कुलसचिव कार्यालय
लखनऊ विश्वविद्यालय
लखनऊ–226007

संदर्भ संख्या :.....

दिनांक :.....

UNIVERSITY OF LUCKNOW
LUCKNOW

Sealed tenders from eligible bidders are invited for supply and commissioning of Lab Equipments in the Faculty of Engineering, Lucknow University, Second Campus, Jankipuram, Lucknow- 226031, for the laboratories: Electrical Engineering, Mechanical Engineering, Electronics and Communication Engineering and Civil Engineering.

For details visit www.lkouniv.ac.in

Registrar

(Prof. R.K. Singh)
Registrar

No E-5896-9.1 Date..07/03/18

Copy forwarded to the following for information and necessary action:

1. Secretary to Vice-Chancellor for kind information of Hon'ble Vice- Chancellor, University of Lucknow.
2. P.S. to P.V.C. for kind information of Pro- Vice- Chacellor, University of Lucknow.
3. Coordinator, Faculty of Engineering, University of Lucknow with request to kindly arrange four tender boxes at Faculty of Engineering, Sencond Camous, Jankipuram, Lucknow- 226031.
4. Director IPPR, University of Lucknow with request to publish the advertisement in 02 newspapers.
5. Prof. Anil Mishra, Director Data Resource Center, Lucknow University, Lucknow for favour to upload on the University website.
6. P.A. to Registrar, University of Lucknow.

Registrar

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 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	- Network Analysis and Synthesis Laboratory
Package – FOE/EE/02	- Electrical Measurement and Measuring Instruments Laboratory
Package – FOE/EE/03	- Electrical Machines Laboratory - I
Package – FOE/EE/04	- Electrical Machines Laboratory – II

For Tender Documents, Tender Cost, EMD, Specifications 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. - 01/FOE/LU/2018 Date: 07.03.2018

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, Luckow (U.P.). Both envelopes should be kept in one big envelope. The tender should reach to the undersigned latest by 02.04.2018 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 expected 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. Details of equipments/materials are as per bill of quantity attached.
3. 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.
4. **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 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.
5. Tenders received after due date and time will not be considered.
6. EMD of all unsuccessful bidders will be refunded after opening of tenders. However, EMD of successful bidder will be refunded only after installation and commissioning of equipments and due verification by concerned authority.

Continued……..

7. DD of Rs. 1000-/- being cost of tender 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.
8. Price quoted should be F.O.R. **Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow-226031 (U.P.).**
9. Detailed specifications and make of the equipments/ materials must be given.
10. Quoted items should be strictly in order of merit with serial number and metric unit otherwise the tenders are liable to be ignored.
11. 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.
12. No sales tax form "CZX" or 'D" etc. for concessional rates shall be provided by the University.
13. Quoted rates should be valid for at least **six months** from the date of opening.
14. Tenders without sample wherever required may not be accepted.
15. In case of imported equipments, commission allowed to agents must be specifically mentioned.
16. Free demonstration shall be done in the University premises if required.
17. Insurance shall be done by the suppliers at their own cost.
18. Tenders without mentioned earnest money deposit will not be entertained.
19. Standing of the firm and major supplies in recent past with proof must be attached.
20. In case of dealers, authorized distributors, dealer's certificate from OEM is required
21. Document through bank and advance payment on proforma invoice may not be accepted.
22. The items and quantity mentioned in bill of quantity against each items will be treated as provisional and it may be changed depending on actual requirement.
23. Payment will be made only after successful installation and commissioning of equipments in the concerned Laboratory and due verification by concerned authority.
24. 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.
25. Deduction of TDS as per Govt. Rules.
26. 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.
27. Any dispute will be subject to **Lucknow (U.P.),** Jurisdiction only.
28. Conditional tenders will not be accepted.
29. Authorized signatory has to keep all the original documents at the time of opening of tender.
30. The Registrar has the right to accept or reject any or all tenders without assigning any reason.

