Tender Ref No: RGUKT/Proc/Labs/Electrical Lab Equipment/T10/2018, dt.08.09.2018

BID DOCUMENT

e-Procurement

Open Competitive Bid (OCB)

For

Supply, Installation, Erection and Commissioning of Lab Equipment for Department of Electrical Engineering at Rajiv Gandhi University of Knowledge Technologies-Basar

Proprietary & Confidential

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES
BASAR
BASAR MANDAL, NIRMAL DISTRICT
TELANGANA-504107
Phone: 9492301704

Proprietary & Confidential

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News paper advertisement

e-Procurement Tender Notice

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES **BASAR CAMPUS,** **BASAR MANDAL, NIRMAL DISTRICT,** **TELANGANA-504107**
Online tenders are hereby invited from interested and eligible bidders for supply and installation of Lab Equipment for Electrical Engineering Department, RGUKT, Basar
Interested bidders can download and submit the bids online before 18.09.2018 up to 05:00PM through www.eprocurement.gov.in. For further details please visit our website: www.rgukt.ac.in **Date.08.09.2018** **Sd/-** **Vice-Chancellor**

Time schedule of various tender related events

Supply and Installation of Lab Equipment for Department of Electrical Engineering, RGUKT, Basar

Bid calling date	08.09.2018
Bid Document fee (Non Refundable)	Rs. 10,000/- (By way of DD from any Scheduled Bank)
Bid Documents Downloading Start date	13.09.2018 from 11.00 AM
Pre Bid Meeting	12.09.2018 11 AM
Bid Document Downloading End Date	18.09.2018 till 05:00 PM
Last date for uploading documents online	18.09.2018 at 05:30 PM.
Last date for Submission of documents (hard copies)	20.09.2018 at 04:00 PM.
Technical Bid opening date/time	22.09.2018 at 02:00 PM.
Price Bid opening date/time	23.09.2018 at 04.00 PM
Contact person	Director, RGUKT, Basar.

Note: For the assistance in the online submission issues, the bidder may contact the help desk of M/s.Vayam Technologies (e-procurement) at their e-mail address: helpdesk.eproc@vayamtech.com

CLARIFICATIONS:

i. Queries if any can be made through e-mail only on procurement@rgukt.ac.in on or before 12.09.2018. Queries received via any mode other then e-mail id mentioned above will not be entertained. The queries should only be sent in following format on the official letter head of the company.

S.No.	Page No. (Tender Ref.)	Clause (Tender Ref.)	Description (Tender Ref.)	Query

ii. The addendum/corrigendum if any shall be published on RGUKT's website i.e. www.rgukt.ac.in as well as on e-procurement platform www.eprocurement.gov.in.

iii. The Bidders are requested to submit the bids after issue of clarifications duly considering the changes made if any. Bidders are totally responsible for incorporating/complying the changes/ amendments issued if any during pre bid meeting in their bid.

Director,
RGUKT-Basar.

TENDER FORM

Not transferable

Reference No: **RGUKT/Proc/Labs/ Electrical Lab Equipment /T10/2018, dt.08.09.2018**

Subject: Tender for Supply and Installation of Electrical Machines for Department of Electrical Engineering, RGUKT, Basar located in Nirmal District – Reg..

Sir/Madam,

1) Bids are invited on the e-procurement platform from the Authorized distributors for supply and Installation of Lab Equipment for Department of Electrical Engineering, RGUKT-Basar. The details of bidding conditions and other terms can be downloaded from our website i.e.www.rgukt.ac.in or from the electronic procurement platform of Government of Telangana i.e. www.eprocurement.gov.in

2) Bidders would be required to register on the e-Procurement market place "www.eprocurement.gov.in" and submit their bids online. On registration with the e-Procurement market place they will be provided with a user id and password by the system through which they can submit their bids online.

3) The bidders need to scan and upload the required documents as per the Check list given. Such uploaded documents pertaining to technical bid need to be attached to the tender while submitting the bids on line. The attested copies of all these uploaded documents of technical bid, signed undertaking of tenderer should be submitted off line to Director, RGUKT, Basar by 04.00PM of 20.09.2018. The RGUKT will consider only the bids submitted through on-line over the copies of the paper based bids.

4)

a) The participating bidder/s will have to pay non-refundable tender processing fee Rs.10,000/- in the form of Demand Draft drawn from any Nationalized Bank, in favour of The Director, RGUKT, Basar payable at Basar.

b) Further the bidder/s shall furnish, as part of it bid, the Bid security for the amounts specified in the Section-II of Tender Document be paid in the form of an unconditional and irrevocable Bank Guarantee issued by any Nationalized bank in the standard format as shown in the Tender Schedule or a crossed Demand Draft drawn in favour of The Director, RGUKT, Basar along with bids.

c) Further all the participating bidders have to electronically pay a non-refundable transaction fee to M/s. TSTS, the service provider through "Payment Gateway

Service on E-Procurement platform", as per the Government Orders placed on the e-procurement website.

d) RGUKT will not accept the tenders from blacklisted companies or undependable Suppliers whose past performance with RGUKT was found poor due to delayed and/or erratic supplies and those with frequent product failures, and also against whom there have been adverse reports of Sub-Standard Quality / Poor Service of Equipment supplies, as defined in the other parts of the Bidding document.

For any clarification and further details on the above tender please contact Telephone No: 9492301704 or Contact Person during office hours.

STATEMENT OF IMPORTANT LIMITS/VALUES RELATED TO BID

Item	Description
Work Description	Supply and Installation of Lab Equipment for Department of Electrical Engineering, RGUKT, Basar
EMD /Bid Security	Rs.1,00,000/- (Rupees One Lakh only) (**by way of Demand Draft or by way of Irrevocable Bank Guarantee from any Scheduled Bank.**
Bid Validity Period	90 days from the date of opening of commercial bid
EMD Validity Period	90 days from the date of opening of commercial bid
Variation in quantities/number of residents	$\pm$ 20 %
Period for furnishing performance Security	Within 10 days from date of receipt of award
Delivery Schedule	The items must be delivered within 8 weeks from the date of Purchase Order.
Performance security value	10 % of contract value
Performance security validity period	38 months from award of contract (including 30 days of installation period)
Period for signing the order Acceptance	Within 7 days from date of receipt of notification of award
Warranty	5 years comprehensive warranty
Payment terms	
Payment of bill	Payment for goods and services shall be made in Indian rupees as follows. 1. 90% of the Order value will be paid after installation and commissioning 2. Balance 10% of the Order value will be paid after obtaining the satisfactory certificate from the end user.
Penalty for delay in supplies	For delays:- If the supplier fails to deliver any (or) all of the goods or perform the services within the time period specified in the contract the purchaser shall without prejudice to its other remedies under the contract deduct from the contract price as liquidated damages a sum equivalent to 0.5% of the contract value per a week until

	actual delivery or performance up to a maximum deduction of 10% of the delayed goods or services contract price. Once the maximum deduction is reached, the purchaser may consider the termination of the contract duly forfeiting the performance security etc.,.
Placing work order	➢ RGUKT, Basar, will place order on identified successful bidder. ➢ All the payments shall be made directly by RGUKT, Basar to the successful bidder as per the tender terms and conditions. ➢ RGUKT can split the order basing on the quoted price and service track record of the firm. The decision of RGUKT is final in this regard.
Transaction Fee	Transaction fee: All the participating bidders who submit the bids have to pay an amount @ 0.04% of their final bid value online with a cap of Rs. 10,000/- for quoted value of purchase up to Rs.50 crores and Rs.25000/- if the purchase value is above Rs.50 crores & service tax applicable @ 15% as levied by Govt. of India on transaction fee through online in favour of MD, TSTS. The amount payable to TSTS is non refundable.
Transaction Fee Payable to	The Managing Director, T.S. Technology Services Ltd., Hyderabad
Bid submission	Online through e-procurement platform i.e. www.eprocurement.gov.in .

TENDER SCHEDULE

1. **PREAMBLE**:

The Director, Rajiv Gandhi University of Knowledge Technologies (RGUKT), Basar, invites sealed tenders for Supply, Installation, Erection and Commissioning of Lab Equipment for Dept. of Electrical Engineering, RGUKT, Basar from reputed Manufacturers or their authorized distributors through e-procurement platfrom (i.e. www.eprocurement.gov.in).

2. **SCOPE OF WORK:**

For Supply, Installation, Erection and Commissioning of the following 5 Lab Equipments for Dept. of Electrical Engineering, RGUKT, Basar (Nirmal Dist), Telangana.

1. CONTROL SYSTEM LAB
2. ELECTRICAL MEASUREMENT LAB
3. POWER SYSTEMS LAB
4. POWER ELECTRONICS LAB
5. BASIC ELECTRICAL ENGINEEING LAB

Control Systems Lab requirements:

Sl.No	Item Description	Qty
1.	Servo Controlled Voltage Stabilizer with Voltmeter, Over Voltage, Under Voltage & Over Load Protections. Rating: 5KVA	1
2.	Transfer function of DC motor DC Shunt Motor-0.5HP/220V/1500rpm with mechanical loading Arrangement, Speed Control unit for the Motor and all other accessories and Equipment to perform above experiment	1
3.	Transfer function of DC Generator DC Motor-Generator set -0.5HP/220V/1500rpm with Speed Control unit for the Motor and all other accessories and Equipment to perform above experiment	1
4.	Time response of Second order system • Square wave rectified output with frequency variation	2

	provision • Damping factor can be varied continuously through suitable. Variable resistor (Potentiometer) provided on the front panel. Apart from the fixed resistances for under damped, critically damped conditions. • System is basically RLC network. • Variable ganged condenser is provided on the panel to vary natural frequency. • Sine function also provided for frequency response. • M p, td, tp&ts can be measured precisely on under damped response through proper triggering on a CRO. • Provision for 1st order 2nd order and 3rd order systems. Theoretical & practical values can be cross verified and all other accessories and Equipment required to perform above experiment	
5.	Characteristics of Synchros Synchro Transmitter/Receiver unit, all measuring devices and accessories and Equipment required to perform above experiment It should have following features : • Calibrated dials for reference and output position • Switch for transmitter and Receiver rotor supply • Synchro Transmitter and Receiver rotor terminals onboard • Synchro Transmitter and Receiver stator terminals onboard. • AC Voltmeter to measure stator and rotor voltages • On/Off Touch Switch • Sensitive, linear, stable and accurate • Easy to operate It should have following Technical Specifications : ➢ Transformer Rating : 100V AC, 1 amp (Rotor winding Supply) ➢ Digital Voltmeter : 0-400 V AC max. ➢ Power Supply : 230V ± 10%, 50Hz/60Hz ➢ Product Tutorial : Online on www.ScientechLearning.com ➢ Operating Conditions : 0-40 °C, 85% RH ➢ Included Accessories : Patch cord 14" (4mm)-10 nos. Mains cord-1 no.	2

	Experiment that can be performed: • Study of Synchro Transmitter • Study of Synchro Transmitter and Receiver pair • Study of Synchro Transmitter and Receiver pair with phase difference	
6.	Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor PLC Trainer, Suitable DRPS, and all other accessories and Equipment to perform above experiment The Trainer Should have the Following Features: • Freedom of select PLC of different make. • Open platform to explore wide PLC applications. • Toggle switches, Push to ON Switch, Limit switch, IR Sensor, Visual Indicator, Audio Indicator, DC Motor, Pilot Lamp, Relay Card , Potentiometer . • Human Machine Interface • Data Acquisition System • Supervisory Control and Data Acquisition System • Slotted disk for speed measurement • Separated unit for Motor in see through cabinet • User Friendly Software • PLC Simulation software • Din rail mounting for PLC. • Powerful Instructions Sets. • PC based Ladder Programming. • High Execution Speed. • Extremely easy and student friendly software to develop different programs. • Several sample ladder program • Choice of PLC and expansion modules. • Easy downloading of Programs. • Practice Troubleshooting Skills. • Compact Tabletop ergonomic design. • Ready experimental details	1

- Robust Construction.

The Trainer Should have the Following Technical Specifications:

Programmable Logic Controller

It should have 20 Digital Inputs , 12 Digital Outputs , 4 Analog Inputs , 2 Analog Output , program size 1K Words, Communication Ethernet and

Human Machine Interface

HMI Supply	:	+24V DC
CPU	:	32-bits 400MHz
RISC Storage	:	128M FLASH + 64M DDRAM
Display size	:	7 inch
Resolution	:	800×480 TFT LCD 65,536 colors
Interface	:	Ethernet
Touch Screen	:	High precision four-wire resistive

Data Acquisition System (DAQ)

It Should have 16 Digital Input , 16 Digital Output with Bottle filling station

Toggle Switch	:	8 nos.
Push to ON switch	:	5 nos.
Selector Switch	:	1 NOS.
IR Sensor	:	1 no.
Limit Switch	:	1 no.
Visual Indicator	:	8 nos.
Audio Indicator	:	1 no

	DC Motor : 1no. Pilot. Lamp : 1 no. Relay Card : 1 no. Supervisory Control and Data Acquisition System Tags : 150 Tags Function : Trending , Alarming , Animation , Reporting It should have following experiments: • Study and use of Ladder Programming. • Study and use of NO (Normally Open) and NC (Normally Close) Instruction. • Study and use of Types of Logic gates • Study and use of set and reset bit. • Study and use of Types of Timers (TON, TOFF, RTO). • Study and use of Types of Counter . • Study and use of compare Instruction. • Study and use of Math Instruction • Study and use of MOV instruction • Study and use Analog Inputs • Study and use of Analog Outputs. • Study and use of Interrupt. • Study and use of subroutine. • Study and use of math function. • PLC Communication with HMI and SCADA • Human machine Interface (HMI) • Creating Application/Screen in HMI • Downloading and Uploading programs • HMI Communication with PLC • Creating Alarm Message in HMI • Creating Trend in HMI • Creating SCADA application • Real time interface PLC with SCADA • Development of Dynamos and relating with parameter of PLC • PLC Interfaced with SCADA and Status read/Command transfer operation • Parameter reading of PLC in SCADA	

	• Creating Database of Tags • Creating & editing graphic display with animation • Trending • Creating Alarms • Connectivity with the different hardware • Communication with PLC • Generate report in text &pdf format • PLC Simulation Software • Control of Bottle filling station using PLC & DAQ.	
7.	Effect of feedback on DC servo motor (12 V, 1.2 A, 50 rpm) This unit consists of: 5K Ohm±1% linearity, Precision Servo Potentiometers having bearings used as error detector. Output potentiometer, similar as input potentiometer to convert output position into a voltage signal. Summing Amplifier with adjustable gain. Armature controlled D.C Servomotor with suitable coupling required for a) Output position indicator and load b) Tacho generator. D.C Tacho generator coupled to D.C. Motor, for derivative feedback. Preamplifier and power amplifier to drive the D.C. Motor on the basis of the error signal. D.C. Motor is 12 Volt lamp. Permanent magnet with gear train. Power supply for armature winding and electronics amplifier. Suitable test points brought on the side panel. A detailed instruction manual will be supplied. all other accessories and Equipment to perform above experiment	2
8.	Effect of P, PD, PI, PID Controller on a second order systems PID controller trainer on a second order system with provision to study response of a system under PI, PD and PID control and all other accessories and Equipment to perform above experiment The instrument should have following features : Proportional, Integral and Derivative functions can be checked on same board (configurable as P, I, D, PI, PD, PID) • ON/OFF Controller • Square and triangular wave with variable frequency for testing PID • Variable DC for set point	2

- Error detector
- Ist order system &IInd order system
- In built power supply
- Dead zone and disturbances generator
- Voltmeter for DC measurement
- Signals can be observed and measured at various blocks
- eManual describing working of trainer along with detailed experiment descriptions
- On board Touch Switch
- 5 Year Warranty

The instrument should have following Technical Specifications :

- Proportional Band : 5% to 55%.
- Integrator : 1 msec to 11 msec
- ON/OFF controller : ON = 12 V, OFF = -12 V
- On board Generator : Square Wave & Triangular Wave Generator of 0-156 Hz,
  Two Variable DC Supply +6V,+10V
- Interconnections : 2 mm socket
- Test Points : 5 nos
- Dimensions (mm) : W 326 x D 252 x H 52
- Power Supply : 100V - 240V AC, 50/60Hz
- Weight : 1.5Kg (approximately)
- Product Tutorial : Online on www.ScientechLearning.com
- Operating Conditions : 0-40 C, 85% RH
- Included Accessories : Patch cord 8"(2mm)-14 nos.
  Patch cord 12" (2mm)-6 Nos.,
  Mains cord-1 no.
  TechBook Power Supply-1 no.

