aesthetically designed injection molded electronic desk**.** Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope:** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Master Unit** **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. •Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondaries: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel** •Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No.	**03**	

	•Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconverters, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **IGBT / MOSFET Inverter Panel** •Provided with uncommitted MOSFET (800V/7.8A, 2No.) IGBT (600V/6.5A, 2 No.) brought out on Banana sockets, LM3525 based PWM converter to generate 200-2000Hz inverter frequency as well as duty cycle control, 1 No. optoisolated driver & 1 no. additional opto Drive provided on Topboard for Chopper etc. •Switching characteristics of MOSFET / IGBT •MOSFET / IGBT based 4 types of Chopper - Buck, Boost, Buckboost, Cuck. •MOSFET / IGBT push pull&half bridge inverter 200/2000Hz. •Open&close loop DC motor (200V/200W) PWM speed control, P/PI closed loop control PMDC. PMDC DC Motor (200V/200W/2000RPM with built in tacho generator & loading for closed loop Control **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
9	**Advance DC to DC Converter Panel** : Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter (Buckboost), Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter, CukConverterm, Various SMPS topologies in standalone panel with built in Power supply. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**	**03**	
10	**Study of a single phase PWM AC to DC converter** **Tender specifications** Aesthetically designed injection molded electronic desk**.** Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. Set of User Guide provided with each unit. **Power Scope :** Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.	**03**	

	Master Unit **Built in power supply** •DC supply : + 12V, 500mA, •Unregulated Power supply 17V / 750mA, •Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc. •Isolated DC supply +12V/ 300amA with isolated common. •On board Inverter transformer of Primary &Secondaries: 12-11-0-11-12/3A. •On board o/p to Isolated Drive Circuit **AC supply** •230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used. •Aux DC Power Supply : (Useful as field / armature supply for DC motor) •Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) •Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** •Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. •Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width **R-L-C Load Panel** •Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each •Centre tapped 3A choke 4mH/ 16mH each -2Nos. •DC choke 0-100-200 mH/750mA- 1No. •Commutation capacitors of 10uF/100V - 4Nos. •AC Paper capacitor of 4uF/440V - 1No. •DC Cap 220uF / 63V- 1No. •Diode BYT 71 (5407)- 1 No. •On board Lamp load of 15W/ 230VAC provided **Accessories:** •15 pin D connector cable assembly, •4mm patch cords : 100mm X 10 Nos& 500mm X 20 Nos. **List of experiments:** Thyristor based - Converters, Inverters, Cycloconverters, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. **IGBT / MOSFET Inverter Panel** •Provided with uncommitted MOSFET (800V/7.8A, 2No.) IGBT (600V/6.5A, 2 No.) brought out on Banana sockets, LM3525 based PWM converter to generate 200-2000Hz inverter frequency as well as duty cycle control, 1 No.		

	optoisolated driver & 1 no. additional opto Drive provided on Topboard for Chopper etc. •Switching characteristics of MOSFET / IGBT •MOSFET / IGBT based 4 types of Chopper - Buck, Boost, Buckboost, Cuck. •MOSFET / IGBT push pull&half bridge inverter 200/2000Hz. •Open&close loop DC motor (200V/200W) PWM speed control, P/PI closed loop control PMDC PMDC DC Motor (200V/200W/2000RPM with built in tacho generator & loading for closed loop Control **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
11	**Study of 1-phase ASCI current source inverter** **The Trainer should consists of following Electrical Specification :** •Input range is 170-270V A.C./50Hz. •Output (Input present) 195-250V sine. •Output (Input unhealthy / absent) •230 V + 5% Quasi-sine. •Capacity 200W lamp load on AVR. •Battery 12V / 7Ah, 'Panasonic' (Maintence free lead acid) •Bkup of 5 mins on 200W lamp load •17 test points are provided. **The Trainer should consists of following Panels :** • Input / Output Module •Battery / Transformer Module •AVR / Charger Module •Inverter Module **The Trainer should cover following Experiments:** •Study of AVR charger •Study of change over logic •Study & working of typical offline UPS **Inclusive of 3 year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**	**03**	
12	**Switching Characteristics of MOSFET and IGBT** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure,&has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel.	**03**	