I/We have read and understand 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	Attach proof
Place of Tender Submission	Office of the Coordinator, Faculty of Engineering, University of Lucknow, Second Campus, Jankipuram, Lucknow- 226031 (U.P.)
Last Date of Tender Submission	Date:- 02.04.2018 Time:- 02.00 PM
Place of Tender Opening	Registrar Office, Committee Room, Lucknow University (Old Camous), Lucknow.
Opening of Tender	Date:- 02.04.2018 Time:- 04.00 PM

Signature and Seal of Bidders

TENDER BID-II (Financial)

Package- FOE/EE/01: Network Analysis and Synthesis Laboratory

Tender Cost: Rs. 1000/- **EMD: Rs. 3000/-**

Bill of Quantity

S.No.	Name of Equipment with specifications	Qty.	Unit Cost	Total Cost
1	**Complete setup for performing:-** Verification of principle of superposition theorem with dc and ac sources. 1. Experimental kit fitted with (a) Bread Board – 01 (b) Voltage Source – 02 (c) Current Source - 01 2. Instrument Module OR Multimeters 3. Carbon Resistances: (a) 1 K – 05 (b) 2 K – 05 (C) 5 K – 05 (d) 10 K - 05 4. Patch Cords	2		
2	**Complete setup for performing:** Verification of Thevenin's, Norton's and Maximum power transfer theorems in ac circuits 1. Variable AC Voltage Source - 2 Nos. 2. Variable AC Current Source - 1 No. 3. Inductors - 2 Nos. 4. Capacitors - 6 Nos. 5. Fixed Resistances - 8 Nos. 6. Variable Resistance - 2 Nos. 7. Digital Multimeters	2		
3.	**Complete setup for performing:** Verification of Tellegen's theorem for two networks of the same topology.	2		
4.	**Complete setup for performing:** Determination of transient response of current in RL and RC circuits with step voltage input 1. DC Voltage Source 2. Resistances - 5 Nos. 3. Capacitances - 3 Nos. 4. Inductors - 2 Nos.	2		
5.	**Complete setup for Performing:** Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically	2		

	damp and over damp cases 1. DC Voltage Source 2. Resistances - 5 Nos. 3. Capacitances - 3 Nos. 4. Inductors - 2 Nos.			
6.	**Complete setup for Performing:** Determination of frequency response of current in RLC circuit with sinusoidal ac input 1. DC Voltage Source 2. Resistances - 5 Nos. 3. Capacitances - 3 Nos. 4. Inductors - 2 Nos. 5. AF Oscillator 1 KHz Digital Frequency Counter 20 Hz to 200 KHz	2		
7.	**Complete setup for Performing:** Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters	2		
8.	**Complete setup for Performing:** Determination of driving point and transfer functions of a two port ladder network and verifywith theoretical values	2		
9.	**Complete setup for Performing:** Determination of image impedance and characteristic impedance of T and π networks, usingO.C. and S.C. tests.	2		
10.	**Complete setup for Performing:** Verification of parameter properties in inter-connected two port networks: series, parallel andcascade also study loading effect in cascade.	2		
11.	**Complete setup for Performing:** Determination of frequency response of a Twin – T notch filter. 1. AF Signal Generator 1 KHz 2. Resistances - 10 Nos. 3. Capacitances - 10 Nos.	2		
12.	**Complete setup for Performing:** To determine attenuation characteristics of a lowpass/ high pass active filters.	2		
13.	Digital AC Millivoltmeter	1		

TENDER BID-II (Financial)