Experiments that can be performed :

- Study of 'On/Off' Controller
- Study of open loop system
- Study of close loop system
- Study of close loop system with disturbance
- Study of steady state error
- Study of proportional Controller
- Study of Integrator Controller
- Study of Derivative Controller

	• Study of proportional + integrator (PI) Controller • Study of proportional + derivative (PD) Controller • Study of proportional + integrator + derivative (PID) Controller • Study of proportional + integrator + derivative (PID) in close Loop • Study of proportional + integrator + derivative (PID) with first order system • Study of proportional + integrator + derivative (PID) with Second order system	
9.	Lag and lead compensation – Magnitude and phase plot Lag-lead network study unit with provision to study the frequency response characteristics of 1. Lag 2. Lead and 3. Lead- lag compensating networks and Suitable Function Generator and All other accessories and Equipment to perform above experiment It should have following features : • Digital Frequency Counter • Square Wave Generator • Precise Signal Conditioning • Sensitive, linear, stable and accurate • Easy to operate • Rugged and compact • Functional Blocks indicated on board mimic • 2 mm socket for interconnection • Test points at various blocks to measure and observe the signals • eManual describing working of TechBook along with detailed experiment descriptions • On Board Touch Switch It should have following Technical Specifications : ➢ Frequency Counter : 0 Hz - 50 KHz ➢ Square Wave Generator : 0 Hz - 2 KHz ➢ 2 mm interconnection sockets : 16 ➢ Power Consumption : 1.6 VA (Approximately) ➢ Test Points : 17 nos ➢ Dimensions (mm) : W 326 x D 252 x H 52 ➢ Power Supply : 110V - 260V AC, 50/60Hz ➢ Weight : 1.5Kg (Approximately)	2

	➢ Product Tutorial : Online on www.ScientechLearning.com ➢ Operating Conditions : 0-40 C, 85% RH ➢ Included Accessories : Patch cords16" (2mm) - 5 nos. Mains cord-1no. TechBook Power Supply-1no. Experiment that can be performed: • Study of Lead Compensator • Study of Lag Compensator • Study of Lag-Lead Compensator • Bode plot of Lead Compensator • Bode plot of Lag Compensator • Bode plot of Lag-Lead Compensator • Study Lead Compensator as a filter • Study Lag Compensator as a filter • Study Lag-Lead Compensator as a filter • Study your various uncompensated circuit modules Lead Compensator • Study your various uncompensated circuit modules Lag Compensator • Study your various uncompensated circuit modules Lead Lag Compensator	
10.	Temperature controller using PID controller PID controller unit to conduct the above experiments with proper heater and cooling arrangements and provision for adjustment of P,I, D gains And all other accessories and Equipment to perform above experiment The Trainer Should have the Following Features: • Use of Industrial Process Control System. • Heavy Duty Bench-top Workstation. • Electrical Control Panel. • Capacitive level Sensor. • Temperature Transmitter. • Interface with Ethernet based DAQ • 8 Channel 24 bit ADC • Din rail mounting for PLC • Process Control Concept • RTD Sensor.	2

- Thermocouple Sensor
- Start, Stop, Emergency Stop button, indicators for Pump, Heater, Stirrer, Solenoid Valve, Audio Indicator, Visual Indicator.

- 2 Types of Controller: PID Control, DAQ Control.
- Process Loop Tuning & Stable Process.
- Real-Time PLC interface with ADC and Digital Input/output.
- Process Control by ON/OFF Controller
- Process Control by PID with Auto Tuning.
- Process Control Loops.
- Temperature Measurement and Control.
- Automatic and Manual Control.
- Leak proof safety Measure, sturdy piping.
- Enhanced Electrical Safety Consideration.
- Heat Transfer Concept.
- Transducer/Transmitter Calibration.
- Piping and Instrumentation Diagram.
- Built-in Instrumentation.
- Sump tank for inlet and outlet of water.
- User Friendly Software.
- Robust Construction.
- Platform with Caster wheel arrangement for ease in movement.
- Online Product tutorial

The Trainer Should have the Following Technical Specifications:

- Push to ON Switch: : 6
- Toggle Switch : 5
- Indicator Lamp : 5
- Emergency Stop Switch : 1
- Audio Indicator : 1
- Process (Measuring) : 1
- Tank

  Capacity : 15 Litres

  Material : Stainless Steel (SS304)

  Dimension : 300 X 315 X 250mm

- Supply (Sump) Tank : 1

  Capacity : 30 Litres

  Material : Stainless Steel (SS304)

	Dimension : 500 X 315 X 250 mm • Temperature Sensor : 1 Type : RTD (PT100) Wire : 3 Wire Rod Length : 9" Temperature Range : (-99 to 850°C) • Thermocouple Sensor : 1 Type : K Type Wire : 2 Wire Rod Length : 9" Temperature Range : (-200 to1250°C) • Heater : 1 Supply : 230 V AC (1000Watt) • Ammeter : 1 Range : 0 to 5A, 0.2% resolution • Solenoid Valve : 1 Supply Voltage : +230V AC Type : 2/2 Port size : 1/2" 2 Pressure range : 0-10kg/cm • Stirrer : 1 Supply : 12 V DC • Level Transmitter : 1 Supply Voltage : +24V DC Output Voltage : 4ma to 20ma Cable Entry : 2 X 1/2" BSP, SC gland brass User Interface : 4 digit display+4 Keys	

	Read out : 0 - 100%, 4-20mA LED (red), Digital, 2-1/2 Outputs : 4-20 mA PNP output (3 wire) or galvanically isolated (4 wire loop) (User selectable) 4 - 20 mA output is over current safe and compatible with PLCMeasurement range : 10-50000 pF. : Calibration :Calibratable over measurement range. : Calibration method : Easy (Using DIP Switches) Sensing rod material : Stainless Steel (SS304) Insulation : Full PTFE Mains : +24V DC @25mA (reverse polarity safe) Probe Length : 250mm • Temperature Transmitter : 1 Input RTD : Pt100 3 wire Output : 4 - 20 mA, two wire Accuracy : ±0.1% of the calibrated span Loop Supply : 24V DC nominal (12 to 36)V DC • Electrical Control panel with Switches, : MS Powder coated panel indicator, Test Points, PID and DAQ , Ammeter on front facia, DAQ mounted on DIN rail channel,multistrand wire with proper insulated, lugs, ferruling & neat wire dressing & clamping	

	• Industrial PID Controller : 1 Input : RTD (PT100), K type Thermocouple Display : 7 segment LED, dual display Control Action : PID & ON/OFF Supply Voltage : 230V AC Relay Action : Forward for cooling and reverse for heating • Water Pump : 1 Flow Rate : 3800L/h Operating Voltage : 165 -230 V AC • Piping : 1/2" PVC • Drain valve : 1 Size : ½" Size : ½" • Computer Interface : Ethernet Caster Wheel : 4 nos Dimension (mm) : W 3850 X D 1400 X H 1400 Weight : 75Kgs (Approximately). Power Supply : 230V ± 10%, 50 / 60 Hz • Data Acquisition System (DAQ) Analog input : 8 Analog output : 2 Digital input : 8 Digital Output : 8 ADC Resolution (In Bit) : 24	

	Unity gain amplifier(Buffer) : 2 (0-5V) USB : Yes Ethernet : Yes Data Login (PC based) : Yes UART Interface : Yes Software : Yes • List of Accessories Mains Cord : 1 Ethernet Cable : 1 Panel Gate Key : 1 Drawer Lock Key : 1 Flexible Pipe : 1 meter Product Tutorial : Online It should have following experiments: • Study of Thermal Process • Study and use of Process Control Platform using Software • Study and use of RTD characteristics. • Study and use of Thermocouple characteristic • Study and use of Temperature Transmitter characteristics • Study and use of Level Transmitter characteristics • Study and use of Alarm function • Study and use of Open loop for Temperature. • Study and use of Temperature on/off action using Software • Study of P, PI and PID control action using the Software for Temperature • Study of Industrial PID Controller as on/off Controller • Study of Industrial PID Controller as P, PI and PID Controller • Study of auto tuning mode of Industrial PID Controller • Study and use of Open loop for Level • Study and use of Level On/Off Controller using Software. • Study and use of Level P, PI and PID Control action using Software.	

11.	Characteristics of magnetic amplifiers Magnetic Amplifier Trainer Kit, Rheostat of 50Ω, 5 A and all other accessories and Equipment to perform above experiment	2
12.	Speed-Torque Characteristics of AC servo motor AC SERVO MOTOR SPEED TORQUE CHARACTERISTICS MEASUREMENT UNIT (Two Phase Servo Motor) Two Phase Servo Motor. A Speed measuring device, which will not load the motor. Loading arrangement for Servo Motor & Ammeter to measure Load current. AC supply to the motor, variable through built in auto transformer all other accessories and Equipment to perform above experiment	2

Electrical Measurements Lab :

S. No	Item Description	Qty.
1.	Crompton D.C Potentiometer- Calibration of PMMC ammeter and PMMC voltmeter Consist of Crompton DC potentiometer with built in coarse& fine, Rheostat, Stabilized power supply unit, volt ratio box, low resistance sensitive galvanometer desk top type. Crompton DC Potentiometer Voltage Details : 1 Dial - 6 x 250mV= 1500mV II Dial (slide wire)500 Divisions= 250mV = Total = 1750mV Electronic Standard Cell for 1.0180V Fixed Power Supply with 2 Volts Volt ratio box to extend the range from 0.00 to 750V Low resistance galvanometer with Desk stand MR-100 Model MCDC Ammeter 0 - 5/10A MCDC Voltmeter 0 - 150/300V Single Tube Rheostat - 50 / 5 Ω and all other accessories and equipments to perform the above experiment	1
2.	Calibration and Testing of single phase energy Meter Understanding Calibration of Energy meter	1

	• Trainer should have microcontroller based designed with inbuilt measurement facility of single phase kWh Energy, Voltage, Current, & Power. • Trainer should have Separate Seven Segment Display for Energy meter • Big font LCD (16 x 2) for use as Standard meter/Energy meter • calibration • Trainer should have Digital Calibration Operation using Keypad. • Trainer should have provision of to Connect External Voltmeter, Ammeter and Watt meter for Calibration. • Trainer should have Default and User Calibration modes are provided to avoid errors\ • Trainer should have operated on single phase supply 90 - 270V ±10%, 50Hz • Trainer should have Resolution 0.001kWh of Energy meter. • Trainer should have Calibration of Energy meter using inbuilt Watt meter & Voltmeter Ammeter with external meter • Trainer should have perform Study & measurement of the connection of Voltmeter, Ammeter & Watt meter for Power measurement of load in Transmission line • Trainer should have performed effect of wrong Calibration on Energy meter. Energy Meter 240V , 5 - 20A , 50 Hz Single Phase Auto Transformer 0 - 230/270V - 10A Single Phase Single Phase UPF Wattmeter - 5/10A -150/300/600V MIAC Voltmeter 0 - 150/300/600V MIAC Ammeter - 0 - 1/3/10A Single Phase / 220 V / 10 A / Wire Wound Resistive Load Bank controlled by Rotary Switches in 10 Steps. (1A - 5 Steps, 2A -1Steps , 3A - 1 Step)	

	Digital Stop watch Single Phase Inductive Load Bank 230V,10A(variable Type) and all other accessories and equipment to perform the above experiment	
3.	Calibration of Dynamometer Type Power Factor Meter Single Phase SPF1 Power Factor Meter -5/10A - 75/150/300V Auto Transformer 0 - 415/440V - 20A -Three Phase Single Phase UPF Wattmeter - 5/10A -150/300/600V MIAC Voltmeter 0 - 150/300/600V MIAC Ammeter - 0 - 1/3/10A Single Phase / 220 V / 10 A / Wire Wound Resistive Load Bank controlled by Rotary Switches in 10 Steps. (1A - 5 Steps, 2A -1Steps , 3A - 1 Step) Single Phase Capacitive Load Bank 230V ,10A with 1A switch with 10 Steps MCB Protection Patch cords. and all other accessories and Equipment to perform the above experiment	1
4.	Kelvin's double Bridge-Measurement of resistance-Determination of Tolerance It should have following features : • Easy illustration of Kelvin's bridge • Digital display (DPM) for null detection • Online product tutorial It should have following Technical Specifications : ➢ DC Power Supply : +5V ➢ Known Resistance : R1=100KΩ, 20KΩ, 10KΩ R3=1KΩ, 200Ω, 100Ω ➢ Unknown Resistance : 0.3Ω, 0.4Ω, 0.8Ω ➢ DPM : 2V ➢ Mains Supply : 230 V ±10%, 50 Hz ➢ Dimensions (mm) : 240 W x 345 D x 110 H Experiment that can be performed: • Determination of unknown resistance using Kelvin's bridge	2

	method and all other accessories and Equipment to perform the above experiment	
5.	Measurement of Inductance by Maxwell Bridge with Accessories It should have following features : • Illustration of both Maxwell's inductance bridge and • Maxwell's inductance-capacitance bridge on a single board • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial It should have following Technical Specifications : ➢ Mains supply : 230 V ±10%, 50 Hz ➢ DC Power supply : +12V, -12V ➢ Sine wave generator ➢ Fixed Frequency : 1KHz ±5% ➢ Amplitude Control Range : Upto 20Vpp ➢ Unknown Inductors : 10 mH, 20mH, 30 mH, 56µH, 24µH, 12µH ➢ DPM : 200mV ➢ Unknown Internal Resistance : 470W, 10 , 20 , 30 ➢ Dimensions (mm) : W 240 x D 345 x H 110 and all other accessories and Equipment to perform the above experiment	2
6.	Measurement of Inductance by Hay's Bridge accessories and Equipment to perform the above experiment	1
7.	Measurement of Inductance by Anderson Bridge Anderson Bridge with 1 Khz Sine wave Oscillator & Sensitive pair of Head Phones and all other accessories and Equipment to perform the above experiment	2
8.	Measurement of Capacitance by De Sauty Bridge with Accessories It should have following features : • A Complete set up with all necessary accessories • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial	1