	•Set of Users Guide provided with each Unit. **Specifications** **•Built in Power Supply :** DC Supply **:**5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
13	**Study of ZVS and ZCS buck converter** **Tender specifications** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure,&has colorful screw	**03**	

	less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Hands on learning by constructing circuits using built in power bread board panel as well as using Discrete component panel. •Set of Users Guide provided with each Unit. **Specifications** **•Built in Power Supply :** DC Supply **:**5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (IsolatedHigh Volt DC 15V to 110V, 100Ma, AC Supply :12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform:Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, forHigh/Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B)DC current : 2mA/200mA - 1No. (C)DC Volts/Current : 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Discrete Component Panel** : Panel with following discrete components : 7 Resistors, 5 diodes, 1 LDR, 1 Zener, 3 NPN transistors, 1 PNP transistors,1 UJT, 4 Capacitors, 1 HV Capacitors, 2 SCR, 2 FET & MOSFET, 1 12V RELAY, 3 Inductors,1 Linear pot, 1 Triac, 1 Audio transformer, 1 PUT, 1 HW Resistor, 1		

	DIAC, 92 Banana sockets for patch cording to construct various circuits. **Advance DC to DC Converter Panel** : Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter (Buckboost), Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter, CukConverterm, Various SMPS topologies. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		
14	**Digital Storage Oscilloscope 25 MHZ** **Band with : 25MHz** Sampling Rate : 500MSa/s Equivalent Sampling Rate- 1GSa/s C + Series: Single Channel : 32 Kpts; Double Channels: 16Kpts MemoryDepth CA Seriesohm Single channel: 40 Kpts; Double Channels : 20Kpts CM Series : Single Channesl: 2Mpts; Double Channels; 1Mpts Rise Time : <14ns I/P impedance : 25ns/div-50s/div Sec/div Range Scan: 100ms-50s/div Horizontal Scan Range: 25ns/div-50s/div Analog Bandwidth (at input BNC) : 25 MHz **Input** In PUT Coupling: AC, DC, GND Input Impedance : DC: 1M +/-2% || 17pF +/-3pF AC: 1.2Mohm+/-2% || 17pF +/-3pF, <=100m V/div 1.0Mohm+/-2% || 17pF +/-3pF, >100mV/div Maximum Input Voltage: +400V PK-PK CATI Probe attenuator: 1X, 10X **Vertical System** Vertical Sensitivity: 2mV-10/div at input BNC (1-2-5 order) Vertical Resolution: 8 bit Channels : 2 Math operation : +, -, *, FFT FFT Window mode: Hanning, Hamming, Blackman, Rectangular Sampling points 1024 **Trigger System** Trigger Types Edge, Pulse Width, Video, Slope, Alternative Trigger Modes : Auto, Normal, Single Trigger Sources : Ch1-2, EXT, EXT/5, AC Line Trigger Coupling : AC, DC, LF, rej, HF rej **Control Panel Function** Auto Set Auto adjusting the vertical, Horizontal system&Trigger position Save/Recall:Support 2 Group referenced Waveforms, 20 Group setups, 20 Group capture Waveforms internal Storage/Recall function&USB flash driver storage function. **Measure System** Auto Measure FPRE Shoot, Rise time, Fall time, Freq, Period, +Wid, -Wid, Dut, -Dut, Bwid, Phase, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF	**03**	

	Cursor Measure: Manual mode, Track mode&Auto mode. **Display** Display Mode Color TFT 5.7in. (145mm) diagonal Liquid Crystal Display Resolution : 320 horizontal by 234 vertical pixels Display color: 64K color Interface : USB Host, USB Device, RS232, Pass/Fail output **Environments** Temperature Operating:100C to +400C Not operting:- 200C to + 600C **Power Supply** Input Voltage 100-240 VAC, CAR II, Auto selection Frequency Scope: 45Hz to 440Hz Power :50VA Max. **Inclusive of 3 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**		

Yours faithfully,

(Signature of Authorized Signatory)

Name:

Designation:

Company seal:

Place:

Date:

9.4 ANNEXURE – IV: UNDERTAKING

To,
Jt. Registrar (Store & Purchase)
Indian Institute of Information Technology
Deoghat, Jhalwa
Prayagraj - 211015

UNDERTAKING

I/We _____, of M/s. _____ having registered office at _____, do hereby undertake that my company, M/s._____, will not withdraw or modify its bids submitted for Tender No. _____ dated _____ for the "**Establishment Power Electronics Lab**" at IIIT-Allahabad during the period of validity of the bids.