Package- FOE/EE/02: Electrical Measurement and Measuring Instruments Laboratory

Tender Cost: Rs. 1000/- **EMD: Rs. 6000/-**

Bill of Quantity

S.No.	Name of Equipment with specifications	Qty.	Unit Cost	Total Cost
1	**Complete setup for performing:-** Calibration of ac voltmeter and ac ammeter **Apparatus Required:** 1. Portable M.I. Voltmeter (for calibration) 0-300V-1 No. 2. Portable M.I. Voltmeter (standard) 0-300V-1 No. 3. Single phase Variac 0-6A -1 No. 4. M.I. Ammeter (for calibration) 0-2.5A-1No. 5. Portable M.I. Ammeter (Standard) 0-10A- 1 No. 6. Lamp Bank Load	2		
2	**Complete setup for performing:** Measurement of form factor of a rectified sine wave and determine source of error if r.m.s. value is measured by a multi-meter	2		
3.	**Complete setup for performing:** Measurement of phase difference and frequency of a sinusoidal ac voltage using CRO. **CRO 30 MHZ Dual Trace (Analog model)**	2		
4.	**Complete setup for performing:** Measurement of low resistance by Kelvin's double bridge	2		
5.	**Complete setup for Performing:** Measurement of voltage, current and resistance using dc potentiometer	2		
6.	**Complete setup for Performing:** Measurement of inductance by Maxwell's bridge	2		
7.	**Complete setup for Performing:** Measurement of inductance by Hay's bridge	2		
8.	**Complete setup for Performing:** Measurement of inductance by Anderson's bridge	2		
9.	**Complete setup for Performing:** Measurement of capacitance by Owen's bridge	2		

10.	**Complete setup for Performing:** Measurement of capacitance by De Sauty bridge	2		
11.	**Complete setup for Performing:** Measurement of capacitance by Schering bridge	2		
12.	**Complete setup for Performing:** Measurement of Power in a 1-Phase load using 3-Voltmeter method and its Calibration using Wattmeter.	1		
13.	**Complete setup for Performing:** Calibration of 3-Phase Energy meter.	1		
14.	**Complete setup for Performing:** Measurement of Earth-Resistance	1		
15.	**Complete setup for Performing:** Range extension of ammeter and voltmeter.	2		
16.	**CRO 30 MHZ Dual Trace (Analog model)**	2		

TENDER BID-II (Financial)

Package- FOE/EE/03: Electrical Machines Laboratory - I

Tender Cost: Rs. 1000/- **EMD: Rs. 14000/-**

Bill of Quantity

S.No.	Name of Equipment with specifications	Qty.	Unit Cost	Total Cost
1	**Complete setup for performing:-** To obtain magnetization characteristic of a DC shunt generator **Machine Required:** DC shunt motor (Prime Mover) flexibly coupled to shunt generator 1.0 KW (self-excited). Both the machines flexibly coupled and mounted on M S channel base. **DC shunt motor:** **Type:** DC motor, shunt wound, self-excited, screen protected, horizontal foot mounted, fan cooled, provided with inter poles with DC starter face plate type. Capacity: 2HP Winding: Shunt wound R.P.M.: 1500 Volts:230V Insulation: Class 'B' **Connections:** All the terminals of armature and shunt field shall be brought over to a Bakelite sheet, fixed to C.I. terminal box, fitted on top of motor. **DC shunt Generator**: **Type:** DC-Generator, shunt wound, self-excited, screen protected, horizontal foot mounted, and fan cooled, provided with inter poles. Capacity: 1.0KW, R.P.M.: 1500 Volts:230V Insulation: Class 'B' **Connections:** All the terminals of armature and shunt field shall be brought over to a Bakelite sheet, fixed to C.I. terminal box, fitted on top of motor. **CONTROL PANEL FOR MG SET: DC SHUNT MOTOR & DC SHUNT GENERATOR WITH**	1		

	All measuring instruments required as per Experiment (Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)			
2	**Complete setup for performing:** To obtain load characteristic of a DC shunt generator. **D.C. Power Supply** Fixed: 230V Variable: 0-230V **DC Machine** Type: DC shunt Rating: 1HP RPM: 1500 (No Load) Tachometer: 20,000 RPM **With**All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)	1		
3.	**Complete setup for performing:** To obtain efficiency of a dc shunt machine using Swinburne's test Swinburne test of DC Machine: Input Supply:230V Fixed DC :0-230V Variable DC **DC Machine Specification** Type: DC Shunt Rating: 1HP Voltage Rating: 230volt RPM: 1500 (No load) **With**All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting).	1		
4.	**Complete setup for performing:** To perform Hopkinson's test and determine losses and efficiency of DC machine. **Hopkinson test of DC Machines:** Input supply: 230 V Fixed DC :0-230V Variable DC **DC Machines specification (2 Nos)** Both the Machines are flexibly coupled and mounted on a M.S. channel base act as a Motor Generator set. Type: DC shunt	1		