	It should have following Technical Specifications : ➢ Sine Wave Generator Frequency range : 1kHz ±10% Amplitude control output : Up to 15Vpp ➢ Fuse : 500 mA, S/B ➢ DPM : 200 mV ➢ Unknown Capacitor : 0.1µF, 0.22µF, 0.47µF ➢ Mains Supply : 230V AC, ±10%,50Hz ➢ Dimension (mm) : W 345 x D 240 x H 110 Experiment that can be performed: • Determination of unknown capacitance using De Sauty's Bridge method And all other accessories and Equipment to perform the above experiment	
9.	Measurement of Capacitance by Schering Bridge It should have following features : • A Complete set up with all necessary accessories • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial • 2 Year Warranty It should have following Technical Specifications : ➢ Sine Wave Generator Frequency range : 1kHz ±10% Amplitude control output : Up to 15Vpp ➢ Fuse : 500 mA, S/B ➢ DPM : 200 mV ➢ Unknown Capacitor : 0.1µF, 0.22µF, 0.47µF ➢ Mains Supply : 230V AC, ±10%,50Hz ➢ Dimension (mm) : W 345 x D 240 x H 110 Experiment that can be performed: • Determination of unknown capacitance using Schearing Bridge method	2

	Schering Bridge with 1 Khz Sine wave Oscillator & Sensitive pair of Head Phones and all other accessories and Equipment to perform the above experiment	
10.	Measurement of voltage, current, and resistance using DC Crompton Potentiometer with and all other accessories and Equipment to perform the above experiment	2
11.	Dielectric oil testing using H.T. testing Kit Fully motorized high voltage control Break down voltage protection Over current protection Mains & H.T. "ON" & "OFF" Switches Incorporates automatic tripping mechanism Mains and H.T. "ON" indications Test cup with adjustable gap electrode arrangement Equipped with Kilo Voltmeter Complies to all the safety standards Product Tutorial (CD) Technical Specifications Mains Supply : 230V AC ±10%, 50Hz Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA HV Control Motor Type : Servo RPM : 500 (No Load) Voltmeter : 0 to 100kV Scope of Learning	1

	Study & measurement of (Dielectric Strength)of transformer oil Breakdown Voltage and all other accessories and equipment to perform the above experiment	
12.	Calibration LPF wattmeter- by Phantom testing Auto Transformer 0 - 230/270V - 10A -Single Phase MIAC Ammeter - 0 - 1/3/10A MIAC Voltmeter - 0 - 75/150/300V Single Phase LPF Wattmeter - 2.5/5A -150/300/600V Rheostat - 180D / 5 A Single Phase Fixed Inductor -50/100/150mH - 5A Single Phase Inductive Load Bank 230V,5A(variable Type) and all other accessories and equipment to perform the above experiment	1
13.	C.T. testing using mutual Inductor-Measurement of % ratio error and phase angle of given C.T.by null method Current Transformer Test Unit, 230V AC: Consist of Variable Current Source 0.30A with Digital Ammeter Primary Resistance (RP) (NI) Bank of fixed values Secondary Resistance (NI) Variable Standard CT 20/1, 15/1, 5/1, (1 No each)-With known Error Test CT 20/1, 15/1, 10/,5/1, (1 No each)-With unknown Error Variable Mutual Inductor Galvanometer /Digital Multimeter Slide Wire resistor Patch Cords and all other accessories and equipment to perform the above experiment	1
14.	P.T. testing by comparison-V.G.as Null detector-Measurement of % ratio error and phase angle of the given P.T Potential Transformer Test Unit, Three phase 415V- 5wire Standard PT 220/110, 440/110V with known Phase angel error and ratio error Test PT 220/110V, 440/110 V with unknown Phase angel error and ratio error Phase Shifter 3 Phase, 500VA	1

	Patch Cords and all other accessories and equipment to perform the above experiment	

POWER SYSTEMS Lab:

	Item Description	Qty
1.	Main Distribution Panel: AC 415V, 300 A	1
2.	Rectifier: 220 V, 100 A	1
3.	To obtain the performance characteristics of long transmission line The Instruments should have Key Features • Voltage, Current, Power, Power Factor Measurement • Simultaneous display of sending & receiving end • Inbuilt Variable AC Supply • Big Graphical LCD • Exclusive and attractive designed panel • Stand alone operation • Designed by considering all safety precautions • Diagrammatic representation for ease of connections • Learning material CD Instruments should have following Experiment Perform • To study Short Circuit, Medium, Long Transmission Line • Determine the ABCD, H, Z and Image parameters of Short ,Medium, Long Transmission Line • Understand the performance of transmission line under different load Artificial Transmission line module (220 KV): 400 KM. **Details of Transmission Line Model:** No. of Pi Sections: 10 nos. Operating Voltage : 110-220V Line to Neutral / Line to Line 415V Current Rating : 5 Amps, **Accessories :** Input Supply: 3 phase Dimmerstat 8 amps -- -- -- -- - -- 1no. **Sending End Panel :** Digital Voltmeters -- -01 no. Digital Ammeters -- -01 no. Analog Panel mounted wattmeter (0-500V, 5 Amps) ----02 nos. MCB Protection	2

	Transmission line model : No. of Pi Sections : 10 nos. Each pi-section for every 40Kms Inductors 10 nos for each phase (3lines) -- -- -- - 30nos. Capacitors 10 nos for each phase (3lines) -- -- -- - 30nos. **Receiving End Panel :** Digital Voltmeters -- -01 no. Digital Ammeters -- -01 no. Analog Panel mounted wattmeter (0-500V, 5 Amps) ----02 nos. MCB Protection Three Phase Resistive Load bank– 5 amps each phase and all other accessories and equipment to perform the above experiment	
4.	To obtain the operating characteristics of IDMT over current relay The Instruments should have Key Features • LCD Voltmeter, Ammeter, Automatic Timer • Inbuilt Variable AC Supply • Big font LCD Display for better visibility • Exclusive and rugged designed panel • Stand alone operation • Designed by considering all the safety precautions • Diagrammatic representation for the ease of connections • Learning material CD Instruments should have following Technical Specification **Electro Mechanical Type Relay** MCB for Switching on with Indications and BTI – 30 terminals for Connections. 1 Phase Auto Transformer 8 amps – 1no. Current Injecting Transformer 25 amps– 1no. Current controlling Choke 22 amps – 1no. Standard Class1 CT 30/1 amp --- 1no. Metering : 30 amps Digital meter reading thru CT ratio of 30/5 amps. Stopwatch to measure IDMT Panel mounting. 4 pole Contactor 16 amps with Push to ON and push to OFF contacts to create fault Current. Instruments should have following Experiment Perform • To study the IDMT Over Current Relay & its applications	1

	• To study and use plug setting multiplier • To study and use time setting multiplier • To study and verify the operating Characteristics of Over Current • Relay at various plug & time settings and all other accessories and equipment to perform the above experiment	
5.	To determine the breakdown strength of oil. Fully motorized high voltage control Break down voltage protection Over current protection Mains & H.T. "ON" & "OFF" Switches Incorporates automatic tripping mechanism Mains and H.T. "ON" indications Test cup with adjustable gap electrode arrangement Equipped with Kilo Voltmeter Complies to all the safety standards Product Tutorial (CD) Technical Specifications Mains Supply : 230V AC ±10%, 50Hz Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA HV Control Motor Type : Servo RPM : 500 (No Load) Voltmeter : 0 to 100kV Scope of Learning	1

	Study & measurement of (Dielectric Strength)of transformer oil Breakdown Voltage and all other accessories to perform the above experiment	
6.	Characteristics of Percentage biased of Static Differential Relay % biased of Static/Numerical differential Relay. Differential relay consists of operating coil and restraining coil in Electro Magnetic Relay. The differential relay is adjustable 20%, 30% and 40%. MCB for Switching on with Indications 3 Phase Auto Transformer 8 amps – 1no. 3 ph Transformer 400/200 volts Star/ Star – 3KVA. 10/5 amps Standard CT --- 3nos. 5/5 amps Standard CT --- 3nos. 12 to 24 VDC, 5Amps Power supply – 1no. Metering : 2AAC-1no, 5AAC – 3nos, 10AAC-3nos. 500VAC-2nos. Load Bank, Balanced load up to 2.5KW and 0.5KW in Unbalanced. 4 pole Contactor 16 amps with Push to ON and push to OFF contacts. and all other accessories and equipment to perform the above experiment	2
7.	Determination of sequence Impedances of a Cylindrical Rotor Synchronous Machine MCB for Switching on with Indications 1 Phase Auto Transformer 6 amps – 1no. 3 Point Starter. Metering : 2ADC, 500VAC, 5AAC, 300VDC,10ADC. DC Shunt motor coupled to 3 Phase Alternator. (Cylindrical Rotor Type). The motor and alternator are coupled with flexible coupling and fitted on MS Channel suitable frame. Make : BEM. Motor: 5 HP-220 volts DC –1500 RPM. Alternator: 3 KW- 3 Ph, 6 wire. and all other accessories and equipment to perform the above experiment	1
8.	Fault analysis of 3 phase Alternator, (LG, LL, LLG, LLLG faults). 1 Phase Auto Transformer 6 amps – 1no. 3 Point Starter. Metering: 2ADC, 500VAC, 5AAC, 300VDC, 10ADC. DC Shunt motor coupled to 3 Phase Alternator. (With Anti Vibration	2

	Pads). Motor: 5 HP-220 volts DC –1500 RPM. Alternator: 3 KW- 3 Ph, 6 wire. 220 Volts DC source required. Generator: 3.6 Kw-220 volt DC-1500 RPM. and all other accessories and equipment to perform the above experiment	
9.	Determination of Positive, Negative and zero sequence reactance of 3 phase Transformers 3 Phase Auto Transformer 10 amps – 1no. 3 phase Star / Delta Transformer Shell type. 400 / 200 Vac. 2KVA. Metering : 200VAC, 10AAC , 500VAC Digital meters. and all other accessories and equipment to perform the above experiment	2
10.	Reactive power control of long Transmission line and all other accessories and equipment to perform the above experiment	1
11.	Earthing, cabling and wiring for entire lab	
12.	Insulation mats for the above experiments	24
13.	Suitable Working tables for the panels to perform all the above mentioned experiments.	14

POWER ELECTRONICS LAB

S.No	**Description**	**Qty**
1	Panel for Power Electronics Lab Technical specifications of instruments and facility to be installed on the Panel should be as under: **Technical Specifications:** On Board Load Assembly, Single Phase Firing Circuit ,Three Phase Firing Circuit Cycloconverter Firing Circuit, Pulse Amplifier & Isolation Section, Diode Assembly SCR and IGBT Assembly ,Single Phase Low Voltage Power Supply, Three Phase Low Voltage Power Supply.	**12**

	It should have following Technical Specifications: Single Phase AC Power Supply : 230 V ± 10%, 50 Hz Center Tapped Transformer Supply : 115 V - 0 - 115 V 2 A Low Voltage AC Power Supply : 18 V - 0 -18 V, 15 V - 0 DC Power Supply : +35 V, - 35 V 250 mA +15 V, - 15 V 250 mA +12 V, - 12 V 500 mA +5 V, - 5 V 500 mA Three Phase AC Power Supply : 230 V Phase voltages, 415 Line voltage 50 Hz Three Phase Low Voltage Power Supply : 18 V Each Phase ± 10%, 50Hz MCB (Power Switch) : Single Phase 10 A MCB (Power Switch) : Three Phase 10 A Interconnections : 2 mm Socket & 4 mm Socket Diode Assembly : Diode 6 A10 1000 V / 6A IGBT Assembly : IGBT G4BC20S 600 / 10A SCR Assembly : YN 616 600 V / 16A Single Phase Firing Circuit : Ramp Comparator Method (Firing Angle Control 0 - 180^{o}) Cycloconverter Firing Circuit : (Firing Angle Control 0 - 180^{o})	

	Three Phase Firing Circuit : Ramp Comparator Method (Firing Angle Control 0 - 150^{o}) PWM Circuit Method : Triangular Comparator Frequency Range 270 Hz to 5 KHz (approx.) PWM Variation 0 - 90 % & 0 - 50% **Power Circuit Module** **Diode Assembly** Diode : 6A10 Voltage : 1000 V Current : 6 A Safety Terminal : 4 mm socket **SCR Assembly** SCR : TYN 616 Voltage : 600 V Current : 16 A Safety Terminal : 4 mm socket Snubber : RC Snubber Protected **IGBT Assembly** IGBT : G4BC20S Voltage : 600 V Current : 10 A Safety Terminal : 4 mm socket Snubber : RC Snubber Protected **Firing Circuit Module** **Ramp Comparator Firing Circuit** Power Supply : 15 V - 0 (AC Supply) +12V & Gnd (DC Supply) Firing Angle Control : 0 -180 variable Terminal Socket : 2 mm. **PWM Circuit** Power Supply : +12 V, - 12V & Gnd (DC Supply)		

	PWM Pulse cycle : PWM Pulse 1, 0 - 90 % duty PWM Pulse 2, 0 - 50 % duty cycle **Three Phase Firing Circuit** Power Supply : R, Y, B & N output1 Three Phase Low Voltage Power supply +12V & Gnd (DC Supply) Firing Angle Control : 0 -150° variable Terminal Socket : 2 mm. **Cycloconverter Firing Circuit** Power Supply : 18 V - 0 - 18 V (AC Supply) +12 V, +5 V & Gnd (DC Supply) Firing Angle Control : 0 -180° variable Terminal Socket : 2 mm. **Firing Circuit Module** **Ramp and Pedestal Firing Circuit** Power Supply : 15 V - 0 (AC Supply) Firing Angle Control : 30 -180° variable Terminal Socket : 2 mm. **Cosine Firing Circuit** Power Supply : 15V - 0 (AC Supply) +12V,+5V, -5V & Gnd (DC Supply) Firing Angle Control : 0 -180° variable Terminal Socket : 2 mm. **Microcontroller Based Firing Circuit** Power Supply : 18V - 0 - 18V (AC Supply) +12V , +5V & Gnd (DC Supply) Firing Angle Control : 0 -180° variable Terminal Socket : 2 mm. **Digital Oscilloscope :-** 50MHz 4 analog channel Digital Storage oscilloscope should support 1GSa/s sampling for analog channel, Memory Depth should be minimum 24 Mpts, Up to 30,000 wfms/s wave form capture rate, DC, AC or GND input coupling, Rise time 3.5	

	ns, vertical rage 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have interface like RS232/UART, I2C, SPI for protocol analysis, it should also have at least 26 nos automatic measurements and 6 bits hardware counter, advance and multi triggering facility, 7 inches 24bit true color TFT Display, I/O USB, LAN and real time waveform monitoring PC Software. Panel is to be integrated with the Work Bench which is already available in the lab All the necessary accessories and equipment and provision of power supply(single phase, three phase has to provided.	
2	**Workbench should have performed following experiments**: 1. Static Characteristics of SCR, Mosfet & IGBT. 2. Gate firing circuit of SCR. 3. Single phase AC Voltage Controller for R and RL loads 4. Single Phase fully controlled Bridge converter for R & RL loads. A. Single Phase full controlled bridge converter power ckt. Unit B. Single Phase Bridge Converter Triggering ckt. Unit. 5. Forced Commutation Study Unit. 6. Jones Chopper Power circuit with built in DC chopper firing circuit. 7. Single Phase Cyclo Converter for R & RL Loads 8. Single Phase Half Controlled Bridge Converter for R & RL loads. 9. 3 phase half controlled converter power circuit, 440v/5amps and 3 ph firing unit. 10. Single Phase Bridge Inverter for R & RL Loads: 11. Single phase Mc-Murray Bedford Inverter power circuit and firing circuit. 12. Single Phase Series Inverter for R & RL Loads	

