

FACULTY OF ENGINEERING
UNIVERSITY OF LUCKNOW
Second Campus, Jankipuram, Lucknow-226031 (U.P.)

TENDER NOTICE

The University of Lucknow, Lucknow invites sealed tender from eligible bidders for supply testing and commissioning of Equipments for **Electrical Engineering laboratories** of Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow-226031 (U.P.). Separate tenders must be submitted at University of Lucknow for each package of following Electrical Engineering Laboratories:

- | | |
|--------------------------|--|
| Package – FOE/EE/01/2019 | - Power Electronics Laboratory |
| Package – FOE/EE/02/2019 | - Control System Laboratory |
| Package – FOE/EE/03/2019 | - Power System Laboratory – I |
| Package – FOE/EE/04/2019 | - Power System Laboratory – II |
| Package - FOE/EE/05/2019 | - Electrical Design & Fabrication Laboratory |

For Tender Documents, Tender Cost, EMD, Specifications of equipments and other details please visit our website: www.lkouni.ac.in

REGISTRAR
University of Lucknow

FACULTY OF ENGINEERING
UNIVERSITY OF LUCKNOW
Second Campus, Jankipuram, Lucknow-226031 (U.P.)

TENDER DOCUMENT

Tender No. - 03/FOE/LU/2019

Date:

Sealed and separate tenders in two parts i.e. tender bid-I (Technical) and tender bid-II (Financial) are herewith invited for Supply & Commissioning of **Electrical Engineering Laboratory Equipments** at **Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow-226031 (U.P.)**, along with Earnest money (Mentioned with package/unit) in the shape of Demand Draft of Nationalized Bank in favour of Finance Officer, University of Lucknow, Lucknow (U.P.). Both envelopes should be kept in one big envelope. The tender should reach to the undersigned latest **20.06.2019 at 02.00 PM.**

Terms & Conditions

1. Tenders are being invited for purchase and commissioning of equipments to establish various laboratories. Each Laboratory will be treated as one package/unit. It is obligatory that a firm selected for the establishment of a Laboratory shall supply all the equipments of that laboratory. The firm will also complete the work of installation/mounting and commissioning of these equipments.
2. Bid Evaluation Criteria: Bid shall be evaluated for whole package.
3. Details of equipments/materials are as per bill of quantity attached.
4. Tenders should be submitted either in person or by post in sealed envelopes on which name of package/unit, tender number and date along with name and address of the firm will be written.
5. **TENDER BID-I** (Technical) shall contain (i) Tender cost (non refundable) (ii) Earnest Money (iii) Proof of PAN and GST registration documents (iv) Standing of the firm (v) Major supplies executed in recent past (vi) Authorized dealer certificate from OEM & Commercial terms and conditions.
TENDER BID-II (Financial) shall contain rate schedule only. The rates per unit must be quoted both in figures and words. Any overwriting and/or cutting must be duly signed failing which tenders are likely to be rejected.
6. Tenders received after due date and time will not be considered.
7. EMD of all unsuccessful bidders will be refunded after opening of tenders. However, EMD of successful bidder will be refunded only after successful installation and commissioning of equipments and due verification by concerned authority.
8. DD of Rs. 1000/- being cost of tender per package has to be attached with Tender form in favour of **Finance Officer, University of Lucknow** payable at Lucknow, which is not refundable in any case.
9. Price quoted should be F.O.R. **Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow-226031 (U.P.)**.

10. Minimum turnover of the firm should be one crore per year (enclosed certificate).
11. The firm should have wide experience of similar work executed during last three years in academic institutions. The proof for the same should be attached.
12. Detailed specifications and make of the equipments/ materials must be given.
13. All available technical literature, catalogues and other data sheets in support of the Specifications and details of the items should be furnished along with the technical bid.
14. All the supplied equipment must have minimum warranty of one year on site from the Date of installation and acceptance by Faculty of Engineering, University of Lucknow.
15. Quoted items should be strictly in order of merit with serial number and metric unit otherwise the tenders are liable to be ignored.
16. Conditions regarding validity of tenders, delivery period, payment discount, warrantee and guarantee period, GST, custom duty and insurance etc. should be mentioned clearly. Net prices should be quoted.
17. No sales tax form "CZX" or "D" etc. for concessional rates shall be provided by the University.
18. Quoted rates should be valid for at least **six months** from the date of opening of tender.
19. Tenders without sample wherever required may not be accepted.
20. In case of imported equipments, commission allowed to agents must be specifically mentioned.
21. The equipments manufactured in China will not be accepted.
22. Free demonstration shall be done in the University premises if required.
23. Insurance during transport shall be done by the suppliers at their own cost.
24. Tenders without mentioned earnest money deposit will not be entertained.
25. Standing of the firm and major supplies carried out in recent past with proof must be attached.
26. In case of dealers, authorized distributors, dealer's certificate from OEM is required
27. Document through bank and advance payment on proforma invoice shall not be accepted.
28. The items and quantity mentioned in bill of quantity against each item will be treated as provisional and it may be changed depending on actual requirement.
29. Payment will be made only after successful installation and commissioning of equipments in the concerned Laboratory and due verification by concerned authority.
30. If the supply is not made within one month, the firm shall be liable to pay a penalty equal to 0.10% of value of purchase order per day. However this can be waved off by the Hon'ble Vice Chancellor under special circumstances. If the firm fails to supply the equipments the earnest money deposit will be forfeited.
31. Deduction of TDS as per Govt. Rules.
32. Tenders will be opened in the presence of Tender Committee and bidders or their authorized representatives who wish to be present on the date of opening.
33. Any dispute will be subject to **Lucknow (U.P.)**, Jurisdiction only.
34. Conditional tenders will not be accepted.
35. Authorized signatory has to keep all the original documents at the time of opening of tender.
36. The Vice-Chancellor has the right to accept or reject any or all tenders without assigning any reason.