	Rating: 1HP Voltage rating: 230 Volt RPM: 1500 (No Load) Insulation: Class B **With**All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)			
5.	**Complete setup for Performing:** **1. To obtain speed control of DC shunt motor using (a) armature resistance control (b) field control.** **2. To obtain speed-torque characteristic of a DC shunt motor** **DC power supply** Input supply: 230 V Fixed DC :0-230V Variable DC **DC Machine** Type: DC Shunt Rating: 1HP Voltage rating: 230 Volt RPM: 1500 (No Load) Insulation: Class B Tachometer: 20,000RPM Arrangement for Speed variation by Armature Control. Arrangement for Speed variation by Field Control. DC Starter 3 Point 2 HP face plate type suitable for above motor. **With** All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)	1		

6.	**Complete setup for Performing:** To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/static Ward-Leonard method. **Ward-Leonard method of DC machine:** **Main Supply: Three phase, 415 Volt** **Machine specification (2 Nos)** Both the machine are flexibly coupled and mounted on a M. S. channel base act as a Motor Generator set. **AC three phase Squirrel Cage Induction motor acts as a Prime Mover** Rating: 1HP Voltage Rating: 415Volt RPM: 1500 (No Load) Insulation: Class B **DC Shunt Motor** Rating: 1HP Voltage rating: 200 Volt RPM: 1500 (No Load) Insulation: Class B **Extra DC Shunt Motor 200 Volt for which the speed can be controlled using Motor Generator set.** Rating: 1/2 HP Voltage Rating: 200Volt RPM: 1500 (No Load) Insulation: Class B **With** All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)	1		
7.	**Complete Setup For performing :-** 1. To study polarity and ratio test of single phase and 3-phase transformers. 2. To obtain equivalent circuit, efficiency and voltage regulation of a Single phase transformer using O.C. and S.C. tests. 3. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner 's test. 3 Phase Variac 0-470V **<u>TEST ON 3 PHASE TRANSFORMER</u>**	1		

	Transformer Three Phase,3 KVA, 400/230, 50 Hz, air cooled, copper double wound with tapings at 50% on primary & secondary side housed in M S box with rubber footings. All the connections of primary & secondary winding with tapings shell be brought over to insulated Bakelite sheet fixed on top of transformer. The transformer can be CORE type. **CONTROL PANEL** Fitted on ENGRAVED Bakelite sheet enclosed in almirah type M S box with lock & handle Arrangement suitable for table mounting. 1. MI Ammeter 0-2A -1 No. 2. MI Ammeter 0-l 0A -2 Nos. 3. MI Voltmeter 0- 300 V -2 Nos. 4. MI Voltmeter 0- 600 V -2 Nos. 5. Educational type Insulating Terminals 6. Indicating Light 7. TP MCB 8. LPF Wattmeter 2.5/5 Amp 150/300/600V -2 Nos. **Additional Accessories** 3 Phase Variac 0-470V -1 No. **OPEN CIRCUIT AND SHORT CIRCUIT TESTS ON SINGLE PHASE TRANSFORMER MACHINE REQUIRED** Single Phase Transformer 2 KVA, 230/23OV with Tappings at 50% & 86.6% .Naturally Air Cooled Copper Double wound, Shell type. The transformer will be housed in MS sheet box enclosure with rubber footings. All the terminals of primary & secondary shall be brought over to Bakelite sheet fitted on top of the box through insulated terminals. **CONTROL PANEL FOR EXPERIMENT** Fitted on Bakelite sheet enclosed in almirah type M S box with lock & handle arrangement suitable for table mounting. 1. MI Voltmeter 0-3OOV -1 No. 2. MI Voltmeter O-6OOV - 1 No. 3. MI Voltmeter 0-3OV- 1 No. 4. MI Ammeter 0-5A- 2 No. 5. Single Phase Single Element Dynamo type Wattmeter 2.5/5Amp,75/150/300V - 1 No. 6. Single Phase Variac Air Cooled O-27OV- lNo.			