	13. Single Phase Dual Converter for R & RL Loads : 14. Single phase Dual Converter Power circuit and firing circuit and many more ….. **15.** Single Phase Parallel Inverter(Centre tapped)	
3	**100 MHz 4 Channel Digital Storage Oscilloscope** 100MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling Analog channel: 1 GSa/s (single-channel),500 MSa/s (dual-channel), 250 MSa/s (three/four-channel),Memory Depth should be more than 20Mpts (more than 5 Mpts when using all channels simultaneously, vertical range 1mV/div - 10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have at least 26 nos automatic measurements and 6 bits hardware counter, more than 6.8" inch TFT Display, I Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., wide PC Interface USB Host & Device and LAN	**6**
4	**100MHz Two Channel Digital Storage Oscilloscope** 100MHz 2 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling Analog channel : 1 GSa/s on both channels,Memory Depth more than 25Mpts,Waveform update rate 50000 wfms/sec, vertical range500 µV/div to 10 V/div, , horizontal range 5.000 ns/div to 1.000 ks/div,the instrument should have triggering facility edge, pulse,video,slope,RS232,I2C,SPI, it should 6 bits hardware counter,Math functions like A+B, A-B, A×B, A/B, FFT, Logic Operation AND,OR,NOT,EXOR, Intg, Diff, Sqrt, LgExp,wide PC Interface USB Host & Device and LAN,more than 7.8" inch TFT Display	**6**

Basic Electrical Engineering Lab:

S.No	Description	Qty
1	Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.	2
2	Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents and power.	2
3	Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.	2
4	Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.	2
5	Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.	2

Important Notes:

1) All the necessary equipment and accessories to perform all the above mentioned experiments in each lab should be supplied along with the equipment.

2) Insulation mats for all labs wherever necessary should be provided by the bidder only

3) Proper earthing for all labs should be done by the bidder

4) Complete electrification work inside the lab should be done by the bidder.

5) Suitable Working tables for the panels to perform all the above mentioned experiments except power electronics lab.

6) Minimum 5 years warranty should be given for all the experiments.

INCOME TAX:

During the course of the contract period, deduction of income tax and surcharge as in force at source shall be made at the prevailing rate of income tax department issued from time to time of the gross amount of each bill.

3. **RATES , TAXES AND DUTIES:**

All the rates in the tender shall be inclusive of all statutory compliances like Service Tax, VAT, etc.

4. **ELIGIBILITY CRITERIA:**

4.1 Duly filled Technical Bid with proper seal and signature of authorized person on each page of the bid submitted. The person signing the bid should be the duly authorized representative of the firm/ company whose signature should be verified and certificate of authority should be submitted.

4.2 The power or authorization or any other document consisting of adequate proof of the ability of the signatory to bind the firm/ company should be annexed to the bid.

4.3 Self-Attested copy of Registration certificate, GST, PAN Card as applicable.

4.4 A certificate by the auditor/ CA/ CS indicating the turnover of the firm should be enclosed. The bidder should have minimum cumulative turnover of Rs. 50 Crore in last three financial years.

4.5 All documents related with Firm Registration/ Partnership Deed/ Articles of Memorandum of Association or Proprietorship Deed, Certificate of Incorporation should be attached.

4.6 Relevant ISO certificate in Laboratory Infrastructure to be submitted

4.7 Only the authorized distributors /resellers are allowed to bid for the items mentioned in the tender document. The specific authorization letter from Principal/s clearly indicating that the bidder is competent to sell & provide services for the items mentioned in the Scope of Supply given in this tender document should been closed.

4.8 The copy of Supply Orders/ Contracts/ Agreements issued by/ signed with Government of India (Ministry/ Department/ Undertaking/ PSU/ Educational Institutions such as IIT's, NIT's, or other such Central Universities/Banking sector/lT-SEZs/Technology parks/ Stock/Commodity exchanges and reputed private organizations including educational institutions in India) executed by the bidders in last five years ending March 31st 2018.

4.9 The bidder should also enclose the completion certificate duly issued by the end user.

4.10 The bidder should have completed at least **ONE** similar work not less than **Rs. 90 Lac** OR **TWO** similar works not less than **Rs. 70 Lac** each OR **THREE** similar works not less than **50 Lac each**. The similar work means supply & installation of all/ most of the items mentioned in this tender document in a single project on turn-key basis in India/abroad.

4.11 The agency must have a bank solvency of **at least 30 lakh**. Certificate from the Banker clearly stating the solvency must be attached **(Statutory Documents)**

4.12 Service call over telephone must be attended by the bidder within 24 hours and has to make necessary arrangement so that the item gets operational

within 7 days of the Phone-call; deviation from the above may lead to forfeiture of EMD/Security deposit and/ or blacklisting

4.13 The bidder should have servicing facility or work shop with in India so the provision of service is possible at a short notice and without incurrence of delay.

4.14 The bidder should have adequate experience in supply of such materials as required in the tender. Bidder should furnish proof of having supplied such materials as required in the tender in the previous financial year ending 31st March 2018 as mentioned above. A certificate indicating the Turn Over value details (in Rupees) of subject material, during the last three financial years 2015-16, 2016-17 and 2017-18 (for the year ending 31.03.2018) from a Firm of Chartered Accountants must be enclosed (in original) as a proof for Turnover along with audited balance sheets. The Turn Over of the subject Material must be separately indicated in the certificate.

4.15 The bidder should furnish satisfactory performance certificate from the parties concerned to whom bulk supplies were affected, in case such supplies were made. RGUKT may contact any such parties to elicit details**.**

4.16 All bidders shall also include the following information and documents with their tenders (in the Technical bid cover)

4.16.1 Copies of original documents defining the constitution or legal status, place of registration, and principal place of business of the bidding firm/entity; written power of attorney of the signatory of the Bid to commit the Bidder.

4.16.2 Machinery/equipment owned by the bidder and number of employees.

4.16.3 Latest Income Tax returns and **VAT/ CST** Returns filed.

4.16.4 List of Present Clientele with contact addresses & telephone numbers.

4.17 The bidder(s) should have their own manufacturing facility in India.

4.18 The bidder(s) should have an experience of establishing similar kind of laboratories in Institutes for more than 5 years.

4.19 The bidder(s) should produce the Certificate of incorporation of the organization.

4.20 The Bidder(s) should be ISO certified or certified by equivalent quality standards and necessary copy of ISO / equivalent certificate is to be enclosed.

4.21 The item to be used is strictly adhering to the specification and subject to test by the Institute / concerned authorities. It must be delivered and installed in good condition.

4.22 Audited balance sheet for the last 3 financial years.

4.23 Company PAN No., Tan No. and TIN No. to be mentioned.

4.24 Technical Brochure / Technical Specification with Equipments photograph to be present

Note: All the copies of certificates furnished should be attested by a Gazetted Officer, Bid document should be signed by bidder along with their seal.

The bidders must submit all relevant documentary evidence to support their claim for eligibility in placing bid. **The tenders received without the above documents will be rejected.**

5. BID PRICE:

i. The price should be quoted in Indian Rupees with delivery at RGUKT-Basar, failing which the bid would be rejected. The price shall be written both in figures & words in the prescribed offer form.

ii. The rates quoted by the bidder shall be fixed for the duration of the contract period and shall not be subject to adjustment on any account. But, any benefit arising out of any subsequent reduction in the prices due to reduction in duty & taxes after the prices are fixed and before the delivery should be passed on to the Purchaser (i.e. RGUKT).

iii. Any variation arises between unit price and the corresponding quoted total cost then the unit rate will prevail for calculating the total cost.

iv. If there is a discrepancy between amount in words and figures, the amount in the words will prevail.

v. Incomplete and/or conditional bids shall be liable to rejection. Prices should be quoted as per the format of price bid.

6. DELIVERY SCHEDULE:

i. The delivery period is 8(Eight) Weeks from the date of Purchase Order.

ii. In the event of delayed delivery i.e. delivery after the expiry of the delivery period as specified in the above table, the vendor shall be liable to pay a

penalty at a percentage of the value of the undelivered machines subject to a maximum of 10% as detailed below:

Note: If any items or part of items not delivered as per the purchase order during the stipulated time penalty will be calculated on all items pertaining to that location.

@ 0.5% for the One week
@1% for Two weeks
@1.5% for Three weeks
if delay continues beyond 4 weeks, then the contract is liable to be cancelled.

iii. The delivery not be deemed to be complete until and unless the ordered products are checked and accepted by the RGUKT as per the order and specifications. After the delivery is made, if it is discovered that the machines supplied are not according to our requirement, such supply would be rejected at the supplier's cost.

7. **PAYMENT TERMS:**

i. 90% payment would be released after installation and balance 10% payment would be released after obtaining satisfactory report from the end user. Payment shall be paid through RTGS/NEFT/Cheque within 45 days on delivery of items & on receipt of the following details:
   a. Original invoice duly signed by the authorized signatory.
   b. Item acceptance certificate duly signed and sealed from authorized representative of RGUKT.
   c. PAN card, Bank Account details, Bank Address & RTGS details of the agency are to be forwarded along with the invoice.

8. **EARNEST MONEY DEPOSIT / BID SECURITY:**

i. The bid should be accompanied by Earnest Money Deposit (EMD) of **Rs.1,00,000/-** by way of crossed Demand Draft drawn from any Nationalized or scheduled Bank in favor of "Director, RGUKT" payable at Basar.

ii. The EMD shall not carry any interest.
Tenders received without EMDs (which should be in Cover 'A') will be summarily rejected.

Forfeiture of the EMD: the forfeiture of EMD will be made in the following events:

i. The bidder qualifies as L1 and backs out of the L1 quotes/tender specification/ tender terms & conditions.
ii. The bidder signs the agreement and furnishes the Security Deposit but backs out of his tender bid.
iii. The bidder withdraws his tender after acceptance.
iv. The bidder withdraws his tender before expiry of the validity period of the tender.
v. The bidder violates any provisions of the terms and conditions of this tender specifications.

REFUND OF EMD:

vi. In case of unsuccessful bidder, the EMD will be returned to them after finalization of the L1 vendor.
vii. The EMD will be returned to the L1 bidder, only after signing of the contract and submission of Security Deposit, completion of formality etc. in all respects to the satisfaction of the RGUKT.

9. **PERFORMANCE SECURITY DEPOSIT:**

i. The successful bidder has to deposit 5% of the total contract value as performance security deposit in the form of Bank Guarantee from any nationalized bank.
ii. The Performance Security Deposit / Bank Guarantee of successful Bidder will be retained for the period of contract in force and will be returned after expiry of the contract period, after deducting the outstanding liabilities if any.
iii. The Performance Security Deposit / Bank Guarantee shall not carry any interest.

10. **GUARANTEE:**

i. The vendor shall provide a Certificate of Guarantee guaranteeing the Purchaser-Company of the satisfactory operation of the machines given by the vendor.

11. **ROYALTIES AND PATENTS:**

Any royalties or patents or the charges for the use or infringement thereof that may be involved in the contract shall be included in the price. Bidder shall protect RGUKT against any claims thereof.

12. The RGUKT shall have the right to relax or waive or alter any of the provisions of the tender document.

13. If the bidder wishes to depart from the Technical specifications in any respect he shall draw the attention to such points of departure explaining fully the reasons thereof and furnish separately adopting the form as per ANNEXURE-III. Unless this is done, the requirements of the Technical specification will be deemed to have been accepted in every respect. The RGUKT reserves the right to accept/reject any or all of the deviations shown by the bidder.

14. **INSTRUCTIONS TO BIDDERS**

i. Tenders with over writings, alterations etc., will not be admitted unless they are attested by the bidder. Where there is a discrepancy between the amount (Rupees) in figures and words, the price, which is least of the two, will prevail.

ii. Bid should be strictly in conformity with the Terms and Conditions mentioned in the tender schedule.

iii. Bidders are expected to examine all the terms and instructions mentioned in the tender schedule and prepare their proposals accordingly. Failure to provide all requisite information will be at the bidders' own risk and may result in the rejection of the tender.

iv. All assertions made in connection with the tender are to be supported/ substantiated by relevant documents. The Director, RGUKT, Basar reserves the right to verify the credentials of the bidder as per the eligibility criteria.

v. The Director, RGUKT, Basar will notify the bidder whose tender has been accepted.

vi. The successful bidder shall execute an agreement with RGUKT on Non-judicial stamp paper worth Rs.100/- agreeing to all the conditions of the contract within one week upon intimation of acceptance of Tender. The successful bidder has to submit performance security guarantee after taking Letter of Intent but before having contract agreement. Failure on enter into an agreement within the stipulated time will result in forfeiture of the EMD.

The Director, RGUKT, Basar reserves the right to issue instructions / modifications at any point of time before award of contract.

15. **METHOD OF SUBMISSION**:

Bids shall be submitted online on www.eprocurement.gov.in Platform.

i. The participating bidders in the tender should register themselves free of cost on e-procurement platform in the website www.eprocurement.gov.in

ii. Bidders can log-in to e-procurement platform in Secure mode only by signing with the Digital certificates.

iii. The bidders who are desirous of participating in e- procurement shall submit their technical bids, price bids as per the standard formats available at the e-market place.

iv. The bidders shall sign on all the statements, documents certificates uploaded by them, owning responsibility for their correctness/authenticity.

v. The bidders should scan and upload the respective documents in Technical Documentation as per the check list.

vi. After uploading the documents, the copies of the uploaded technical bid documents and original Demand Drafts in respect of Bid Security and Bid document fee are to be submitted by the bidder to the "The Director, RGUKT, Basar, Nirmal District-504107", by **04:00PM on 17.09.2018. (No physical submission of price bid will be entertained)**

vii. Failure to furnish any of the uploaded documents, certificates, will entitled in rejection of the bid. The RGUKT shall not hold any risk on account of postal delay. Similarly, if any of the certificates, documents, etc., furnished by the Bidder are found to be false / fabricated / bogus, the bidder will be disqualified, blacklisted, action will be initiated as deemed fit and the Bid Security will be forfeited.

viii. RGUKT will not hold any risk and responsibility regulating non-visibility of the scanned and uploaded documents.

ix. The Documents that are uploaded online on e-market place will only be considered for Bid Evaluation.

x. Important Notice to Contractors, Suppliers and Department users (i) In the endeavor to bring total automation of processes in e-Procurement, the Govt.hasissued orders vide G.O.Ms.No. 13 dated. 5.7.2006 permitting integration of electronic Payment Gateway of ICICI/HDFC/Axis Banks with e-Procurement platform, which provides a facility to participating suppliers / contractors to electronically pay the transaction fee online using their credit cards.