I/We have read and understood the above conditions and agree to abide by them.

Authorized Signatory & Seal of the Bidder/Proprietor

FACULTY OF ENGINEERING
UNIVERSITY OF LUCKNOW
Second Campus, Jankipuram, Lucknow-226031 (U.P.)

TENDER BID-I (Technical)

Tender	Purchase and Commissioning of Equipments for Electrical Engineering Laboratories
Package No.	
Name of the firm with full address and contact number	
For	Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow-226031 (U.P.)
Cost of Tender Document	DD No: Amount: Bank: Date: Drawn in favour of Finance Officer, University of Lucknow, payable at Luckow (U.P.).
Earnest Money Deposit	DD No: Amount: Bank: Date: Drawn in favour of Finance Officer, University of Lucknow, payable at Luckow (U.P.).
PAN/GST No	PAN GST (Attach proof)
Income Tax Return of last three years	Attach Copy
Original Equipment Manufacturers/Authorization Letter from O.E.M.	Attach proof
Turnover in the last three years	Attach proof
Details of Similar Work Executed during last Three years in academic institution	Attach proof
Place of Tender Submission	Proctor Office, University of Lucknow, Old Campus, Lucknow- 226 007 (U.P.)
Last Date of Tender Submission	Date:- 20.06.2019 Time:- 02.00 PM
Place of Tender Opening	Registrar Office, Committee Room, Lucknow University (Old Campus), Lucknow.
Opening of Tender	Date:- 21.06.2019 Time:- 02.00 PM

Signature and Seal of Bidders

TENDER BID-II (Financial)

Package-FOE/EE/01: Power Electronics Laboratory

Tender Cost: Rs. 1000/-+ Rs. 180 GST

EMD: Rs. 9,000=00

Bill of Quantity

S.No.	NAME OF EQUIPMENT	QTY.	Unit Cost	Total Cost
1.	<p>Complete Setup For performing :- <i>To study V-I characteristics of SCR and measure latching and holding currents. Complete setup with digital measuring instruments.</i></p> <p>Demonstration board with following facilities :-</p> <p>(a) Isolated 0-230 V DC variable source – 1 Set (b) Isolated 0-600 V DC variable source – 1 Set (c) Isolated 0-12 V DC variable source – 2 Sets (d) External Load – 3 Nos. (e) SCR</p> <ul style="list-style-type: none">• Multimeter• Lamp 15 Watt 230 V – 2 Nos.• Demonstration Board Cover.• To conduct SCR Shorted gate experiment• To conduct biased (Forward & Reverse) gate SCR firing experiments• Set of Patch Chords & Manual.	02		
2.	<p>Complete Setup For performing :- <i>To study R, RC and UJT trigger circuit for SCR.</i></p> <p>Setup will consists of :-</p> <ul style="list-style-type: none">• Demonstration Board with following facilities :- <p>(a) Isolated AC 230 V & 14 V Supply (b) 10:1 Resistive Attenuator for observation on CRO. (c) Fuse for short circuit protection.</p> <ul style="list-style-type: none">• 25 Watt 250 V Lamp.• Demonstration Board Cover• R, RC and UJT Triggering circuits• Set of Patch Chords & Manual	02		
3.	<p>Complete Setup For performing :- <i>To study the various commutation circuits for SCR.</i></p> <p>Demonstration Board with following facilities :-</p> <p>(a) Isolated DC 230 V. (b) Isolated DC 30 V. (c) Pulse Frequency Generator (d) External Load (Lamp Load) (e) 10:1 Resistive Attenuator for observation of CRO (f) 3A Fuse for short circuit protection.</p>	02		

	<ul style="list-style-type: none"> • 15 Watt 250 V Lamp. • Demonstration Board Cover • Auxiliary Commutation Circuit • Resonant Commutation Circuit • Complimentary Commutation Circuit • Set of Patch Chords & Manual 			
4.	<p>Complete Setup For performing :- <i>To study single-phase half wave controlled rectifier with (i) resistive load (ii) inductive load with and without freewheeling diode.</i></p> <p>The setup is provided with isolation transformer for C.R.O. protections and lamp bank.</p> <p>1. Demonstration Board with following facilities :-</p> <ol style="list-style-type: none"> (a) Single Phase Half Controlled Bridge (b) Firing Pulse Generator (c) Resistive Load (Lamp) (d) Inductive Load (Choke) (e) Voltmeter 0-300V (f) Ammeter 0-5A (g) 1:10 Attenuator for CRO (h) Isolated 220 V AC for CRO <p>2. DC Motor 1 HP</p> <p>3. Connecting Leads</p> <p>4. Lamp Holder</p> <p>5. Lamp 250 Volts</p> <p>Complete experimental setup with DC Motor & Engraved Panel board with Banana Sockets for ease of connections by students</p>	01		
5.	<p>Complete Setup For performing :- <i>To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and Inductive loads.</i></p> <p>Features :-</p> <ul style="list-style-type: none"> • 230V, AC Isolated Transformer, Power 50 Watt • 9V DC at 100 mA Zener Regulated Power Supply • Two UJT. • Two Pulse Transformer 1:1:1. • Two Potentiometers for controlling UJT firing angle. • Bulb 40W, 230 AC • Adequate no of others Electronics Components. 	02		
6.	<p>Complete Setup For performing :- <i>To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.</i></p> <p>Features :-</p> <ul style="list-style-type: none"> • Three Phase line commuted fully-controlled thyristorized bridge converter. • Miniature Circuit Breaker (MCB). • Three cards consisting of Zero Crossing Detector, Integrator, Comparator and Pulse Generator one for each phase, for controlling thyristors. Another card in 	01		