	TO OBTAIN EFFICIENCY & REGULATION OF A SINGLE PHASE TRANSFORMER BY SUMPNER'S (BACK TO BACK) TEST 2 Nos Single Phase Transformer 1 KVA 230/230V with Tappings at 50% & 86.6% Naturally Air Cooled Copper Double wound, Shell type. The transformer will be housed in MS sheet box enclosure with rubber footings. All the terminals of primary & secondary shall be brought over to bakelite sheet fitted on top of the box through insulated terminals. **CONTROL PANEL FOR EXPERIMENT** Fitted on engraved bakelite sheet enclosed in almirah type ms box suitable for table mounting. 1. MI Voltmeter 0-300V -1 No. 2. MI Voltmeter 0-600V-1 No. 3. MI Voltmeter 0-30V -1 No. 4. MI Ammeter 0-5A -2 No. 5. Single Phase Single Element Dynamo type Wattmeter 2.5/5A, 75/150/300V- 1 No. 6. Single Phase Variac Air Cooled 0-270V - 1 No.			
8.	**Complete Setup For performing :-** T o obtain 3-phase to 2—phase conversion by Scott connection. **TO STUDY THREE PHASE TO TW'O PHASE CONVERSION OF 3 PHASE TRANSFORMER BY SCOTT CONNECTION MACHINE** **REQUIRED FOR EXPERIMENT** 2 Nos Single Phase Transformer 1 KVA 230/230V with Tappings at 50% & 86.6% Naturally Air Cooled Copper Double wound, Shell type. The transformer will be housed in MS sheet box enclosure with rubber footings. All the terminals of primary & secondary shall be brought over to bakelite sheet fitted on top of the box through insulated terminals. **CONTROL PANEL FOR EXPERIMENT** Fitted on **ENGRAVED BAKELITE** sheet enclosed in almirah type ms box suitable for table mounting. 1. MI Voltmeter 0-300V -1 No. 2. MI Voltmeter 0-600V -1 No. 3. MI Ammeter 0-5A-5 No. 4. Three Phase Variac Air Cooled 0-270V -1	1		

	No. 5. Electrical Load 2.5 KW, 250V with dual output 1 No. portable trolley mounted with castor wheels make.			
9.	**Complete experimental setup:-** **<u>TO DETERMINE EXCITATION PHENOMENON (B.H. LOOP) OF SINGLE PHASE TRANSFORMER USING CRO (MEASUREMENT OF IRON LOSSES)</u>** Consisting of 1 KVA Transformer & control panel consisting of single phase variac 6 amp & digital voltmeter, ammeter & wattmeter. Power supply variable in steps. Complete experimental setup with CRO.	1		
10.	**A.C. TO D.C. POWER SUPPLY RECTIFIER TYPE WITH TRANSFORMER**	1		
11.	**Cut section model of DC motor(working type) with DC starter**	1		
12.	**Cut section model of Transformer 3 phase (working type)**	1		
13.	**Cut section model of Transformer single phase shell type**	1		

TENDER BID-II (Financial)