In case of consortium either the prime bidder or the consortium partner can purchase the bid document. The bid can be filed either with user ID of prime bidder or consortium partner.

xi. The rates should be quoted online only.

16. **EVALUATION PROCEDURE:**

i. The Technical Bids will be opened by the Director, RGUKT, Basar or his authorized representative in the presence of the bidders or their authorized representative who may be present at that time.

ii. The tenders will be evaluated so as to ascertain the capability of the bidders to provide the material with in the period mentioned above and also to assess whether the bidder satisfies the eligibility criteria as detailed in Clause 3 above.

iii. The rejection of the bidder on technical grounds will be based on the failure to meet eligibility requirements.

iv. Price Bids of only those bidders, who have fulfilled the eligibility criteria specified, will be opened. The Price Bid of the bidder who does not fulfill the eligibility criteria will not be opened and their tender stands rejected.

v. Any claims or disputes raised by the unsuccessful bidders in respect of selection process and non-allotment of award will have no legal validity and will not be enforceable against the RGUKT. No further correspondence will be entertained regarding the disqualification.

vi. The Director, RGUKT, Basar, reserves the right to accept or reject any / or all the tenders without assigning any reasons whatsoever. The Director, RGUKT, Basar, also reserves the right to cancel the selection process for award of the contract at any time. The decision of the Director, RGUKT, Basar is final and binding.

17. **FORCE MAJEURE:**

During force Majeure i.e. Acts of God, War, Floods, Riot, Earthquake, General Strike, Lock outs, Epidemics, Civil Commotions, the bidder shall inform the Purchaser immediately and provide their best possible service in given circumstances, and resume services as soon as possible after force majeure ceases.

18. **ARBITRATION:**

In the event of any dispute or differences between the supplier and the purchaser whether arising during the execution of orders under these terms and conditions or thereafter whether by breach or in manner in regard to:

i. The Construction or interpretation of the terms and conditions
ii. The respective rights and liabilities of the parties hereto there under
iii. Any matter or thing out of or in relation to or in connection with these terms and conditions then either party shall give notice to the other of the same and such dispute or difference shall be and hereby referred to the arbitration of such person as the Director, RGUKT, Basar, may nominate and the decision of such Arbitrator shall be conclusive and binding on the parties hereto. The provisions of Arbitration and Conciliation Act 1996 shall apply.

19. **DISPUTES**:

All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during or after completion of contract will be settled amicably (by negotiations) and the RGUKT's decision shall be final on all such matters and shall be binding on the Bidder.

20. **DISCLAIMER**:

i. Neither RGUKT nor its employees make any representation or warranty as to the accuracy, reliability or completeness of the information in this tender schedule and it is not possible for the RGUKT to consider the investment objective, financial situation and particular needs of each party who reads or uses the Tender Schedule. Certain prospective Bidders may have a better knowledge of the scope of work than others. Each prospective Bidder should conduct his or her own investigations and analysis and check the accuracy, reliability and completeness of the information in the Tender schedule and obtain independent advice from appropriate sources.

ii. Director, RGUKT, Basar, reserves the right to reject any or all the Bids submitted in response to this request for Proposal at any stage without assigning any reasons whatsoever.

iii. Director, RGUKT, Basar, reserves the right to change any or all of the provisions of this Request for Proposal.

21. **REJECTION OF TENDERS**:

i. The Director, RGUKT, Basar, reserves the right to cancel the tender process and reject all tenders at any time prior to the award of contract without thereby incurring any liability as against the affected bidder or any obligations to inform the affected bidder of the grounds of acceptance or rejection.

ii. No bidder is entitled to withdraw his or her offer after submission. In case of such withdrawal, the EMD deposited along with the tender schedule shall stand forfeited.

22. For breach of any of the conditions prescribed in the tender or as specified by the RGUKT from time to time, the EMD is liable to the forfeited. Decision of the Director, RGUKT, Basar in this regard is final and binding on bidder.

TECHNICAL BID

ANNEXURE-I

1. ELEGIBILITY CRITERIA:

S.No.	Description	Complied / Not ?
1	Duly filled Technical Bid with proper seal and signature of authorized person on each page of the bid submitted. The person signing the bid should be the duly authorized representative of the firm/ company whose signature should be verified and certificate of authority should be submitted.	
2	The power or authorization or any other document consisting of adequate proof of the ability of the signatory to bind the firm/ company should be annexed to the bid.	
3	Self-Attested copy of Registration certificate, GST, PAN Card as applicable	
4	A certificate by the auditor/ CA/ CS indicating the turnover of the firm should be enclosed. The bidder should have minimum average turnover of Rs50Cr in last three financial years.	
5	All documents related with Firm Registration/ Partnership Deed/ Articles of Memorandum of Association or Proprietorship Deed, Certificate of Incorporation should be attached.	
6	Relevant ISO certificate in Laboratory Infrastructure to be submitted	
7	Only the authorized distributors /resellers are allowed to bid for the items mentioned in the tender document. The specific authorization letter from Principal/s clearly indicating that the bidder is competent to sell & provide services for the items mentioned in the Scope of Supply given in this tender document should been closed.	
8	The copy of Supply Orders/ Contracts/ Agreements issued by/ signed with Government of India (Ministry/ Department/ Undertaking/ PSU/ Educational Institutions such as IIT's,	

	NIT's, or other such Central Universities/Banking sector/lT-SEZs/Technology parks/ Stock/Commodity exchanges and reputed private organizations including educational institutions in India) executed by the bidders in last five years ending March 31st 2018.	
9	The bidder should also enclose the completion certificate duly issued by the end user.	
10	The bidder should have completed at least **ONE** similar work not less than **Rs. 90 Lakh** OR **TWO** similar works not less than **Rs. 70 Lakh** each OR **THREE** similar works not less than **50 Lakh each**. The similar work means supply & installation of all/ most of the items mentioned in this tender document in a single project on turn-key basis in India/abroad.	
11	The agency must have a bank solvency of **at least 30 lakh**. Certificate from the Banker clearly stating the solvency must be attached **(Statutory Documents)**	
12	The bidder should have adequate experience in supply of such materials as required in the tender. Bidder should furnish proof of having supplied such materials as required in the tender in the previous financial year ending 31st March 2018 as mentioned above. A certificate indicating the Turn Over value details (in Rupees) of subject material, during the last three financial years 2015-16, 2016-17 and 2017-18 (for the year ending 31.03.2018) from a Firm of Chartered Accountants must be enclosed (in original) as a proof for Turnover along with audited balance sheets. The Turn Over of the subject Material must be separately indicated in the certificate.	
13	The bidder should furnish satisfactory performance certificate from the parties concerned to whom bulk supplies were affected, in case such supplies were made. RGUKT may contact any such parties to elicit details**.**	
14	Copies of original documents defining the constitution or legal status, place of registration, and principal place of business of the bidding firm/entity; written power of attorney of the signatory of the Bid to commit the Bidder.	

15	Latest Income Tax returns and **VAT/ CST** Returns filed.	
16	List of Present Clientele with contact addresses & telephone numbers.	
17	List of Present Clientele with contact addresses & telephone numbers.	
18	The bidder(s) should produce the Certificate of incorporation of the organization.	
19	Audited balance sheet for the last 3 financial years.	
20	Company PAN No., Tan No. and TIN No. to be mentioned	
21	Technical Brochure / Technical Specification with Equipments photograph to be present	

(on the official letterhead of Firm)

Financial Bid

ANNEXURE-II

Please quote amounts in numerals and words :

Sl.No	Item Description	Qty.		
1.	Servo Controlled Voltage Stabilizer with Voltmeter, Over Voltage, Under Voltage & Over Load Protections. Rating: 5KVA	1		
2.	Transfer function of DC motor DC Shunt Motor-0.5HP/220V/1500rpm with mechanical loading Arrangement, Speed Control unit for the Motor and all other accessories and Equipment to perform above experiment	1		
3.	Transfer function of DC Generator DC Motor-Generator set -0.5HP/220V/1500rpm with Speed Control unit for the Motor and all other accessories and Equipment to perform above experiment	1		
4.	Time response of Second order system • Square wave rectified output with frequency variation provision • Damping factor can be varied continuously through suitable. Variable resistor (Potentiometer) provided on the front panel. Apart from the fixed resistances for under damped, critically damped conditions. • System is basically RLC network. • Variable ganged condenser is provided on the panel to vary natural frequency. • Sine function also provided for frequency response. • M p, td, tp&ts can be measured precisely on under damped response through proper triggering on a CRO. • Provision for 1st order 2nd order and 3rd order systems. Theoretical & practical values can be cross verified	2		

	and all other accessories and Equipment required to perform above experiment			
5.	Characteristics of Synchros Synchro Transmitter/Receiver unit, all measuring devices and accessories and Equipment required to perform above experiment It should have following features : • Calibrated dials for reference and output position • Switch for transmitter and Receiver rotor supply • Synchro Transmitter and Receiver rotor terminals onboard • Synchro Transmitter and Receiver stator terminals onboard. • AC Voltmeter to measure stator and rotor voltages • On/Off Touch Switch • Sensitive, linear, stable and accurate • Easy to operate It should have following Technical Specifications : ➢ Transformer Rating (Rotor winding Supply) : 100V AC, 1 amp ➢ Digital Voltmeter : 0-400 V AC max. ➢ Power Supply : 230V ± 10%, 50Hz/60Hz ➢ Product Tutorial : Online on www.ScientechLearning.com ➢ Operating Conditions : 0-40 °C, 85% RH ➢ Included Accessories : Patch cord 14" (4mm)-10 nos. Mains cord-1 no. Experiment that can be performed: • Study of Synchro Transmitter • Study of Synchro Transmitter and Receiver pair	2		

	• Study of Synchro Transmitter and Receiver pair with phase difference			
6.	Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor PLC Trainer, Suitable DRPS, and all other accessories and Equipment to perform above experiment The Trainer Should have the Following Features: • Freedom of select PLC of different make. • Open platform to explore wide PLC applications. • Toggle switches, Push to ON Switch, Limit switch, IR Sensor, Visual Indicator, Audio Indicator, DC Motor, Pilot Lamp, Relay Card , Potentiometer . • Human Machine Interface • Data Acquisition System • Supervisory Control and Data Acquisition System • Slotted disk for speed measurement • Separated unit for Motor in see through cabinet • User Friendly Software • PLC Simulation software • Din rail mounting for PLC. • Powerful Instructions Sets. • PC based Ladder Programming. • High Execution Speed. • Extremely easy and student friendly software to develop different programs. • Several sample ladder program • Choice of PLC and expansion modules. • Easy downloading of Programs. • Practice Troubleshooting Skills. • Compact Tabletop ergonomic design. • Ready experimental details • Robust Construction.	1		

	The Trainer Should have the Following Technical Specifications: Programmable Logic Controller It should have 20 Digital Inputs , 12 Digital Outputs , 4 Analog Inputs , 2 Analog Output , program size 1K Words, Communication Ethernet and Human Machine Interface HMI Supply : +24V DC CPU : 32-bits 400MHz RISC Storage : 128M FLASH + 64M DDRAM Display size : 7 inch Resolution : 800×480 TFT LCD 65,536 colors Interface : Ethernet Touch Screen : High precision four-wire resistive Data Acquisition System (DAQ) It Should have 16 Digital Input , 16 Digital Output with Bottle filling station Toggle Switch : 8 nos. Push to ON switch : 5 nos. Selector Switch : 1 NOS. IR Sensor : 1 no. Limit Switch : 1 no.			

	Visual Indicator : 8 nos. Audio Indicator : 1 no DC Motor : 1no. Pilot. Lamp : 1 no. Relay Card : 1 no. Supervisory Control and Data Acquisition System Tags : 150 Tags Function : Trending , Alarming , Animation , Reporting It should have following experiments: • Study and use of Ladder Programming. • Study and use of NO (Normally Open) and NC (Normally Close) Instruction. • Study and use of Types of Logic gates • Study and use of set and reset bit. • Study and use of Types of Timers (TON, TOFF, RTO). • Study and use of Types of Counter . • Study and use of compare Instruction. • Study and use of Math Instruction • Study and use of MOV instruction • Study and use Analog Inputs • Study and use of Analog Outputs. • Study and use of Interrupt. • Study and use of subroutine. • Study and use of math function. • PLC Communication with HMI and SCADA • Human machine Interface (HMI) • Creating Application/Screen in HMI • Downloading and Uploading programs • HMI Communication with PLC • Creating Alarm Message in HMI • Creating Trend in HMI • Creating SCADA application • Real time interface PLC with SCADA			

	• Development of Dynamos and relating with parameter of PLC • PLC Interfaced with SCADA and Status read/Command transfer operation • Parameter reading of PLC in SCADA • Creating Database of Tags • Creating & editing graphic display with animation • Trending • Creating Alarms • Connectivity with the different hardware • Communication with PLC • Generate report in text &pdf format • PLC Simulation Software • Control of Bottle filling station using PLC & DAQ.			
7.	Effect of feedback on DC servo motor (12 V, 1.2 A, 50 rpm) This unit consists of: 5K Ohm±1% linearity, Precision Servo Potentiometers having bearings used as error detector. Output potentiometer, similar as input potentiometer to convert output position into a voltage signal. Summing Amplifier with adjustable gain. Armature controlled D.C Servomotor with suitable coupling required for a) Output position indicator and load b) Tacho generator. D.C Tacho generator coupled to D.C. Motor, for derivative feedback. Preamplifier and power amplifier to drive the D.C. Motor on the basis of the error signal. D.C. Motor is 12 Volt lamp. Permanent magnet with gear train. Power supply for armature winding and electronics amplifier. Suitable test points brought on the side panel. A detailed instruction manual will be supplied. all other accessories and Equipment to perform above	2		

	experiment			
8.	Effect of P, PD, PI, PID Controller on a second order systems PID controller trainer on a second order system with provision to study response of a system under PI, PD and PID control and all other accessories and Equipment to perform above experiment The instrument should have following features : Proportional, Integral and Derivative functions can be checked on same board (configurable as P, I, D, PI, PD, PID) • ON/OFF Controller • Square and triangular wave with variable frequency for testing PID • Variable DC for set point • Error detector • Ist order system &IInd order system • In built power supply • Dead zone and disturbances generator • Voltmeter for DC measurement • Signals can be observed and measured at various blocks • eManual describing working of trainer along with detailed experiment descriptions • On board Touch Switch • 5 Year Warranty The instrument should have following Technical Specifications : ➢ Proportional Band : 5% to 55%. ➢ Integrator : 1 msec to 11 msec ➢ ON/OFF controller : ON = 12 V, OFF = -12 V ➢ On board Generator : Square Wave & Triangular Wave Generator of 0-156 Hz, Two Variable DC Supply +6V,+10V	2		