	<p>conjunction with above three cards for controlling the triggering angles of the negative group of three thyristors.</p> <ul style="list-style-type: none"> • Firing angle control potentiometer. • 415:50V transformer for rectification and low voltage AC supply for triggering. • 12V at 500mA power supply for triggering circuit. • Driver Circuits with Pulse Transformer: 06 No. • R & L load with Load voltage divider. • Panel meter for measurement of voltage & current. • Freewheel diode: 01 No. • Unearthed mains sockets for CRO. 			
7.	<p>Complete Setup For performing :- <i>To study TRIAC based single-phase ac voltage regulator and determination of thyristor switching characteristics and pulse transformer characteristics.</i></p> <p>Complete setup with fraction Horse Power Motor.</p> <ul style="list-style-type: none"> • AC Phase Control training unit with following facilities :- <p>(a) Isolated 230 V or 50 V supply (b) Fuse for Short Circuit protection (c) AC Phase control by RC Triggering (d) AC Phase Control by UJT Triggering (e) 10:1 Potential Divider for CRO</p> <ul style="list-style-type: none"> • Protection Cover - 1 No. • Lamp 25 Watt, 230 V - 1 No. • Set of Patch Chords & Manual. <p>Complete setup with Motor</p>	02		
8.	<p>Complete Setup For performing :- <i>To study single phase cyclo-converter</i></p> <p>The experimental setup consists of :-</p> <p>(i) Power Circuit consisting of two fully controlled Bridge Converter connected in anti parallel (Bridges P & N). Bridge P supplies load current in the positive half of output cycle and bridge N provides load current in the negative half of output cycle.</p> <p>(ii) Firing Circuit consists of Micro Controller Based Firing Unit which provides Isolated Gate pulses through pulse transformers separately for P & N Bridges. Toggle switch is provided to select the output frequency (1/1f, 1/2f, 1/3f, 1/4f, 1/5f). Firing angle can be changed either :-</p> <p>a) through toggle switches for increasing and decreasing of firing angle. Firing angle during all half cycles of AC input supply remains same in this mode of control.</p> <p>b) through serial port of computer by connector provided on the experimental kit to the serial port of computer and then entering the firing angle to the key board.</p> <p>In this mode of control the firing angle of each half cycle of input supply can be independently controlled.</p>	01		

	(iii) Patch Cord. (iv) Instruction Manual			
9.	Complete Setup For performing :- <i>To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor.</i> 1. Complete experimental setup consisting demonstration Board with following facilities :- (a) 110 V DC Supply (b) Different testing points (c) 1:10 Attenuator for CRO (d) Triggering Generator (e) IGBT, MOSFET & Power Transistor 2. Lamp 15 Watt 250V 3. Connecting Leads	02		
10.	Complete Setup For performing :- <i>To study four quadrant operation of IGBT/MOSFET chopper circuit.</i> This is DC chopper circuit for getting a variable DC voltage by using on time control and frequency control to feed DC-motor (Universal Motor). Circuit demonstrate the use of smooth speed variation with the help of chopper circuit and test points are provided. 1. Demonstration Board with following facilities :- (a) 110 V DC Supply (b) Different testing points (c) 1:10 Attenuator for CRO (d) DC Voltmeter (e) DC Amp Meter 2. Lamp 60 Watt 250V 3. Connecting Leads	01		
11.	Complete Setup For performing :- <i>To study MOSFET/IGBT based single-phase series-resonant inverter.</i> Complete experimental setup consisting of :- 1. Demonstration Board with following facilities :- (a) Isolated DC 110 V (b) Isolated Gate Frequency (c) External Load (d) 200 W Lamp for Short Circuit Protection (e) 1:10 Resistive Attenuator (f) 1A Fuse for short circuit protection. 2. Demonstration Board Cover 3. Patch Cords All the circuit diagram and necessary test point are clearly marked on Engraved front panel for education study purpose.	01		
12.	Complete Setup For performing :- <i>To study MOSFET/IGBT based single-phase bridge inverter.</i> Consisting of :-	01		

	<p>1. Demonstration Board with following facilities :-</p> <p>(a) Isolated DC 110 V.</p> <p>(b) Isolated Gate Frequency</p> <p>(c) External Load</p> <p>(d) 200 W Lamp for Short Circuit Protection</p> <p>(e) 1:10 Resistive Attenuator</p> <p>(f) 1A Fuse for short circuit protection.</p> <p>2. Demonstration Board Cover</p> <p>3. Patch Cords</p> <p>All the circuit diagram and necessary test point are clearly marked on Engraved front panel for education study purpose.</p>			
13.	<p>CRO 30 MHZ</p> <ul style="list-style-type: none"> • Dual Channel, DC to 30 MHz, Invert facility in both Channels • Vertical Deflection coefficients: 5 mV to 20 V/div. • Time Base: 20 ns -0.2 s/ div; Variable Hold- Off; X10 Magnification • Triggering: DC-60 MHz; Active TV Sync Sep.; Alternate triggering • LED indication for stable triggering • XY mode • Z Modulation • Saw tooth output (5 Vpp approx) • Component Tester; 2 Level Calibrator 	05		
Total				

Note: Provide all the required measuring instruments for each setup.

TENDER BID-II (Financial)

Package-FOE/EE/02: Control System Laboratory

Tender Cost: Rs. 1000/-+ Rs. 180 GST

EMD: Rs. 9,000=00

Bill of Quantity

S.No.	NAME OF EQUIPMENT	QTY.	Unit Cost	Total Cost
1.	<p>Complete Setup For performing :- <i>To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.</i></p> <p>Simulated blocks – configurable as 1st, 2nd and 3rd order systems with negative feedback.</p> <ul style="list-style-type: none"> • Forward gain adjustable through a calibrated 10 turn potentiometer (Resolution 1 in 1000) • Three built-in signal sources • Square wave : 1 V p-p (min) • Triangular wave : + 0.5 V p-p (min) • Trigger pulses : + 10 V (min) • Frequency adjustable : 40 Hz – 90 Hz • Provision for disturbance inputs at input and load • I.C. regulation in all internal power supplies. • Power requirement less than 10W at 220 V, 50 Hz operation • Supporting literature and patch cords included. • Except a CRO no other equipment is required. 	02		
2.	<p>Complete Setup For performing :- <i>To study P, PI and PID temperature controller for an oven and compare their performance.</i></p> <p>Temperature controller with facilities for P, I, D and relay control blocks.</p> <ul style="list-style-type: none"> • Operating temperature: ambient to 90^o C. • Separate controls for P.I.D channel gains. • Two settings for relay hysteresis. • Fast 25 W oven fitted with IC temperature sensor. • Digital display of set and measured temperature on a 3½ digit built in DVM. • Buffered output for recorder • IC regulation in controller circuit power supplies. • 220V, 50 Hz mains operated. • Supporting literature and patch cords included. 	02		