Package- FOE/EE/04: Electrical Machines Laboratory - II

Tender Cost: Rs. 1000/- **EMD: Rs. 16000/-**

Bill of Quantity

S.No.	Name of Equipment with specifications	Qty.	Unit Cost	Total Cost
1	**Complete setup for performing:-** 1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit. 2. To perform load test on a three phase induction motor and draw its Torque -speed characteristics And Power factor-line current characteristics. 3. Reversal & speed control of 3 phase induction motor by using variable frequency supply and hence to plot a graph for speed vs frequency of supply voltage. **Three Phase Induction Motor Trainer:** Main Supply: Three phase 415V ±10%, 50Hz **Motor's Specification** Type :Squirrel C age Rating : 2 HP RPM :1500 (No Load) Tachometer :20,000 RPM Volts : 415 V Starting : DOL Insulation :Class B Connections: All the four terminals of auxiliary winding & main winding are brought over to a bakelite sheet, fixed to C.I. terminal box, fitted on top of Motor. Mechanical Loading: Loading of the Motor shall be made through Pronney brake arrangement, consisting of a C.I. drum pulley, suitable for water cooling, round dial spring balances, canvas belt with hooks, C.P. wheels with threaded studs for tightening the belt frame. **With** All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock &	1		

	handle arrangement suitable for table mounting). **CONTROL PANEL FOR AC SQUIRREL CAGE INDUCTION MOTOR THREE PHASE FOR NO LOAD AND BLOCKED ROTOR TESTS ON A THREE PHASE SQUIRREL CAGE INDUCTION MOTOR** Fitted on **ENGRAVED BAKELITE** sheet enclosed in almirah type ms box suitable for table mounting. 1. MI Voltmeter0-500V -1 No. 2. MI Ammeter,0-5 A -1 No. 3. MCB 16A, 415V -1 No. 4. Indicating Light. -3 Nos. 5. D.O.L STARTER 6. Single Phase Single Element dynamometer type Wattmeter 2.5/5A, 150/300/600V -2 Nos. 7. Insulation terminals. **CONTROL PANEL FOR LOAD TEST ON A THREE PHASE INDUCTION MOTOR** Type :Squirrel Cage Rating : 2 HP RPM :1500 (No Load) Tachometer :20,000 RPM Volts : 415 V Starting : DOL Insulation :Class B Connections: All the four terminals of auxiliary winding & main winding are brought over to a bakelite sheet, fixed to C.I. terminal box, fitted on top of Motor. Mechanical Loading: Loading of the Motor shall be made through Pronney brake arrangement, consisting of a C.I. drum pulley, suitable for water cooling, round dial spring balances, canvas belt with hooks, C.P. wheels with threaded studs for tightening the belt, frame. **Same as above.** **<u>CONTROL PANEL FOR SPEED CONTROL USING V/F METHOD</u>** A.C. Squirrel cage induction motor 3 Phase, 415V, 1500 R.P.M. T.E.F.C.horizontal foot mounted, class 'B' insulation with D.O.L. Starter 1 HP. The motor will be supplied with			

	M.S.channel base. Variable Frequency Supply Source 2 KVA ,415 V frequency range 47.5 Hz to 52 .5 Hz (a) MI Voltmeter 0-500 V -1 No. (b) MI Ammeter 0-5 A-1 No. (c) 3 Pole MCB 4 A -1 No. (d) DP Switch reversing type 16A/250V -1 No. (e) DOL Starter manual -1 No. (f) Phase Sequence Indicator-1 No. (g) Digital Tachometer -1 No			
2	**Complete setup for performing:** To perform no load and blocked rotor tests on a single phaseinduction motor and determine equivalent circuit. **Single Phase Induction Motor Trainer with belt Induction Motor** Type :Capacitor Phase : Single RPM : 1500 Current Type: AC Rating :1HP Voltage rating :230 V, ±10%, 50Hz MCB :10A Tachometer :20,000 RPM Mains Supply : 230 V, ±10%, 50Hz Connections: All the four terminals of auxiliary winding & main winding are brought over to a bakelite sheet, fixed to C.I. terminal box, fitted on top of Motor. Mechanical Loading: Loading of the Motor shall be made through Pronney brake arrangement, consisting of a C.I. drum pulley, suitable for water cooling, round dial spring balances, canvas belt with hooks, C.P. wheels with threaded studs for tightening the belt, frame. 1. MI Voltmeter 0-300V- 1 No. 2. MI Ammeter 0-10 A-1 No. 3. MCB Double Pole-1 No. 4. Indicating Light -3 Nos. 5. DOL Starter 6. Single Phase Single Element dynamometer type 1 No. Wattmeter 5/10A, 75/150/300 V 7. Insulation terminals **Single Phase Variac 6 A, 0-300V -1 No.**	1		