	➢ Interconnections : 2 mm socket ➢ Test Points : 5 nos ➢ Dimensions (mm) : W 326 x D 252 x H 52 ➢ Power Supply : 100V - 240V AC, 50/60Hz ➢ Weight (approximately) : 1.5Kg ➢ Product Tutorial : Online on www.ScientechLearning.com ➢ Operating Conditions : 0-40 C, 85% RH ➢ Included Accessories : Patch cord 8″(2mm)-14 nos. Patch cord 12″ (2mm)-6 Nos., Mains cord-1 no. TechBook Power Supply-1 no. Experiments that can be performed : • Study of 'On/Off' Controller • Study of open loop system • Study of close loop system • Study of close loop system with disturbance • Study of steady state error • Study of proportional Controller • Study of Integrator Controller • Study of Derivative Controller • Study of proportional + integrator (PI) Controller • Study of proportional + derivative (PD) Controller • Study of proportional + integrator + derivative (PID) Controller • Study of proportional + integrator + derivative (PID) in close Loop • Study of proportional + integrator + derivative (PID) with first order system • Study of proportional + integrator + derivative (PID) with Second order system			

9.	Lag and lead compensation – Magnitude and phase plot Lag-lead network study unit with provision to study the frequency response characteristics of 2. Lag 2. Lead and 3. Lead- lag compensating networks and Suitable Function Generator and All other accessories and Equipment to perform above experiment It should have following features : • Digital Frequency Counter • Square Wave Generator • Precise Signal Conditioning • Sensitive, linear, stable and accurate • Easy to operate • Rugged and compact • Functional Blocks indicated on board mimic • 2 mm socket for interconnection • Test points at various blocks to measure and observe the signals • eManual describing working of TechBook along with detailed experiment descriptions • On Board Touch Switch It should have following Technical Specifications : ➢ Frequency Counter : 0 Hz - 50 KHz ➢ Square Wave Generator : 0 Hz - 2 KHz ➢ 2 mm interconnection sockets : 16 ➢ Power Consumption : 1.6 VA (Approximately) ➢ Test Points : 17 nos ➢ Dimensions (mm) : W 326 x D 252 x H 52 ➢ Power Supply : 110V - 260V AC, 50/60Hz ➢ Weight : 1.5Kg (Approximately)	2		

	➢ Product Tutorial : Online on www.ScientechLearning.com ➢ Operating Conditions : 0-40 C, 85% RH ➢ Included Accessories : Patch cords16" (2mm) - 5 nos. Mains cord-1no. TechBook Power Supply-1no. Experiment that can be performed: • Study of Lead Compensator • Study of Lag Compensator • Study of Lag-Lead Compensator • Bode plot of Lead Compensator • Bode plot of Lag Compensator • Bode plot of Lag-Lead Compensator • Study Lead Compensator as a filter • Study Lag Compensator as a filter • Study Lag-Lead Compensator as a filter • Study your various uncompensated circuit modules Lead Compensator • Study your various uncompensated circuit modules Lag Compensator • Study your various uncompensated circuit modules Lead Lag Compensator			
10.	Temperature controller using PID controller PID controller unit to conduct the above experiments with proper heater and cooling arrangements and provision for adjustment of P,I, D gains And all other accessories and Equipment to perform above experiment The Trainer Should have the Following Features: • Use of Industrial Process Control System. • Heavy Duty Bench-top Workstation. • Electrical Control Panel. • Capacitive level Sensor.	2		

	• Temperature Transmitter. • Interface with Ethernet based DAQ • 8 Channel 24 bit ADC • Din rail mounting for PLC • Process Control Concept • RTD Sensor. • Thermocouple Sensor • Start, Stop, Emergency Stop button, indicators for Pump, Heater, Stirrer, Solenoid Valve, Audio Indicator, Visual Indicator. • 2 Types of Controller : PID Control, DAQ Control. • Process Loop Tuning & Stable Process. • Real-Time PLC interface with ADC and Digital Input/output. • Process Control by ON/OFF Controller • Process Control by PID with Auto Tuning. • Process Control Loops. • Temperature Measurement and Control. • Automatic and Manual Control. • Leak proof safety Measure, sturdy piping. • Enhanced Electrical Safety Consideration. • Heat Transfer Concept. • Transducer/Transmitter Calibration. • Piping and Instrumentation Diagram. • Built-in Instrumentation. • Sump tank for inlet and outlet of water. • User Friendly Software. • Robust Construction. • Platform with Caster wheel arrangement for ease in movement. • Online Product tutorial The Trainer Should have the Following Technical Specifications: • Push to ON Switch: : 6 • Toggle Switch : 5 • Indicator Lamp : 5 • Emergency Stop Switch : 1 • Audio Indicator : 1 • Process (Measuring) : 1			

	• Tank Capacity : 15 Litres Material : Stainless Steel (SS304) Dimension : 300 X 315 X 250mm • Supply (Sump) Tank : 1 Capacity : 30 Litres Material : Stainless Steel (SS304) Dimension : 500 X 315 X 250 mm • Temperature Sensor : 1 Type : RTD (PT100) Wire : 3 Wire Rod Length : 9" Temperature Range : (-99 to 850°C) • Thermocouple Sensor : 1 Type : K Type Wire : 2 Wire Rod Length : 9" Temperature Range : (-200 to1250°C) • Heater : 1 Supply : 230 V AC (1000Watt) • Ammeter : 1			

	Range : 0 to 5A, 0.2% resolution • Solenoid Valve : 1 Supply Voltage : +230V AC Type : 2/2 Port size : 1/2" 2 Pressure range : 0-10kg/cm • Stirrer : 1 Supply : 12 V DC • Level Transmitter : 1 Supply Voltage : +24V DC Output Voltage : 4ma to 20ma Cable Entry : 2 X 1/2" BSP, SC gland brass User Interface : 4 digit display+4 Keys Read out : 0 - 100%, 4-20mA LED (red), Digital, 2-1/2 Outputs : 4-20 mA PNP output (3 wire) or galvanically isolated (4 wire loop) (User selectable) 4 - 20 mA output is over current safe and compatible with PLCMeasurement			

		range : 10-50000 pF. : Calibration :Calibratable over measurement range. : Calibration method : Easy (Using DIP Switches)			
	Sensing rod material : Stainless Steel (SS304) Insulation : Full PTFE Mains : +24V DC @25mA (reverse polarity safe) Probe Length : 250mm				
	• Temperature Transmitter : 1 Input RTD : Pt100 3 wire Output : 4 - 20 mA, two wire Accuracy : ±0.1% of the calibrated span Loop Supply : 24V DC nominal (12 to 36)V DC				
	• Electrical Control panel : MS Powder coated panel with Switches, indicator, Test Points, PID and				

		DAQ , Ammeter on front facia, DAQ mounted on DIN rail channel,multistrand wire with proper insulated, lugs, ferruling & neat wire dressing & clamping			
	• Industrial PID Controller : 1 Input : RTD (PT100), K type Thermocouple Display : 7 segment LED, dual display Control Action : PID & ON/OFF Supply Voltage : 230V AC Relay Action : Forward for cooling and reverse for heating • Water Pump : 1 Flow Rate : 3800L/h Operating Voltage : 165 -230 V AC • Piping : 1/2" PVC				

	• Drain valve : 1 Size : ½″ Size : ½″ • Computer Interface : Ethernet Caster Wheel : 4 nos Dimension (mm) : W 3850 X D 1400 X H 1400 Weight : 75Kgs (Approximately). Power Supply : 230V ± 10%, 50 / 60 Hz • Data Acquisition System (DAQ) Analog input : 8 Analog output : 2 Digital input : 8 Digital Output : 8 ADC Resolution (In Bit) : 24 Unity gain amplifier(Buffer) : 2 (0-5V) USB : Yes Ethernet : Yes Data Login (PC based) : Yes UART Interface : Yes Software : Yes • List of Accessories Mains Cord : 1			

	Ethernet Cable : 1 Panel Gate Key : 1 Drawer Lock Key : 1 Flexible Pipe : 1 meter Product Tutorial : Online It should have following experiments: • Study of Thermal Process • Study and use of Process Control Platform using Software • Study and use of RTD characteristics. • Study and use of Thermocouple characteristic • Study and use of Temperature Transmitter characteristics • Study and use of Level Transmitter characteristics • Study and use of Alarm function • Study and use of Open loop for Temperature. • Study and use of Temperature on/off action using Software • Study of P, PI and PID control action using the Software for Temperature • Study of Industrial PID Controller as on/off Controller • Study of Industrial PID Controller as P, PI and PID Controller • Study of auto tuning mode of Industrial PID Controller • Study and use of Open loop for Level • Study and use of Level On/Off Controller using Software. • Study and use of Level P, PI and PID Control action using Software.			
11.	Characteristics of magnetic amplifiers Magnetic Amplifier Trainer Kit, Rheostat of 50Ω, 5 A and all other accessories and Equipment to perform above experiment	2		

12.	Speed-Torque Characteristics of AC servo motor AC SERVO MOTOR SPEED TORQUE CHARACTERISTICS MEASUREMENT UNIT (Two Phase Servo Motor) Two Phase Servo Motor. A Speed measuring device, which will not load the motor. Loading arrangement for Servo Motor & Ammeter to measure Load current. AC supply to the motor, variable through built in auto transformer all other accessories and Equipment to perform above experiment	2		
13	Crompton D.C Potentiometer- Calibration of PMMC ammeter and PMMC voltmeter Consist of Crompton DC potentiometer with built in coarse& fine, Rheostat, Stabilized power supply unit, volt ratio box, low resistance sensitive galvanometer desk top type. Crompton DC Potentiometer Voltage Details : 1 Dial - 6 x 250mV= 1500mV II Dial (slide wire)500 Divisions= 250mV = Total = 1750mV Electronic Standard Cell for 1.0180V Fixed Power Supply with 2 Volts Volt ratio box to extend the range from 0.00 to 750V Low resistance galvanometer with Desk stand MR-100 Model MCDC Ammeter 0 - 5/10A MCDC Voltmeter 0 - 150/300V Single Tube Rheostat - 50 / 5 Ω and all other accessories and equipments to perform the above experiment	1		
14	Calibration and Testing of single phase energy Meter <u>Understanding Calibration of Energy meter</u> • Trainer should have microcontroller based designed with inbuilt measurement facility of single phase kWh Energy, Voltage, Current, &	1		

	Power. • Trainer should have Separate Seven Segment Display for Energy meter • Big font LCD (16 x 2) for use as Standard meter/Energy meter • calibration • Trainer should have Digital Calibration Operation using Keypad. • Trainer should have provision of to Connect External Voltmeter, Ammeter and Watt meter for Calibration. • Trainer should have Default and User Calibration modes are provided to avoid errors\ • Trainer should have operated on single phase supply 90 - 270V ±10%, 50Hz • Trainer should have Resolution 0.001kWh of Energy meter. • Trainer should have Calibration of Energy meter using inbuilt Watt meter & Voltmeter Ammeter with external meter • Trainer should have perform Study & measurement of the connection of Voltmeter, Ammeter & Watt meter for Power measurement of load in Transmission line • Trainer should have performed effect of wrong Calibration on Energy meter. Energy Meter 240V , 5 - 20A , 50 Hz			

	Single Phase Auto Transformer 0 - 230/270V - 10A Single Phase Single Phase UPF Wattmeter - 5/10A - 150/300/600V MIAC Voltmeter 0 - 150/300/600V MIAC Ammeter - 0 - 1/3/10A Single Phase / 220 V / 10 A / Wire Wound Resistive Load Bank controlled by Rotary Switches in 10 Steps. (1A - 5 Steps, 2A -1Steps , 3A - 1 Step) Digital Stop watch Single Phase Inductive Load Bank 230V,10A(variable Type) and all other accessories and equipment to perform the above experiment			
15	Calibration of Dynamometer Type Power Factor Meter Single Phase SPF1 Power Factor Meter -5/10A - 75/150/300V Auto Transformer 0 - 415/440V - 20A -Three Phase Single Phase UPF Wattmeter - 5/10A -150/300/600V MIAC Voltmeter 0 - 150/300/600V MIAC Ammeter - 0 - 1/3/10A Single Phase / 220 V / 10 A / Wire Wound Resistive Load Bank controlled by Rotary Switches in 10 Steps. (1A - 5 Steps, 2A -1Steps , 3A - 1 Step) Single Phase Capacitive Load Bank 230V ,10A with 1A switch with 10 Steps MCB Protection Patch cords. and all other accessories and Equipment to perform the above experiment	1		
16	Kelvin's double Bridge-Measurement of resistance-Determination of Tolerance	2		

	It should have following features : • Easy illustration of Kelvin's bridge • Digital display (DPM) for null detection • Online product tutorial It should have following Technical Specifications : ➢ DC Power Supply : +5V ➢ Known Resistance : R1=100KΩ, 20KΩ, 10KΩ R3=1KΩ, 200Ω, 100Ω ➢ Unknown Resistance : 0.3Ω, 0.4Ω, 0.8Ω ➢ DPM : 2V ➢ Mains Supply : 230 V ±10%, 50 Hz ➢ Dimensions (mm) : 240 W x 345 D x 110 H Experiment that can be performed: • Determination of unknown resistance using Kelvin's bridge method and all other accessories and Equipment to perform the above experiment			
17	Measurement of Inductance by Maxwell Bridge with Accessories It should have following features : • Illustration of both Maxwell's inductance bridge and • Maxwell's inductance-capacitance bridge on a single board • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial It should have following Technical Specifications : ➢ Mains supply : 230 V	2		

	±10%, 50 Hz ➢ DC Power supply : +12V, -12V ➢ Sine wave generator ➢ Fixed Frequency : 1KHz ±5% ➢ Amplitude Control Range : Upto 20Vpp ➢ Unknown Inductors : 10 mH, 20mH, 30 mH, 56µH, 24µH, 12µH ➢ DPM : 200mV ➢ Unknown Internal Resistance : 470W, 10 , 20 , 30 ➢ Dimensions (mm) : W 240 x D 345 x H 110 and all other accessories and Equipment to perform the above experiment			
18	Measurement of Inductance by Hay's Bridge accessories and Equipment to perform the above experiment	1		
19	Measurement of Inductance by Anderson Bridge Anderson Bridge with 1 Khz Sine wave Oscillator & Sensitive pair of Head Phones and all other accessories and Equipment to perform the above experiment	2		
20	Measurement of Capacitance by De Sauty Bridge with Accessories It should have following features : • A Complete set up with all necessary accessories • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial It should have following Technical Specifications : ➢ Sine Wave Generator Frequency range : 1kHz ±10% Amplitude control output : Up	1		

	to 15Vpp ➢ Fuse : 500 mA, S/B ➢ DPM : 200 mV ➢ Unknown Capacitor : 0.1µF, 0.22µF, 0.47µF ➢ Mains Supply : 230V AC, ±10%,50Hz ➢ Dimension (mm) : W 345 x D 240 x H 110 Experiment that can be performed: • Determination of unknown capacitance using De Sauty's Bridge method And all other accessories and Equipment to perform the above experiment			
21	Measurement of Capacitance by Schering Bridge It should have following features : • A Complete set up with all necessary accessories • Inbuilt 1 kHz sine wave generator with variable amplitude • Null detector with DPM • Online product tutorial • 2 Year Warranty It should have following Technical Specifications : ➢ Sine Wave Generator Frequency range : 1kHz ±10% Amplitude control output : Up to 15Vpp ➢ Fuse : 500 mA, S/B ➢ DPM : 200 mV ➢ Unknown Capacitor : 0.1µF, 0.22µF, 0.47µF ➢ Mains Supply :	2		