3.	<p>Complete Setup For performing :- <i>To study the potentiometer as error detector for DC/AC excitation.</i></p> <p>Complete experimental setup consisting of :- Potentiometer: Two high quality servo potentiometers 360° Mechanical, 350° Electrical span with 1° resolution dials. Type of operation: DC and AC signal operation Display: 3.5 Digital Panel Meter for measurements Excitation: IC regulated DC excitation for both potentiometers (DC operation). AC excitation at 400 Hz approx. (AC operation). Balanced Demodulator: Built in demodulator circuit (balanced demodulator) for C.R.O. Observation. Power supply: Built in IC regulated power supplies Cabinet: Housed in rigid MS powder coated with moulded frame.</p>	01		
4.	<p>Complete Setup For performing :- <i>To study and calibrate temperature using resistance temperature detector (RTD)</i> Using Temperature sensor : RTD PT 100 1. Range: 0 to 200 degree centigrade. 2. Mode of control: on/off. 3. Relay: O/E/N make 5 Amp rating. 4. Optional : Recorder. 5. Set up comes with digital temp. indication, set point indication, set point control and calibration check up for 0 degree and 100 degree centigrade.</p> <p>Model size: 192 x 96 x 300 mm with powder coated M.S. box having neatly labeled anodized plate.</p> 6. Accuracy of indication: +/- 1% of the full range. Complete set up with model process heated with comptalux bulbs. A detailed manual.	02		
5.	<p>Complete Setup For performing :- <i>To design Lag, Lead and Lag-Lead compensators using Bode plot.</i></p> <p>Demonstration unit with following facilities :-</p> <ul style="list-style-type: none"> • Simulated uncompensated system having adjustable damping peak, percent overshoot M_p variable from 20% to 50% and steady state error variable from 50% to 0.5%. • Compensation network implementation through built-in variable gain amplifier. Gain is adjustable from 1 to 11. • Built-in square and sine wave generators for transient and frequency response studies. Frequency adjustable from 25Hz – 800Hz (approx.) • 220V + 10% 50 Hz mains operation. 	02		

6.	<p>Complete Setup For performing :- <i>To study relay characteristics and display of the same on CRO for different values of hysteresis and dead zone.</i></p> <p>Demonstration unit with following facilities :-</p> <ul style="list-style-type: none"> • Simulated electronic relay using high speed IC's • Simulated 2nd order linear plant. Facility for displaying x and x signals • Dead zone variable from 0-600mV (approx.) • Hysteresis variable from 0-500mV (approx.) • Built-in signal sources – sine and square • Amplitude : 0-1V (min.) variable • Frequency: 10, 20, 40, 80, 100, 200, 400, 800 and 1000Hz • IC regulated internal power supplies • 220V±10%, 50Hz mains operation • Literature and patch cords included 	01		
7.	<p>Complete Setup For performing :- <i>To study DC position control system</i></p> <p>Demonstration unit with following facilities :-</p> <ol style="list-style-type: none"> 1. 5k ohm +/- 1% linearity, Precision servo Potentiometers having bearing used as error detector. 2. Output potentiometer, similar as input potentiometer to convert output position into a voltage signal. 3. Summing Amplifier with adjustable gain. 4. Armature controlled D.C. servomotor with suitable coupling required for (i) output position indicator and load. (ii) Tacho-generator. 5. D.C. tacho-generator coupled to D.C. motor, for derivative feedback. 6. Preamplifier and power amplifier to drive the D.C. motor on the basis of the error signal. D.C. motor is 12 volt, 1amp, permanent magnet with gear train. 7. Power supply for, armature winding and electronic amplifier. Suitable test points brought on the side panel. 8. A detailed instruction manual 	02		
8.	<p>Complete Setup For performing :- <i>To study synchro-transmitter and receiver and obtain output V/S input characteristics</i></p> <p>Demonstration unit with following facilities :-</p> <p>Transmitter: Fitted with dial for input/output angular displacement with graduation with 2°resolution</p> <p>Receiver: Fitted with dial for input/output angular displacement with graduation with 2°resolution</p> <p>Observation: Sockets for Rotor (R1, R2), Stator (S1, S2, S3) on panel with attenuated output on sockets for view of signal observation on CRO</p> <p>Power supply: Built in IC regulated power supplies</p> <p>Mains: 230V/50Hz AC</p> <p>Supporting literature and patch cords included.</p>	02		

