

S. No.

Tender cost Rs. 1000/-

**MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE  
GWALIOR – 474005**

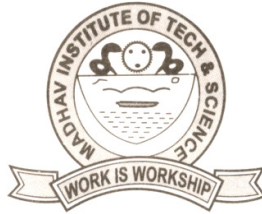
*TENDER DOCUMENT*

For

**Electrical Machines Lab Equipments**

(2018-19)

01



**Last Date of submission: 24-08-2018**

**The Tender document Contains 18 Pages (From Page No. 1 to 18)**

# MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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## GENERAL TERMS & CONDITIONS

1. Tender documents can be obtained against cash payment/DD of 1000/- (in favor of DIRECTOR, MITS, Gwalior payable at Gwalior) only of cost of tender form (non-refundable) on or before **24.08.2018** upto **01.00 PM** from the Institute during working days. The tender form can also be directly downloaded from the institute website [www.mitsgwl.in](http://www.mitsgwl.in) / [www.mitsgwalior.in](http://www.mitsgwalior.in) and shall be enclosed with tender form fees of Rs.1000/- in form of a D.D. in name of Director, MITS, payable at Gwalior.
2. Earnest money deposit (EMD) **Rs. 15,000/-** is to be submitted along with the completed tender form duly sealed in **Envelope-1**. The EMD shall be in the form of Demand Draft/Pay order in favour of the **Director, MITS, Gwalior**, payable at Gwalior.
3. Eligibility criteria for applying for the tender-
  - A. Valid GST Number is compulsory.
  - B. Valid TIN Number and PAN Card photocopy.
  - C. Proof of past satisfactory assignment of the same nature done in the reputed departments.

**These (A, B & C) certificates are to be put inside the Envelope-1.**

4. The tenderers shall submit the tender in **two sealed envelopes** marked as; **Envelope-1** and **Envelope-2**. **The Envelope-1 should contain the E.M.D. and copies of all relevant documents pertaining to eligibility criteria and Envelope-2 should contain the tender form of the price bid.** In case, the **Envelope-1** is not annexed for eligibility criteria in the proper form as mentioned above in clause (3), and /or is without E.M.D, the envelope **Envelope-2** will not be opened at all and the same will be rejected and no representation shall be entertained in this regard. These two envelopes are to be put inside the **third separate envelope**. **All sealed cover envelope** must be super-scribed "**Electrical Machines Lab Equipments**" on the top of envelope. **The tender documents directly downloaded from the institute website, must be attached with a demand draft of tender cost of Rs. 1000/- in the favour of Director, MITS, Gwalior payable at Gwalior.**
5. The last date and time of submission of tenders is, (on or before) **24.08.2018 upto 3:00 PM.**
6. Tenders will be opened on **24.08.2018** at **4.00PM**. First envelope will be opened from **4.00PM** and the second envelope of only the eligible tenderers will be opened at **4:15PM** on the same date.
7. Validity of the rates will be **upto 31.03.2019** from the date of opening of tender.
8. Telegraphic/Fax and conditional tenders shall not be accepted.
9. **Director, MITS, Gwalior**, reserves the right to accept or reject any or all tenders without assigning any reason thereof.
10. The rates should be **F.O.R. at site (Institute Premises)**. No extra charges on this account (for Octroi, sales tax, and surcharge etc.) shall be payable to the suppliers.
11. Our Institute is exempted to pay excise duty.
12. **The rates should include all materials, labour charges, profit & relevant taxes including GST, if any.**
13. The tenderers whose tender is accepted shall have to sign an agreement as per the given format of institute.
14. Any amount due or becoming due for the tender shall be covered from their bills.
15. The competent authority reserves the right to increase or decrease the quantity of any item of sale, during the period of contract. The tenderers will be bound to comply with the order of the competent authority without any claim and compensation.
16. The rates should be competitive and workable.
17. Any controversy will be subject to disposal in Gwalior Jurisdiction only.
18. The Income Tax shall be deducted from the bills as per the rules.
19. The whole supply should be satisfactory executed within stipulated time from the date of issue of order. Time extension will not be permitted.
20. The tenderers shall execute the work as per specification mentioned in the supply order.
21. Before making any supply of any materials to the Institute, the tenderer or his representative shall get it approved by the competent authority, otherwise the supply shall not be approved. To

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- check the rest of supply, he should submit the approved sample in our office, if items do not belong to reputed or registered make.
22. The tenderer should satisfy him regarding the magnitude of the supply and no claim on this account shall be entertained thereafter.
  23. Warranty period should be clearly specified as per the latest terms & conditions of the Original manufactures and the parts and labour costs are to be included for the full warranty period.
  24. The warranty period will be considered from the date of supply of the items.
  25. A duly constituted committee of the Institute may inspect the supply made by the tenderer at other places. The committee may also inspect infrastructure of those applicants who qualify the eligibility criteria in clause-3, for satisfaction.
  26. M.I.T.S. Gwalior will have the rights to check the samples before supply.
  27. Payment will be made after the successful and satisfactory supply and installation/ completion of the work.
  28. The Work order will be issued to the lowest total rate vender with the conditions that the vender will supply the items at approved rates of item in tender.
  29. The competent authority has the right to reject all or any part of the tender without assigning any reason. **Even the lowest tender may not necessarily qualify for the order.**

**Registrar**

I have studied the above general conditions of the contract and shall abide by them.