	230V AC, ±10%,50Hz ➢ Dimension (mm) : W 345 x D 240 x H 110 Experiment that can be performed: • Determination of unknown capacitance using Schearing Bridge method Schering Bridge with 1 Khz Sine wave Oscillator & Sensitive pair of Head Phones and all other accessories and Equipment to perform the above experiment			
22	Measurement of voltage, current, and resistance using DC Crompton Potentiometer with and all other accessories and Equipment to perform the above experiment	2		
23	Dielectric oil testing using H.T. testing Kit Fully motorized high voltage control Break down voltage protection Over current protection Mains & H.T. "ON" & "OFF" Switches Incorporates automatic tripping mechanism Mains and H.T. "ON" indications Test cup with adjustable gap electrode arrangement Equipped with Kilo Voltmeter Complies to all the safety standards Product Tutorial (CD) Technical Specifications Mains Supply : 230V AC ±10%, 50Hz	1		

	Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA HV Control Motor Type : Servo RPM : 500 (No Load) Voltmeter : 0 to 100kV Scope of Learning Study & measurement of (Dielectric Strength)of transformer oil Breakdown Voltage and all other accessories and equipment to perform the above experiment			
24	Calibration LPF wattmeter- by Phantom testing Auto Transformer 0 - 230/270V - 10A -Single Phase MIAC Ammeter - 0 - 1/3/10A MIAC Voltmeter - 0 - 75/150/300V Single Phase LPF Wattmeter - 2.5/5A - 150/300/600V Rheostat - 180D / 5 A Single Phase Fixed Inductor -50/100/150mH - 5A Single Phase Inductive Load Bank 230V,5A(variable Type) and all other accessories and equipment to perform the above experiment	1		
25	C.T. testing using mutual Inductor-Measurement of % ratio error and phase angle of given C.T.by null method Current Transformer Test Unit, 230V AC: Consist of Variable Current Source 0.30A with Digital Ammeter Primary Resistance (RP) (NI) Bank of fixed	1		

	values Secondary Resistance (NI) Variable Standard CT 20/1, 15/1, 5/1, (1 No each)-With known Error Test CT 20/1, 15/1, 10/,5/1, (1 No each)-With unknown Error Variable Mutual Inductor Galvanometer /Digital Multimeter Slide Wire resistor Patch Cords and all other accessories and equipment to perform the above experiment			
26	P.T. testing by comparison-V.G.as Null detector-Measurement of % ratio error and phase angle of the given P.T Potential Transformer Test Unit, Three phase 415V- 5wire Standard PT 220/110, 440/110V with known Phase angel error and ratio error Test PT 220/110V, 440/110 V with unknown Phase angel error and ratio error Phase Shifter 3 Phase, 500VA Patch Cords and all other accessories and equipment to perform the above experiment	1		
27	Main Distribution Panel: AC 415V, 300 A	1		
28	Rectifier: 220 V, 100 A	1		
29	To obtain the performance characteristics of long transmission line The Instruments should have Key Features • Voltage, Current, Power, Power Factor Measurement • Simultaneous display of sending & receiving end • Inbuilt Variable AC Supply • Big Graphical LCD • Exclusive and attractive designed panel	2		

	• Stand alone operation • Designed by considering all safety precautions • Diagrammatic representation for ease of connections • Learning material CD Instruments should have following Experiment Perform • To study Short Circuit, Medium, Long Transmission Line • Determine the ABCD, H, Z and Image parameters of Short ,Medium, Long Transmission Line • Understand the performance of transmission line under different load Artificial Transmission line module (220 KV): 400 KM. **Details of Transmission Line Model:** No. of Pi Sections: 10 nos. Operating Voltage : 110-220V Line to Neutral / Line to Line 415V Current Rating : 5 Amps, **Accessories :** Input Supply: 3 phase Dimmerstat 8 amps -- -- -- -- - -- 1no. **Sending End Panel :** Digital Voltmeters -- -01 no. Digital Ammeters -- -01 no. Analog Panel mounted wattmeter (0-500V, 5 Amps) ----02 nos. MCB Protection **Transmission line model :** No. of Pi Sections : 10 nos. Each pi-section for every 40Kms Inductors 10 nos for each phase (3lines) -- -- -- - 30nos. Capacitors 10 nos for each phase (3lines) -- -- -- - 30nos. **Receiving End Panel :** Digital Voltmeters -- -01 no. Digital Ammeters -- -01 no. Analog Panel mounted wattmeter (0-500V, 5 Amps) ----02 nos.			

	MCB Protection Three Phase Resistive Load bank– 5 amps each phase and all other accessories and equipment to perform the above experiment			
30	To obtain the operating characteristics of IDMT over current relay The Instruments should have Key Features • LCD Voltmeter, Ammeter, Automatic Timer • Inbuilt Variable AC Supply • Big font LCD Display for better visibility • Exclusive and rugged designed panel • Stand alone operation • Designed by considering all the safety precautions • Diagrammatic representation for the ease of connections • Learning material CD Instruments should have following Technical Specification **Electro Mechanical Type Relay** MCB for Switching on with Indications and BTI – 30 terminals for Connections. 1 Phase Auto Transformer 8 amps – 1no. Current Injecting Transformer 25 amps– 1no. Current controlling Choke 22 amps – 1no. Standard Class1 CT 30/1 amp --- 1no. Metering : 30 amps Digital meter reading thru CT ratio of 30/5 amps. Stopwatch to measure IDMT Panel mounting. 4 pole Contactor 16 amps with Push to ON and push to OFF contacts to create fault Current. Instruments should have following Experiment Perform • To study the IDMT Over Current Relay & its applications	1		

	• To study and use plug setting multiplier • To study and use time setting multiplier • To study and verify the operating Characteristics of Over Current • Relay at various plug & time settings and all other accessories and equipment to perform the above experiment			
31.	To determine the breakdown strength of oil. Fully motorized high voltage control Break down voltage protection Over current protection Mains & H.T. "ON" & "OFF" Switches Incorporates automatic tripping mechanism Mains and H.T. "ON" indications Test cup with adjustable gap electrode arrangement Equipped with Kilo Voltmeter Complies to all the safety standards Product Tutorial (CD) Technical Specifications Mains Supply : 230V AC ±10%, 50Hz Single Phase Variac : 230V/ 0-270V High Voltage Source : 80kV, 20mA HV Control Motor Type : Servo RPM : 500 (No Load)	1		

	Voltmeter : 0 to 100kV Scope of Learning Study & measurement of (Dielectric Strength)of transformer oil Breakdown Voltage and all other accessories to perform the above experiment			
32.	Characteristics of Percentage biased of Static Differential Relay % biased of Static/Numerical differential Relay. Differential relay consists of operating coil and restraining coil in Electro Magnetic Relay. The differential relay is adjustable 20%, 30% and 40%. MCB for Switching on with Indications 3 Phase Auto Transformer 8 amps – 1no. 3 ph Transformer 400/200 volts Star/ Star – 3KVA. 10/5 amps Standard CT --- 3nos. 5/5 amps Standard CT --- 3nos. 12 to 24 VDC, 5Amps Power supply – 1no. Metering : 2AAC-1no, 5AAC – 3nos, 10AAC-3nos. 500VAC-2nos. Load Bank, Balanced load up to 2.5KW and 0.5KW in Unbalanced. 4 pole Contactor 16 amps with Push to ON and push to OFF contacts. and all other accessories and equipment to perform the above experiment	2		
33.	Determination of sequence Impedances of a Cylindrical Rotor Synchronous Machine MCB for Switching on with Indications 1 Phase Auto Transformer 6 amps – 1no. 3 Point Starter. Metering : 2ADC, 500VAC, 5AAC, 300VDC,10ADC. DC Shunt motor coupled to 3 Phase Alternator. (Cylindrical Rotor Type). The motor and alternator are coupled with flexible coupling and fitted on MS Channel suitable frame. Make : BEM.	1		

	Motor: 5 HP-220 volts DC –1500 RPM. Alternator: 3 KW- 3 Ph, 6 wire. and all other accessories and equipment to perform the above experiment			
34.	Fault analysis of 3 phase Alternator, (LG, LL, LLG, LLLG faults). 1 Phase Auto Transformer 6 amps – 1no. 3 Point Starter. Metering: 2ADC, 500VAC, 5AAC, 300VDC, 10ADC. DC Shunt motor coupled to 3 Phase Alternator. (With Anti Vibration Pads). Motor: 5 HP-220 volts DC –1500 RPM. Alternator: 3 KW- 3 Ph, 6 wire. 220 Volts DC source required. Generator: 3.6 Kw-220 volt DC-1500 RPM. and all other accessories and equipment to perform the above experiment	2		
35	Determination of Positive, Negative and zero sequence reactance of 3 phase Transformers 3 Phase Auto Transformer 10 amps – 1no. 3 phase Star / Delta Transformer Shell type. 400 / 200 Vac. 2KVA. Metering : 200VAC, 10AAC , 500VAC Digital meters. and all other accessories and equipment to perform the above experiment	2		
36	Reactive power control of long Transmission line and all other accessories and equipment to perform the above experiment	1		
37	Earthing, cabling and wiring for entire lab			
38	Insulation mats for the above experiments	24		

39	Suitable Working tables for the panels to perform all the above mentioned experiments.	14		
40	Panel for Power Electronics Lab			
	Technical specifications of instruments and facility to be installed on the Panel should be as under: **Technical Specifications:** On Board Load Assembly, Single Phase Firing Circuit ,Three Phase Firing Circuit Cycloconverter Firing Circuit, Pulse Amplifier & Isolation Section, Diode Assembly SCR and IGBT Assembly ,Single Phase Low Voltage Power Supply, Three Phase Low Voltage Power Supply. **It should have following Technical Specifications:** Single Phase AC Power Supply : 230 V ± 10%, 50 Hz Center Tapped Transformer Supply : 115 V - 0 - 115 V 2 A Low Voltage AC Power Supply : 18 V - 0 -18 V, 15 V - 0 DC Power Supply : +35 V, - 35 V 250 mA +15 V, - 15 V 250 mA +12 V, - 12 V 500 mA +5 V, - 5 V 500 mA Three Phase AC Power Supply : 230 V Phase voltages, 415 Line voltage 50 Hz Three Phase Low Voltage Power Supply :	**12**		

	18 V Each Phase ± 10%, 50Hz MCB (Power Switch) : Single Phase 10 A MCB (Power Switch) : Three Phase 10 A Interconnections : 2 mm Socket & 4 mm Socket Diode Assembly : Diode 6 A10 1000 V / 6A IGBT Assembly : IGBT G4BC20S 600 / 10A SCR Assembly : YN 616 600 V / 16A Single Phase Firing Circuit : Ramp Comparator Method (Firing Angle Control 0 - 180^{o}) Cycloconverter Firing Circuit : (Firing Angle Control 0 -180^{o}) Three Phase Firing Circuit : Ramp Comparator Method (Firing Angle Control 0 - 150^{o}) PWM Circuit : Triangular Comparator Method Frequency Range 270 Hz to 5 KHz (approx.) PWM Variation 0 - 90 % & 0 - 50% **Power Circuit Module** **Diode Assembly**			

	Diode : 6A10 Voltage : 1000 V Current : 6 A Safety Terminal socket : 4 mm **SCR Assembly** SCR : TYN 616 Voltage : 600 V Current : 16 A Safety Terminal socket : 4 mm Snubber : RC Snubber Protected **IGBT Assembly** IGBT : G4BC20S Voltage : 600 V Current : 10 A Safety Terminal socket : 4 mm Snubber : RC Snubber Protected **Firing Circuit Module** **Ramp Comparator Firing Circuit** Power Supply : 15 V - 0 (AC Supply) +12V & Gnd (DC Supply) Firing Angle Control variable : 0 -180 Terminal Socket : 2 mm. **PWM Circuit** Power Supply : +12 V, - 12V & Gnd (DC Supply) PWM Pulse : PWM Pulse 1, 0 - 90 % duty cycle PWM Pulse 2, 0 - 50 % duty			

		cycle			
	Three Phase Firing Circuit				
	Power Supply & N output1	: R, Y, B			
		Three Phase Low Voltage Power supply +12V & Gnd (DC Supply)			
	Firing Angle Control variable	: 0 -150°			
	Terminal Socket	: 2 mm.			
	Cycloconverter Firing Circuit				
	Power Supply 0 - 18 V (AC Supply)	: 18 V -			
		+12 V, +5 V & Gnd (DC Supply)			
	Firing Angle Control variable	: 0 -180°			
	Terminal Socket	: 2 mm.			
	Firing Circuit Module				
	Ramp and Pedestal Firing Circuit				
	Power Supply 0 (AC Supply)	: 15 V -			
	Firing Angle Control 180° variable	: 30 -			
	Terminal Socket	: 2 mm.			
	Cosine Firing Circuit				
	Power Supply (AC Supply)	: 15V - 0			
		+12V,+5V, -5V & Gnd (DC Supply)			
	Firing Angle Control variable	: 0 -180°			
	Terminal Socket	: 2 mm.			
	Microcontroller Based Firing Circuit				
	Power Supply	: 18V - 0			

	- 18V (AC Supply) +12V , +5V & Gnd (DC Supply) Firing Angle Control : 0 -180° variable Terminal Socket : 2 mm. **Digital Oscilloscope :-** 50MHz 4 analog channel Digital Storage oscilloscope should support 1GSa/s sampling for analog channel, Memory Depth should be minimum 24 Mpts, Up to 30,000 wfms/s wave form capture rate, DC, AC or GND input coupling, Rise time 3.5 ns, vertical rage 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have interface like RS232/UART, I2C, SPI for protocol analysis, it should also have at least 26 nos automatic measurements and 6 bits hardware counter, advance and multi triggering facility, 7 inches 24bit true color TFT Display, I/O USB, LAN and real time waveform monitoring PC Software. Panel is to be integrated with the Work Bench which is already available in the lab All the necessary accessories and equipment and provision of power supply(single phase, three phase has to provided. **Workbench should have performed following experiments**: 16. Static Characteristics of SCR, Mosfet & IGBT. 17. Gate firing circuit of SCR. 18. Single phase AC Voltage Controller for R and RL loads 19. Single Phase fully controlled Bridge converter for R & RL loads. A. Single Phase full controlled bridge converter power ckt. Unit B. Single Phase Bridge Converter Triggering ckt. Unit. 20. Forced Commutation Study Unit.			