9.	<p>Complete Setup For performing :- <i>To determine speed-torque characteristics of an ac servomotor.</i></p> <p>Demonstration unit with following facilities :-</p> <ol style="list-style-type: none"> 1. Two phase servomotor. 2. The speed measuring device which will not load the motor. A photoelectric pick up using disc with 20 holds and a phototransistor are used for speed sensing. Calibration source at 100 Hz is used for RPM indicator. 3. Loading arrangement for servomotor. 4. Torque measuring device. 5. A detailed manual. 6. RPM indicator and ammeter measuring load current. 7. Unit will be covered by an acrylic sheet to facilitate clear view of the entire system 	02		
10.	<p>Complete Setup For performing :- <i>To study performance of servo voltage stabilizer at various loads using load bank.</i></p> <ol style="list-style-type: none"> 1. Demonstration unit with following facilities :- <ol style="list-style-type: none"> (a) Variable Input AC Supply (b) AC Servo Motor (c) Servo Amplifier & Controller (d) 0-300 Voltmeter (e) Auto and Non-auto provision (f) Manual Up & Down 2. 100 Watt 250 V Lamp: Qty – 05. 3. Capacity of stabilizer 1 KVA. 	02		
11.	<p>Complete Setup For performing :- <i>To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.</i></p> <p>DC motor speed control demonstration unit with following facilities :-</p> <ol style="list-style-type: none"> 1. Potentiometer as input transducer for converting reference voltage. 2. A DC Tacho-generator/speed sensor to indicate the motor speed in RPM. 3. Summing amplifier (with adjustable gain) to receive inputs, reference signal and tacho-generator output. 4. Separately excited DC Motor rated for 1500 RPM, 1 HP at 220 volts with loading arrangement. 5. Thyristor converter using single phase half controlled converter to control DC motor through armature and power supply for field winding and electronic amplifier. 6. Instruction manual. 7. The entire system will, for the range 300 RPM to 1000 RPM work as a closed loop control system. 8. Suitable protection for the electronic circuits and motor. <p>With DC motor & loading arrangement</p>	01		

12.	<p>Complete Setup For performing :- <i>To study PID Controller for simulation proves like transportation lag.</i></p> <ul style="list-style-type: none"> • Simulated block-dead time (transportation lag), integrator, Time constants, error detector and gain. • PID Controller (configurable as P, PI, PD or PID) • Proportional Band : 5% to 50% (Gain 2-20) • Integral Time : 10 ms – 100 ms • Derivative time : 2-20 ms • Built in IC regulated power supply. • Built in 3½ digit DVM • Built in signal sources. • Set value : -1V to + 1V • Square wave 1 V p-p (min) at 40 Hz (typical) • Triangular wave : 1 V p-p (min) at 40 Hz (typical) • Detailed literature and patch chords included • 220 V, 50 Hz mains operations 	02		
13.	<p>CRO 30 MHZ</p> <ul style="list-style-type: none"> • Dual Channel, DC to 30 MHz, Invert facility in both Channels • Vertical Deflection coefficients: 5 mV to 20 V/div. • Time Base: 20 ns -0.2 s/ div; Variable Hold- Off; X10 Magnification • Triggering: DC-60 MHz; Active TV Sync Sep.; Alternate triggering • LED indication for stable triggering • XY mode • Z Modulation • Saw tooth output (5 Vpp approx) • Component Tester; 2 Level Calibrator 	02		
Total				

Note: Provide all the required measuring instruments for each setup.

TENDER BID-II (Financial)

Package-FOE/EE/03: Power System Laboratory-I

Tender Cost: Rs. 1000/-+ Rs. 180 GST

EMD: Rs. 8,000=00

Bill of Quantity

S.No.	NAME OF EQUIPMENT	QTY.	Unit Cost	Total Cost
1.	<p>Complete Setup For performing :- <i>To study the basic components of power system.</i> Demonstration unit with following facilities :- Display Board of various power system components SP MCB, DP MCB, TP MCB, FP MCB, MCCB, Change Over Relay (02), 11 Pin 24 Volt DC Relay, Single Phase Contactor, Three Phase Contactor, Contactor with Thermal Relay, Push button NO/NC, Transformer, Multistrand PVC Cable (0.75, 1.0, 1.5, 2.5, 4.0,6.0.10.0, 16.0 MM), 2 Wire Multistrand PVC Cable 1.5 MM, 3 Wire Multistrand PVC Cable 1.5MM, 2 Core Aluminium Cable 4 MM, 2 Core Aluminium Armored Cable 8 mm, Multistrand 4 Wire PVC Cable, 4 Core Aluminium Cable 10MM, 4 Wire Armored Cable, Over Current Relay, Thimble 5/32" (U) Type, Thimble 5/32" (O Type), Thimble 3/16" (U Type), Thimble 3/16" (O Type), Thimble 1/4" (U Type), Thimble 1/4" (O Type), Copper Thimble 16 MM (U Type), Copper Thimble 25 MM (U Type), Copper Thimble 35 MM (O Type), Aluminium Thimble 16 MM (O Type), Aluminium Thimble 35 MM (O Type), Aluminium Thimble 70 MM (O Type), 4 Polar Stator & Rotor Stamping, Shackle Type Insulator 230Volt shackle Type Insulator 440Volt, CT Round Type , CT WPL Type, PT, PIN Type Insulator, Transformer Bushing, Stay Insulator, 11 KV Disc, HT Bushing, HT Wire Clamp (Holding), Different types of Insulators (05), Different types of cables (05), Different Relays, Circuit Breaker's, Busbar, Corona Ring, Various Insulating Materials, Transmission Lines</p>	01		
2.	<p>Complete Setup For performing :- <i>To calculate the voltage regulation of a transmission line.</i> Demonstration unit with following facilities :- 1. Transmission line model consisting of four action of transmission on line operatable at 220 V with current rating at 2A connected in π network. 2. Variable Power Supply (0-230V) 3. Digital ammeter: 02 No. 4. Digital Voltmeter: 02 No. mounted on front panel with resistive, inductive, capacitive load fitted in m.s. sheet box complete with patch cords for inter connection & Manual</p>	01		