I/We further undertake to have understood that if my company M/s._____ withdraws or modifies its bids or if it fails to sign the contract or fails to submit a performance security within the stipulated deadline if the work is awarded to it, M/s. _____ will be suspended for a specified time period at least for two years from being eligible to submit bids for contracts with the Indian Institute of Information Technology, Allahabad.

I/We further certify that in the event of any decrease in the price/ price variation indices during the currency of this contract, we shall be promptly notify this to the purchaser and offer the requisite reduction in the contract rate.

Yours faithfully,

(Signature of Authorized Signatory)

Name:

Designation:

Company seal:

Place:

Date:

9.5 ANNEXURE – V: DECLARATION

DECLARATION

(Regarding ownership and/or employment of IIIT-A Employees)

(To be filled in by the Tenderer, signed and submitted along with tender papers.)

Ref. No.: IIIT-A/SP/NIT/612/1145/2020 **Date: / /**

I/We hereby declare that I/we or Partners or Directors of our concern do not have any such person under my/or employment who has retired/ resigned/ removed/ dismissed from IIIT-A during the last two years.

I/We hereby declare that I/We or partners or Directors of our concern have the following under my/our employment who has/have retired/resigned/removed/dismissed from IIIT-A during the last two years.

I/We hereby declare that I/We or partners of directors are not related to any employees of IIIT-A

Sl no	Name of person	Date of leaving IIIT-A	Reason for leaving IIIT-A

OR

I/We hereby declare that the following persons employed in IIIT-A and any other IIIT-A Project/Station are related to me/us for partners or directors of our concern as per details indicated.

Sl no	Name of person	Designation and Name of project or Office of IIIT-A	Relationship

Note: The near relative shall include wife, husband, parents and grandparents, children and grand-children, brothers, sisters,uncles, aunts and cousins and their corresponding in-laws.

(Signature of Tenderer)

(Name)

Witness Signature
Name:
Place:
Date:

Note:

1. Please tick whatever is applicable and delete/cut whatever is not applicable
2. Please attach extra sheet if necessary.

9.6 ANNEXURE – VI: BIDDER DETAILS

Sl	Name of the Company/ Bidder	To be filled by bidder (Documentary proof must be attached as applicable)
1	**Registered office Name**	
	Full address of the Registered office	
	Details of contact person(s)	
	Name	
	Designation	
	Telephone number(s)	
	Email	
2	**Name of Bidder**	
	Full Address of Office in Allahabad	
	Name of Contact person(s)	
	Designation	
	Telephone number(s)	
	Email	
3	**Technical Expert/Engineer who will be involved in this work in Allahabad, if any**	
	Name	
	Designation	
	Telephone number(s)	
4	List the major clients with whom your organization has been associated and submit documentary proof	a.
		b.
		c.
		d.

(Signature of Tenderer)

(Name)
(Seal)

Place:
Date:

9.7 ANNEXURE – VII:MANDATE FORM FOR ELECTRONIC FUND TRANSFER/RTGS TRANSFER & DETAILS OF BID SECURITY TRANSACTION

Ref. No.: IIIT-A/SP/NIT/612/1145/2020 **Date: / /**

To,
Registrar (Acting)
Indian Institute of Information Technology Allahabad
Deoghat, Jhalwa
Prayagraj - 211015

Sub: Authorization for release of payment/dues from Indian Institute of Information Technology, Allahabad through Electronic Fund Transfer/ RTGS Transfer.