	With All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)			
4.	**Complete setup for performing:** To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method. **Three Phase Synchronous Generator Trainer:** **Input Supply** :230 V Fixed DC :0-230 V Variable DC **Machine Specification (2 Nos.)** Both the Machine are flexibly coupled and mounted on a M.S. channel base **DC Machine acts as a Prime Mover** Type : DC Shunt Rating : 3 HP Voltage Rating : 230 Volt RPM : 1500 (No Load) 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. **Three Phase Synchronous Motor act as Generator** Type: Salient Pole Motor separately excited Current type :AC Rating: 3HP Excitation Voltage: 120V Voltage rating: 415V, ±10% Power factor: 0.8 p.f. lagging **TABLE MOUNTING TYPE CONTROL PANEL FOR M.G. SET : DC SHUNT MOTOR/AC GENERATOR SEPARATELY EXCITED** : Fitted on **ENGRAVED BAKELITE** sheet enclosed in almirah type MS box suitable for table mounting. **For DC Motor** (i) MC Voltmeter 0-300 V	1		

	(ii) MC Ammeter 0-10 A or 20 Amp (iii) Starting Compensator, DC Starter face plate type. (iv) Double Pole Iron clad cutout 16 A (v) Field Rheostat 1.4 A, 230 Ohms **For AC Generator** (i) MI Voltmeter 0-500V (ii) MI Ammeter 0-10 A or 5 Amp (iii) Vibrating Reed type Frequency meter, 45-50-55 Hz, 440 V, flush mounted. (iv) T.P. M.C.B (v) Indicating Light. (vi) Excitation controlling arrangement **For Excitor** (i) MC Volt meter 0-300V (ii) MC Ammeter 0-2.5 A **With** All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)			
5.	**Complete setup for Performing:** To determine V-curves and inverted V-curves of a three phase synchronous motor. **Three Phase Synchronous Generator Trainer:** **Input Supply:** Three phase 415V, ±10%, 50Hz **Machine Specification (2 Nos.)** **Both the machines are flexibly coupled and mounted on a M.S. channel base** **Thee phase Synchronous Motor** Type: Salient Pole Motor Current Type: AC Rating: 3HP Excitation Voltage: 120V Voltage Rating: 415V, ±10% **DC Machine** **Type: DC Shunt** **Rating: 2HP** **Voltage rating: 230V** **RPM: 1500 (No Load)** **Insulation: Class B** **With** All measuring instrument required as per	1		

	experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting)			
6.	**Complete setup for Performing:** To determine *Xd* and *Xq* of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve. **Three Phase Synchronous Machine** Type :Salient Pole Motor Current type :AC Rating: 3 HP Voltage rating :415 V, ±10% **With** All measuring instrument required as per experiment(Fitted on Engraved Bakelite sheet enclosed in almirah type MS box with lock & handle arrangement suitable for table mounting) **3 Phase Variac, 0-500V**	1		
7.	**Complete setup for Performing:** To study synchronization of an alternator with the infinite bus by using: (i) dark lamp method (ii) two bright and one dark lamp method **M G set : dc shunt motor/3 phase alternator (fixed pole rotating armature type)** **Synchronising panel for parallel operation of alternator**	1		
8.	**Complete setup for Performing:** Determination of losses and efficiency of an alternator.	1		
9.	**A.C. TO D.C. POWER SUPPLY RECTIFIER TYPE WITH TRANSFORMER**	1		
10.	**Cut section model of slip ring induction motor(Non working type)**	1		
11.	**Cut section model of squirrel cage induction motor(working type)**	1		
12.	**Cut section model of synchronous machine (Non-working type)**	1		