3.	<p>Complete Setup For performing :- <i>To find out the voltage distribution across the string of insulator with and without guard ring and calculate string efficiency.</i></p> <p>Demonstration unit with following facilities :- String of 3 suspension insulators mounted on stand with proper mounting arrangement for guard ring with 5.0 KV high voltage transformer and voltmeter</p>	01		
4.	<p>Complete Setup For performing :- <i>To determine the dielectric strength of transformer oil.</i></p> <p>Demonstration unit with following facilities :-</p> <ol style="list-style-type: none"> 1. Fully motorized high voltage control 2. Break down voltage protection 3. Over current protection 4. Mains & H.T. “ON” & “OFF” Switches 5. Incorporates automatic tripping mechanism 6. Mains and H.T. “ON” indications 7. Test cup with adjustable gap electrode arrangement 8. Equipped with Kilo Voltmeter 9. Complies to all the safety standards <p>Technical Specifications:-</p> <ol style="list-style-type: none"> 1. Mains Supply : 230V AC $\pm 10\%$, 50Hz 2. Single Phase Variac : 230V/ 0-270V 3. High Voltage Source : 80kV, 20mA 4. HV Control Motor 5. Type : Servo 6. RPM : 500 (No Load) 7. Voltmeter : 0 to 100kV 	01		
5.	<p>Complete Setup For performing :- <i>Determination of R, L and C parameters of a transmission line model and observing the Ferranti effect.</i></p> <p>Demonstration unit with following facilities:- Transmission line model is consisting of four action of transmission on line operatable at 220 V with current rating at 2A connected in π network. A continuous variable power supply with two digital voltmeter & two digital ammeters, mounted on front panel with variable resistive, inductive, capacitive load fitted in m.s. sheet box complete with patch cords for inter connection & Manual.</p>	01		
6.	<p>Complete Setup For performing :- <i>Determination of A,B,C,D parameters, Hybrid parameter and Image parameter of a given transmission line model.</i></p> <p>Demonstration unit with following facilities:-</p> <ol style="list-style-type: none"> 1. Transmission line model consisting of four action of transmission on line operated at 220 V with current rating at 2 A connected in π network. 2. Variable power supply (0-230V, 4A) 3. Digital Voltmeter: 02 No. 4. Digital ammeter: 02 No. 	01		

	mounted on front panel fitted in m.s. sheet box complete with patch cords for inter connection & Manual. Detailed calculation supplied alongwith the setup.			
7.	<p>Complete Setup For performing :- <i>Experiment setup to plot the equipotential line of paper model of single layer and multi-layer cables.</i></p> <p>Demonstration unit with following facilities :- 1. Paper model of single-phase cable mounted on a bakelite sheet in vertical position with provision for giving 220 volts to the conductor and provision for locating equipotential point with digital voltmeter 2. Paper model of three-phase cable mounted on a bakelite sheet in vertical position with provision for giving 415 V (L-L) to the conductor and provision for locating equipotential point with digital voltmeter</p>	01		
8.	<p>Complete Setup For performing :- <i>To find location of fault in Cable by bridge method.</i></p> <p>Demonstration unit with following facilities :- 1. Rheostat 2. Galvanometer 3. Measuring Tape 4. 3 Core cable 5. DC Power supply 6. Digital measuring instrument 7. Manual</p>	01		
9.	<p>Complete Setup For performing :- <i>To study the performance characteristics of a typical dc distribution system (ring configuration).</i></p> <p>Demonstration unit with following facilities :- DC distribution system (Ring configuration) Digital Ammeter: 05 No. Voltmeter: 01 No. Variable power supply (0-100V, 2A) 110V DC supply Manual</p>	01		
10.	<p>Complete Setup For performing :- <i>To study the performance characteristics of a typical dc distribution system (radial configuration).</i></p> <p>Demonstration unit with following facilities :- DC distribution system (Rdial configuration) Digital Ammeter: 05 No. Voltmeter: 01 No. Variable power supply (0-100V, 2A) 110V DC supply Manual</p>	01		
Total				

Note: Provide all the required measuring instruments for each setup.

TENDER BID-II (Financial)

Package-FOE/EE/04: Power System Laboratory-II

Tender Cost: Rs. 1000/-+ Rs. 180 GST

EMD: Rs. 13,000=00

Bill of Quantity

S.No.	NAME OF EQUIPMENT	QTY.	Unit Cost	Total Cost
1.	<p>Complete Setup For performing :- <i>Determination of positive, negative and zero sequence impedances of a three phase transformer.</i></p> <p>Demonstration unit with following facilities :- The Setup must consist of Three Phase Transformer with connections of Primary & Secondary brought out core type double copper wound, Measuring instruments such as Digital Clamp-on Meter, Digital Voltmeter and other necessary apparatus.</p>	01		
2.	<p>Complete Setup For performing :- <i>To determine negative and zero sequence reactance of an alternator.</i></p> <p><u>MACHINES REQUIRED</u> M G Set: DC SHUNT MOTOR/3 PHASE ALTERNATOR SALIENT POLE TYPE (ROTATING FIELD)</p> <p>DC Motor Type. DC Shunt wound, screen protected. Horizontal foot mounted, with interpoles and 3 points DC Starter, having No volt and overload release coils. Capacity: 3HP RPM : 1500 (controlled variation) Volts : 230 Insulation : Class 'B' Cooling : Fan cooled Connections: Shunt, all the terminals of Armature and x field winding shall be brought over to a Bakelite sheet fixed to C I terminal fix fitted on top of Motor.</p> <p><u>Alternator :</u> Type : Salient pole type (Rotating Field type), 3 phase 4 wire screen protected, horizontal foot mounted, fan cooled, separately excited Capacity : 2 KVA RPM : 1500 for max output and frequency of 50 Hz Volts : 415V Insulation : Class 'B' Frequency : 50 Hz Power factor : 0.8 p.f. lagging</p> <p><u>Exciter</u> Type : Static type through Rectifier</p>	01		