1. Name of the Party/Firm/Company/Institute: _____
2. Address of the Party: _____
   City: _____
   Email ID: _____ Mob: _____
   Permanent Account Number: _____
3. Particulars of Bank:
   Bank Name: _____ Branch Place: _____
   Branch Name: _____ Branch City: _____
   PIN Code: _____ Branch Code: _____
   IFSC Code (11 Digit Alpha-Numeric Code): _____
   Account Type: Savings/ Current/ Cash Credit: _____
   Account Number:_____

DECLARATION

I hereby declare that the particulars given above are correct and complete. If any transaction delayed and not effected for reasons of incomplete or incorrect information, I shall not hold Indian Institute of Information Technology responsible. I also undertake to advise any change in the particulars of my account to facilitate updating of records for purpose of credit of amount through NEFT/RTGS Transfer.

Place: _____

Date: _____

Signature & Seal of the Authorized Signatory of the Party

Details of BID SECURITY are as follows (if submitted, attach a photocopy)*:

Bid security amount (in Rs.)	Bank Name	Issue Date	Valid till date	If transferred online (mention NEFT/RTGS)	Online Transaction No.OR DD/ FDR/ BG No.	Online Transaction dateOR DD/ FDR/ BG Date	If MSE's(mention Yes)#

***Attach a photocopy of proof regarding submission of bid security amount/ MSE Registration Certificate**

9.8ANNEXURE – VIII: ORIGINAL EQUIPMENT MANUFACTURER (OEM)

MANUFACTURER'S AUTHORIZATION FORM (MAF)

To,

The Director,
Indian Institute of Information Technology Allahabad
Deoghat, Jhalwa
Prayagraj - 211015

Dear Sir,

Reg: IIIT's Ref No. _____ Dated: _____

I/We manufacturers of original equipment at (address of factory) do hereby authorize M/s. (Name and address of Agent) to offer their quotation and conclude the contract with you against the above invitation for the Bid, as **one of our Authorized Dealers/only Dealer authorized to Bid. No company or firm or individual other than M/s. _____ _____is authorized to bid, and conclude the contract in regard to this business.** ***(Mention either Red or Blue Part)***

I/We have carefully read and understood all the terms and conditions of the tender and undertake to abide by them.

I/We hereby extend our full guarantee and comprehensive warranty as per terms and conditions of the NIT for our products offered against this invitation for Bid by the above firm.

Dated at _____this _____ day of _____ 2019.

Authorised Signatory,

(Name)
(Designation)
(Name & Address of the company)

Note: This letter of authority should be on the letterhead of the manufacturer and should be signed by a person competent and having the power of attorney to bind the manufacturer. It should be included by the Bidder in its techno-commercial unpricedbid.

9.9 ANNEXURE – IX: PERFORMANCE BANK GUARANTEE

To,

Registrar (Acting)
Indian Institute of Information Technology-Allahabad
Deoghat, Jhalwa
Prayagraj - 211015
(Uttar Pradesh)

WHEREAS……

(Name and address of the Contractor/Vendor) (Hereinafter called "the supplier") has undertaken, in pursuance of contract no. ……..

Dated …… to perform the work) (herein after called "the contract").

AND WHEREAS it has been stipulated by you in the said contract that the supplier shall furnish you with a bank guarantee by a scheduled commercial bank recognized by you for the sum specified therein as security for compliance with its obligations in accordance with the contract;

AND WHEREAS I/we have agreed to give the supplier such a bank guarantee:

NOW THEREFORE I/we hereby affirm that we are guarantors and responsible to you, on behalf of the supplier, up to a total of …… …… (Amount of the guarantee in words and figures), and we undertake to pay you, upon your first written demand declaring the supplier to be in default under the contract and without cavil or argument, any sum or sums within the limits of (amount of guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

I/We hereby waive the necessity of your demanding the said debt from the supplier before presenting us with the demand.

I/We further agree that no change or addition to or other modification of the terms of the contract to be performed there under or of any of the contract documents which may be made between you and the supplier shall in any way release us from any liability under this guarantee and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until the ……day of……., 20 _ _

……

(Signature of the authorized officer of the Bank)……

Name and designation of the office……

Seal, name & address of the Bank and address of the Branch (Bank's common seal)