	21. Jones Chopper Power circuit with built in DC chopper firing circuit. 22. Single Phase Cyclo Converter for R & RL Loads 23. Single Phase Half Controlled Bridge Converter for R & RL loads. 24. 3 phase half controlled converter power circuit, 440v/5amps and 3 ph firing unit. 25. Single Phase Bridge Inverter for R & RL Loads: 26. Single phase Mc-Murray Bedford Inverter power circuit and firing circuit. 27. Single Phase Series Inverter for R & RL Loads 28. Single Phase Dual Converter for R & RL Loads : 29. Single phase Dual Converter Power circuit and firing circuit and many more ….. **30.** Single Phase Parallel Inverter(Centre tapped)			
41	**100 MHz 4 Channel Digital Storage Oscilloscope** 100MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling Analog channel: 1 GSa/s (single-channel),500 MSa/s (dual-channel), 250 MSa/s (three/four-channel),Memory Depth should be more than 20Mpts (more than 5 Mpts when using all channels simultaneously, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have at least 26 nos automatic measurements and 6 bits hardware counter, more than 6.8" inch TFT Display, I Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., wide PC Interface USB Host & Device and LAN	**6**		
42	**100MHz Two Channel Digital Storage Oscilloscope** 100MHz 2 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling Analog channel : 1 GSa/s on both channels,Memory Depth more than 25Mpts,Waveform update rate 50000 wfms/sec, vertical range500 µV/div to 10 V/div,	**6**		

	, horizontal range 5.000 ns/div to 1.000 ks/div,the instrument should have triggering facility edge, pulse,video,slope,RS232,I2C,SPI, it should 6 bits hardware counter,Math functions like A+B, A-B, A×B, A/B, FFT, Logic Operation AND,OR,NOT,EXOR, Intg, Diff, Sqrt, LgExp,wide PC Interface USB Host & Device and LAN,more than 7.8" inch TFT Display			
43	Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.	**2**		
44	Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents and power.	**2**		
45	Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.	**2**		
46	Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-	**2**		

	phase induction machine.			
47	Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.	**2**		
			SUB TOTAL	
			GST	
			GRAND TOTAL	

In figures: Rs. _____/-

In words: Rupees _____ only.

Note:

1) The bidder has to mention the percentage of taxes and duties.

2) The bidders have to strictly follow the formats available without any change in *Particulars* & *Format Nos.*

***3)* The prices should be inclusive of all taxes, central excise duty, standard packing, freight, transit, insurance, loading and unloading charges including Service Tax, Cess, etc. for each of the items quoted.**

(Signature of Bidder along with stamp)

DEVIATIONS FORMAT

ANNEXURE-III

Please quote amounts in numerals and words:

S.No.	Pg. No.	Clause (Tender Ref.)	Description in the Tender (Ref.)	Deviation Details	Reasons for deviation
1					

(Signature of Bidder along with stamp)

Ref. No. RGUKT/Proc/Labs/Electrical Lab Equipment/T10/2018, dt.08.09.2018

PERFORMANCE SECURITY FORM

(To be issued by any Scheduled in India and having at least one branch in Basar)

To
The Director,
Rajiv Gandhi University of Knowledge Technologies,
Basar, Nirmal District,
Telangana-504107.

WHEREAS…….. (Name of Vendor) hereinafter called "the Vendor" has undertaken, in pursuance of

Contract No……...Dated,…….(Date), to supply……called "the Contract" AND WHEREAS it has been stipulated by you in the said Contract, that the Vendor shall furnish you with a Bank guarantee by a recognized bank for the sum specified therein as security for compliance with the supplier's performance Obligations in accordance with the Contract.

WHEREAS we have agreed to give the Vendor a Guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Vendor, up to a total of Rs…….and we undertake to pay you, upon your first written demand declaring the Vendor to be in default under Rs……. (Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the ……..day of ……. (Date)

Place: Signature of Guarantors

Date: and Seal.

SUPPLY AGREEMENT FORM

Tender Ref : RGUKT/Proc/Labs/Electrical Lab Equipment/T10/2018, dt.08.09.2018
Tender Subject: Supply and installation of Electrical Machines to RGUKT.

THIS AGREEMENT made the ..... day of..... (Month) (Year). Between the Rajiv Gandhi University of Knowledge Technologies, Basar (hereinafter "the RGUKT") the first party

AND

..... (Name of Vendor) of..... (City and Country of Vendor) (Hereinafter "the Vendor") of the second party:

This agreement of the two parties read as follows:

WHEREAS the RGUKT called for tenders from various companies for supply of Electrical Machines as follows:

S.No.	Item Description
1	Kindly attach as Annexure as mentioned in the document

WHEREAS the vendor has submitted the quotations, which was accepted by the RGUKT after discussions; and

WHEREAS the RGUKT is desirous of placing the purchase order for supply of the above Software (latest version); and

WHEREAS the vendor had agreed to affect the above supplies, as per the terms and conditions mentioned herein below:

WHEREAS The vendor has submitted Bank Guarantee vide BG No: _____ Dt._____, issued by _____(Name of the Bank & Branch), which is valid up to _____. The vendor was issued the **Purchase order No RGUKT/Proc/Labs/Electrical Lab Equipment/T10/2018, dt.08.09.2018, Dt. _____,** subject to the following terms and conditions and the schedules I, II and III appended.

TERMS AND CONDITIONS:

1. Tender Offer & Period of Agreement:
   - 1.1. The lab equipments are purchased, delivered to the RGUKT, Basar.
   - 1.2. This agreement is valid for this lot of order(s) only and till expiry of warranty period/installation of the last license under this lot. However, the period of agreement may be extended by mutual consent.
2. PRICE:
   - 2.1. The order value is as follows:

S.No.	Item Description
1	Kindly attach as Annexure as mentioned in the document

2.2. The above prices are inclusive of all applicable taxes (VAT/Service Tax), octroi and for life time validity.

2.3. The price quoted shall be all inclusive of ex-factory price, packing, forwarding, freight

2.4. The rates quoted by the bidder shall be fixed for the duration of the contract period and shall not be subject to adjustment on any account. But, any benefit arising out of any subsequent reduction in the prices due to reduction in duty & taxes after the prices are fixed and before the delivery should be passed on to the Purchaser (i.e. RGUKT).

3. DELIVERY SCHEDULE:

3.1. The vendor has to deliver the handbooks to the RGUKT-Basar.

3.2. The delivery period is 8 (Eight) Weeks from the date of award of Contract.

3.3. In the event of delayed delivery i.e. delivery after the expiry of the delivery period as specified Para 4(iii) herein above, the vendor shall be liable to pay a penalty at a percentage of the value of the undelivered machines subject to a maximum of 10% as detailed below:

Note: If any items or part of items not delivered as per the purchase order during the stipulated time penalty will be calculated on all items pertaining to that location.

@ 0.5% for the One week
@1% for Two weeks
@1.5% for Three weeks
if delay continues beyond 4 weeks, then the contract is liable to be cancelled.

3.4. The delivery not be deemed to be complete until and unless the ordered products are checked and accepted by the RGUKT as per the order and specifications. No installation required for the above products.

3.5. After the delivery is made, if it is discovered that the licenses supplied are not according to our requirement, such supply would be rejected at the supplier's cost.

4. PAYMENT TERMS:

i. 90% payment would be released after installation and balance 10% payment would be released after 15 days after obtaining satisfactory

report from the end user. Payment shall be paid through RTGS/NEFT/Cheque within 45 days on delivery of items & on receipt of the following details:

4.1.1. Original invoice duly signed by the authorized signatory.

4.1.2. Item acceptance certificate duly signed and sealed from authorized representative of RGUKT.

4.1.3. PAN card, Bank Account details, Bank Address & RTGS details of the agency are to be forwarded along with the invoice.

5. GUARANTEE:

5.1. The vendor shall provide a Certificate of Guarantee guaranteeing the Purchaser-Company of the satisfactory operation of the Electrical Machines given by the vendor.

6. ROYALTIES AND PATENTS:

Any royalties or patents or the charges for the use or infringement thereof that may be involved in the contract shall be included in the price. Bidder shall protect RGUKT against any claims thereof.

7. FORCE MAJEURE:

During force Majeure i.e. Acts of God, War, Floods, Riot, Earthquake, General Strike, Lock outs, Epidemics, Civil Commotions, the bidder shall inform the Purchaser immediately and provide their best possible service in given circumstances, and resume services as soon as possible after force majeure ceases.

8. ARBITRATION:

In the event of any dispute or differences between the supplier and the purchaser whether arising during the execution of orders under these terms and conditions or thereafter whether by breach or in manner in regard to:

8.1. The Construction or interpretation of the terms and conditions

8.2. The respective rights and liabilities of the parties hereto there under

8.3. Any matter or thing out of or in relation to or in connection with these terms and conditions then either party shall give notice to the other of the same and such dispute or difference shall be and hereby referred to the arbitration of such person as the Director, RGUKT, Basar, may nominate and the decision of such Arbitrator shall be conclusive and binding on the parties hereto. The provisions of Arbitration and Conciliation Act 1996 shall apply.

9. **DISPUTES**:

All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during or after completion of contract will be settled amicably (by negotiations) and the RGUKT's decision shall be final on all such matters and shall be binding on the Bidder.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with their respective laws the day and year above written.

Signed, and delivered by	Signed, and delivered by
Second Party	First Party
for _____ (Name of the Vendor)	For Rajiv Gandhi University of Knowledge Technologies, Basar
Vendor's common seal: Place: Basar Date: _____	RGUKT common seal: Place: Basar Date: _____
IN THE PRESENCE OF 1) _____ 2) _____	IN THE PRESENCE OF 1) _____ 2) _____

Bid letter form

From:

(Registered name and address of the bidder)

To
Rajiv Gandhi University of Knowledge Technologies,
Basar, Nirmal Dsitrict,
Telangana-504107.

Sir,

Having examined the bidding documents and amendments there on, we the undersigned, offer to supply of lab equipment as the case may be, in conformity with the terms and conditions of the bidding document and amendments thereon in response to your tender call dated……

We undertake to provide the above mentioned services, as assigned to us in conformity with the said bidding documents, for an estimated sum of Rs …… (Total bid amount in words and figures) which may vary in accordance with the schedule of prices attached herewith and coverage options made by RGUKT or its user organization.

If our bid is accepted, we undertake to:

a. Supply of lab equipment according to the time schedule specified in the bid document,

b. Obtain the performance guarantee from a Nationalized bank in accordance with bid requirements for the due performance of the contract,

c. Agree to abide by the bid conditions, which remain binding upon us during the entire bid validity period and bid, may be accepted any time before the expiration of that period.

d. We understand that you are not bound to accept the lowest or any bid you may receive, nor to give any reason for the rejection of any bid, and that you will not defray any expenses incurred by us in bidding.

Place: Bidder's Signature

Date: Seal.

Bidder Information

(IN TECHNICAL BID)

1	Name of the organization	
2	Year of establishment	
3	Registered Office Address	
4	Name & Designation of Authorized person	
5	Phone No.	
6	Fax No.	
7	Email	
8	**Bank Details of the Agency**	
	Bank Name	
	Bank Address	
	Bank Account Number	
	IFSC Code	
9	PAN No.	
10	TIN No.	
11	Total No. of branch offices in Telangana	
12	Details of EMD furnished	
13	Details of certificates enclosed.	

(IN TECHNICAL BID)

Turn over details of item/product – 2017-18

S.No	Name of the Organization from which purchase order is obtained	Details of Electrical Machines sold	Amount (Rs in Lakhs)

List of Major Customers – 2017-18

S. No	Customer Full Address	Year of supply	Details of Electrical Machines sold	Turn Over (Rs.)

CHECK LIST

IMPORTANT:

The Bidder must ensure that the following details in the check list are furnished along with the bid document. The bidder must also carefully go through all the contents of the BID Document and any additional information/documents, required more than the items listed in the check list below, also shall have to be furnished. Non-furnishing of any required information/document as per the Tender Document will lead to rejection of the bid.

S.No	Particulars	Name of the file uploaded	Page Number
1	Bidder Information Sheet		
2	Tender Processing Fee of Rs.10,000/- by way of DD from any nationalized Bank		
3	EMD (DD/BG) of Rs. 1,00,000/- from any Scheduled Bank.		
4	Duly filled Technical Bid with proper seal and signature of authorized person on each page of the bid submitted. The person signing the bid should be the duly authorized representative of the firm/ company whose signature should be verified and certificate of authority should be submitted.		
5	The power or authorization or any other document consisting of adequate proof of the ability of the signatory to bind the firm/ company should be annexed to the bid.		
6	Self-Attested copy of Registration certificate, GST, PAN Card as applicable		
7	A certificate by the auditor/ CA/ CS indicating the turnover of the firm should be enclosed. The bidder should have minimum average turnover of Rs50Cr in last three financial years.		
8	All documents related with Firm Registration/ Partnership Deed/ Articles of Memorandum of Association or Proprietorship Deed, Certificate of Incorporation should be attached.		
9	Relevant ISO certificate in Laboratory Infrastructure to be submitted		
10	Only the authorized distributors /resellers are		

	allowed to bid for the items mentioned in the tender document. The specific authorization letter from Principal/s clearly indicating that the bidder is competent to sell & provide services for the items mentioned in the Scope of Supply given in this tender document should been closed.		
11	The copy of Supply Orders/ Contracts/ Agreements issued by/ signed with Government of India (Ministry/ Department/ Undertaking/ PSU/ Educational Institutions such as IIT's, NIT's, or other such Central Universities/Banking sector/lT-SEZs/Technology parks/ Stock/Commodity exchanges and reputed private organizations including educational institutions in India) executed by the bidders in last five years ending March 31st 2018.		
12	The bidder should also enclose the completion certificate duly issued by the end user.		
13	The bidder should have completed at least **ONE** similar work not less than **Rs. 90 Lakh** OR **TWO** similar works not less than **Rs. 70 Lakh** each OR **THREE** similar works not less than **50 Lakh each**. The similar work means supply & installation of all/ most of the items mentioned in this tender document in a single project on turn-key basis in India/abroad.		
14	The agency must have a bank solvency of **at least 30 lakh**. Certificate from the Banker clearly stating the solvency must be attached **(Statutory Documents)**		
15	The bidder should have adequate experience in supply of such materials as required in the tender. Bidder should furnish proof of having supplied such materials as required in the tender in the previous financial year ending 31st March 2018 as mentioned above. A certificate indicating the Turn Over value details (in Rupees) of subject material, during the last three financial years 2015-16, 2016-17		

	and 2017-18 (for the year ending 31.03.2018) from a Firm of Chartered Accountants must be enclosed (in original) as a proof for Turnover along with audited balance sheets. The Turn Over of the subject Material must be separately indicated in the certificate.		
16	The bidder should furnish satisfactory performance certificate from the parties concerned to whom bulk supplies were affected, in case such supplies were made. RGUKT may contact any such parties to elicit details**.**		
17	Copies of original documents defining the constitution or legal status, place of registration, and principal place of business of the bidding firm/entity; written power of attorney of the signatory of the Bid to commit the Bidder.		
18	Latest Income Tax returns and **VAT/ CST** Returns filed.		
19	List of Present Clientele with contact addresses & telephone numbers.		
20	List of Present Clientele with contact addresses & telephone numbers.		
21	The bidder(s) should produce the Certificate of incorporation of the organization.		
22	Audited balance sheet for the last 3 financial years.		
23	Company PAN No., Tan No. and TIN No. to be mentioned		
24	Technical Brochure / Technical Specification with Equipments photograph to be present		
25	All other information/documents that are required in the bid document		

NOTE: All pages of the bid documents must be serially numbered and signed.