	<p><u>With</u> All Measuring instruments required as per Experiments (Fitted on Engraved Bakelite sheet enclosed in almirah type M S box with lock & handle arrangement suitable for table mounting.) Manual</p>			
3.	<p>Complete Setup For performing :- <i>To determine sub transient direct axis reactance (X_d'') and sub transient quadrature axis reactance (X_q'') of an alternator</i></p> <p><u>MACHINES REOUIRED</u> M G Set: DC SHUNT MOTOR/3 PHASE ALTERNATOR SALIENT POLE TYPE (ROTATING FIELD)</p> <p>DC Motor Type. DC Shunt wound, screen protected. Horizontal foot mounted, with interpoles and 3 points DC Starter, having No volt and overload release coils. Capacity : 3HP RPM : 1500 (controlled variation) Volts : 230 Insulation : Class 'B' Cooling : Fan cooled Connections: Shunt, all the terminals of Armature and x field winding shall be brought over to a Bakelite sheet fixed to C I terminal fix fitted on top of Motor.</p> <p><u>Alternator :</u> Type : Salient pole type (Rotating Field type), 3 ph 4 wire screen protected, horizontal foot mounted, fan cooled, separately excited with connection brought out top of terminal plate for each measurement of sub transient reactance Capacity : 2 KVA RPM : 1500 for max output and frequency of 50 Hz Volts : 415V Insulation : Class 'B' Frequency : 50 Hz Power factor : 0.8 p.f. lagging</p> <p><u>Exciter</u> Type: D.C Shunt Generator or Rectifier, 220V, DC through slip rings.</p> <p><u>With</u> All Measuring instruments required as per Experiment (Fitted on Engraved Bakelite sheet enclosed in almirah type M S box with lock & handle arrangement suitable for table mounting.)</p> <ul style="list-style-type: none"> • Manual 	01		

<p>4.</p>	<p>Complete Setup For performing :- <i>To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation</i></p> <p><u>MACHINES REQUIRED</u> : M G Set : D C SHUNT MOTOR/3 PHASE ALTERNATOR SALIENT POLE TYPE (ROTATING FIELD)</p> <p>DC Motor Type. DC Shunt wound, screen protected. Horizontal foot mounted, with interpoles and 3 points DC Starter, having No volt and overload release coils.</p> <p>Capacity : 3HP RPM : 1500 (controlled variation) Volts : 230 Insulation : Class 'B' Cooling : Fan cooled Connections: Shunt, all the terminals of Armature and x field winding shall be brought over to a Bakelite sheet fixed to C I terminal fix fitted on top of Motor.</p> <p><u>Alternator</u> : Type : Salient pole type (Rotating Field type), 3 ph 4 wire screen protected, horizontal foot mounted, fan cooled, separately excited Capacity : 2 KVA RPM : 1500 for max output and frequency of 50 Hz Volts : 415V Insulation : Class 'B' Frequency : 50 Hz Power factor : 0.8 p.f. lagging Connections : 3 phase 4 wire</p> <p><u>Exciter</u> Type : Static type through Rectifier</p> <p><u>With</u> All Measuring instruments required as per Experiment (Fitted on Engraved Bakelite sheet enclosed in almirah type M S box with lock & handle arrangement suitable for table mounting.)</p> <ul style="list-style-type: none"> • Manual 	<p>01</p>		
<p>5.</p>	<p>Complete Setup For performing :- <i>Study of symmetrical fault of a power system with generating sources.</i></p> <p>Demonstration unit with following facilities :- The basic system consists of Powder Coated m.s. box with following accessories :-</p> <ol style="list-style-type: none"> 1. Three Phase Over Current & Earth Fault Relay, Static Type 2. Digital MI Voltmeter Microcontroller based 3. Neon Lamp 	<p>01</p>		

<p>4. TP Switch 5. Insulating Terminals 6. Transformers Three Phase (Star/Star & Delta/Star): 02 Nos. 7. Line Impedances 2 Ohms each 8. Three Phase Variable Voltage Source 9. Digital Clamp on Meter GENERATING SOURCE M G SET : D C SHUNT MOTOR/3 PHASE ALTERNATOR <u>DC Motor</u> Type. : DC Shunt wound, screen protected. Horizontal foot mounted. Capacity. : 3 HP RPM : 1500 (controlled variation) Volts : 230 Insulation : Class 'B' Cooling : Fan cooled Connections: Shunt, all the terminals of Armature and field winding shall be brought over to a bakelite sheet fixed to C I terminal fix fitted on top of Motor. <u>Alternator</u> Type : 3 ph 4 wire screen protected, horizontal foot mounted, fan cooled, separately excited Capacity. : 2 KVA RPM : 1500 for max output and frequency of 50 Hz Volts : 415V Insulation : Class 'B' Frequency 50 Hz Power factor : 0.8 p.f. lagging Connections : 3 phase 4 wire <u>Excitor</u> Type : Static type through sliprings. CONTROL PANEL FOR GENERATING SOURCE Fitted on ENGRAVED BAKELITE sheet enclosed in almirah type m.s. box suitable for table mounting and consisting of :- For DC Motor (i) Digital MC Voltmeter (ii) Digital MC Ammeter (iii) Starting Compensator, DC Starter face plate type. (iv) DP MCB (v) Field Rheostat 1.4 A, 230 Ohms For AC Generator (i) Digital Multi Function Meter (ii) TP M.C.B (iii) Indicating Light. (iv) Excitation controlling arrangement For Excitor (i) Digital MC Volt meter</p>			
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	(ii) Digital MC Ammeter All the accessories will be fitted on Bakelite sheet fixed to m.s. box cabinet almirah type suitable for table mounting.			
6.	Complete Setup For performing :- <i>To determine location of fault in a cable using cable fault locator.</i> APPARATUS REQUIRED <ul style="list-style-type: none"> • CABLE FAULT LOCATOR • Complete experimental setup consisting of Rheostat, Galvanometer, Measuring Tape, 3 Core Cable, DC Power Source, Digital Measuring Instrument 	01		
7.	Complete Setup For performing :- <i>Measurement & verification of active & reactive power flow. Compensation of VAR at the Receiving end using long line model.</i> Demonstration unit with following facilities :- Transmission line model is consisting of four action of transmission on line operatable at 220 V with current rating at 2A connected in π network, A continuous variable power supply with two digital voltmeter & two digital ammeters, mounted on front panel with variable capacitive load fitted in m.s. sheet box complete with patch cords for inter connection & Manual.	01		
8.	Complete Setup For performing :- <i>To determine the wavelength of the transmission line from the standing wave ratio and compare this to the theoretical value using the line parameters.</i> Demonstration unit with following facilities :- Transmission line model consisting of four action of transmission on line operatable at 220 V with current rating at 2 A connected in π network, A continuous variable power supply with two digital voltmeter & two digital ammeter, mounted on front panel fitted in m.s. sheet box complete with patch cords for inter connection & Manual. Detailed calculation supplied alongwith the setup	01		
Total				

Note: Provide all the required measuring instruments for each setup.

TENDER BID-II (Financial)

Package-FOE/EE/05: Electrical Design & Fabrication Laboratory

Tender Cost: Rs. 1000/-+ Rs. 180 GST

EMD: Rs. 5,000=00

Bill of Quantity

S. N.	NAME OF EQUIPMENT	QTY.	Unit Cost	Total Cost
1.	Complete Setup For performing :- <i>Design & Fabrication of Power amplifier.</i> Unit with following components: <ul style="list-style-type: none">• Transformer winding machine• Insulating sheet, tape and sleeve• Winding wires• Core (Stamping), Bobbins & Clamp• Bakelite sheet for terminal plate• Terminals• Testing panel including wattmeter, voltmeter, ammeter, bulb and holder• Tool kit	02		
2.	Complete Setup For performing :- <i>Small Power Supply design & Fabrication.</i> Unit with following components: <ul style="list-style-type: none">• AC Supply 18V• PN Junction diodes• Zener Diode• Different type of capacitors• Different type of IC for Regulated Power Supply• Glass fuse for short circuit protection• Multimeter• ON/OFF switch with indication light• Patch cords suitable to the terminals with board for easy interconnection All above accessories will be fitted on bakelite sheet fixed on box	02		
3.	Complete Setup For performing :- <i>Transformer design & Fabrication.</i> Unit with following components: <ul style="list-style-type: none">• Transformer winding machine• Core (Stamping), Bobbins & Clamp• Insulating sheet, tape and sleeve• Winding wires• Bakelite sheet for terminal plate• Terminals	01		

	<ul style="list-style-type: none"> • Testing panel including wattmeter, voltmeter, ammeter, bulb and holder • Tool kit 			
4.	<p>Complete Setup For performing :- Controller design & Fabrication. Unit with following components:</p> <ul style="list-style-type: none"> • AC Supply Source • Different types of resistors • Different type of capacitors • IC-741(8 Nos) • 10:1 Resistive Attenuator • External load (Bulb) • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection • Small fan Motor <p>All above accessories will be fitted on bakelite sheet fixed on box</p>	02		
5.	<p>Complete Setup For performing :- <i>Design & Fabrication of chopper.</i> Unit with following components:</p> <ul style="list-style-type: none"> • DC Supply (24V) • Isolated firing pulse and test point (1 No.) • MOSFET (2 No.) • Diodes (4 Nos.) • Different types of resistors • Different type of capacitors and Inductors • 10:1 Resistive Attenuator • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>	02		
6.	<p>Complete Setup For performing :- <i>Design & Fabrication of High-Power factor-controlled rectifier.</i> Unit with following components:</p> <ul style="list-style-type: none"> • AC Supply • Tubular Rheostat (2Nos) • SCR (4 Nos) • Isolated firing pulse (4Nos) • Capacitors • Inductors • Power factor meter 	01		

	<ul style="list-style-type: none"> • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>			
7.	<p>Complete Setup For performing :- <i>Inductor design and Fabrication.</i></p> <p>Unit with following components:</p> <ul style="list-style-type: none"> • Winding Machine • Ferrite core (Stamping), Bobbins & Clamp • Insulating sheet, tape and sleeve • Winding wire • Bakelite sheet for terminal plate • Multimeter for inductance measurement • Terminals • Tool kit 	02		
8.	<p>Complete Setup For performing :- <i>Design & Fabrication of Microcontroller based digital energy meters / sensors.</i></p> <p>Unit with following components:</p> <ul style="list-style-type: none"> • Microcontroller (Atmega328P) • 16*2 LCD • Crystal Oscillator(16MHz) • Resistors, Capacitors, Diodes • Transformer • Current Sensor (ACS712CTR) • Energy Meter • Relay Module • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>	01		
9.	<p>Complete Setup For performing :- <i>Design Fabrication of AC phase converter and its firing circuit</i></p> <p>Unit with following components:</p> <ul style="list-style-type: none"> • Isolated power supply (220VAC, 50Hz) • IC TCA-785 • Pulse Transformer (2 Nos.) • Different types of resistor • Potentiometer (2 Nos) • Different types of capacitors • 10:1 Resistive Attenuator 	02		

	<ul style="list-style-type: none"> • PN Junction Diode • External load (Bulb) • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>			
10.	<p>Complete Setup For performing :- <i>IGBT based single phase inverter design and Fabrication.</i></p> <p>Unit with following components:</p> <ul style="list-style-type: none"> • DC Supply (12V) • IC-SG3525 • IGBT (2Nos) • 12-0-12 Transformer • Different types of resistors • Different type of capacitors • 10:1 Resistive Attenuator • External load • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>	01		
11.	<p>Complete Setup For performing :- <i>Filter design & Fabrication.</i></p> <p>Unit with following components:</p> <ul style="list-style-type: none"> • AC Supply 18V (9-0-9) • Bridge rectifier for dc rectification • Different types of resistors • Different type of capacitors • Different type of inductors • Glass fuse for short circuit protection • ON/OFF switch with indication light • Patch cords suitable to the terminals with board for easy interconnection <p>All above accessories will be fitted on bakelite sheet fixed on box</p>	02		
Total				

Note: Provide all the required measuring instruments for each setup.