**Seal & Signature of the Agency/Firm**

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## Scope of Work

### **Objective -**

It is proposed to develop a fully equipped state of Art Electrical Machine lab at MITS-Gwalior. The Laboratory must have a rotating machine, control panel with all associated instrumentation facility, loading arrangement, relevant switchgear and connection wires.

### **The work basically consists of following components:-**

1. Supply of Electrical Machines and Control Panels (as per Annexure-I)
2. Supply & laying of Electrical wiring/ cable (as per Annexure-I & relevant Specifications Annexure-II).
3. Installation, commissioning & erection of complete Experimental Beds (as per Schedule Annexure-II)
4. Development of proper Grounding/Earthing System (as per Annexure-I) & relevant Specifications (Annexure-II).
5. Supply of Experimental Tables (as per Annexure-III)

**Note: The Tenderer will have to quote for all the components of the work in each Item.**

### **TERMS AND CONDITIONS:**

1. The Tenderer should supply following with the tender, without which the offer is liable to be rejected.
  - Profile of the company
  - List of customers
  - Detailed Project Report (DPR) for the completed work, covering all aspects of the work.
  - Cost break up of complete work, under following heads.
    - Supply of Machines, Transformers and Accessories like loading arrangement etc.
    - Supply of Control panels for Experimental beds (including meters and accessories to be fitted on it).
    - Distribution panel
    - Cable erection & commissioning
    - Earthing
  - Name/Make of the manufacturer of each
    - Machine, Transformer etc.
    - Equipment
    - Control & distribution panel
    - Power Cables
    - Accessories etc.

Note : Before deciding the award of contract and/or during the contract period, Director MITS Gwalior reserves the right to inspect/depute his representative to inspect, the factory/workshop of the suppliers/manufactures and institutions where the tenderer had carried out work in the past. During the inspection, if it is observed that the work carried/being carried out is not upto the mark, then Director MITS Gwalior reserves the right of not awarding/cancellation of the contract.

After the award of the contract, firm has to get approved the plan for the complete work including: design of control & distribution panel, cable layout, earthing system etc. from MITS Gwalior

2. The **Layout Plan**, details of work of installation & commissioning etc should be supplied with the tender document.

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3. All the items, cables, wires, switches, working benches, motors, generators, transformers etc should be of standard make.
4. Damaged, defective or substandard material will not be accepted under any circumstances.
5. Catalogue for experiments, technical literature, wherever necessary should be supplied along with tender document.
6. In the last three year, the bidders should have supplied the product/components/equipment to the minimum two Government or Autonomous organization/Institution. The copy of the proof is to be attached.
7. Average annual turnover for the last 3 year should at least Rs. 200 lakhs.
8. The tenderer should produce audit statement of accounts for the last 3 years.

**The tenderer shall produce documentary evidence on the above said items as proof of meeting the above qualifying requirements.**

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## Electrical Engineering Department Annexure-I

EMD (Rs.15,000/-)

S. No.	Name of Setup	Equipments with Specification	Qty.	Quoted Rate (Rs.)	Amount (Rs.)
1.	<b>D.C. Motor -Shunt Generator Setup</b>	<p><b>Experiments to be performed:</b></p> <p>1) Back to back testing of DC Machines (Hopkinson's method)                      2) External Characteristics of a DC Shunt Generator                      3) Magnetization characteristics of a DC Shunt Generator</p> <p><b>D.C motor –Shunt Generator set – 1 No.</b>                      Shunt Motor 3HP Coupled to DC Self Excited Shunt generator, 1.8kW, 220 V. The armature assembly of generator should be made from silicon steel laminated core with winding in slots of SE copper wire. Screen Protected Drip proof,</p> <p>a) Motor – 3HP Generator - 1.8 kW                      b) Voltage – 220 V                      c) Insulation class 'B' type                      d) RPM 1500 for maximum output (Approx)                      e) Screen protected, horizontal foot mounted, Internal fan cooled.                      f) Motor Generator should confirm to IS standard 4722                      h) Frame : 132 as per BIS</p> <p>The motor &amp; generator coupled with flexible LOVEJOY coupling &amp; fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted provided with speed sensor and display</p> <p><b>The supplier should supply motors with CE certification only.</b>                      Hylem Sheet Panel with Connector &amp; Accessories:                      MCB Two pole DC16 Amp, 250 Volt – 2 Nos.                      BTI Terminals                      HRC Fuse Bakelite type base with top 16A 440 – 4 Nos.                      Indicating Lamps LED type 22.5mm size                      Hylem sheet with duly printed circuit diagram Poly carbonate labeling and termination marking etc.3 Point DC starter flush mounted with no load and over load coils                      Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 45° inclined.                      DC Voltmeter Flush type 0-300V – 2 Nos.                      DC Ammeter Flush type 0-5 A – 2 Nos.                      DC Ammeter Flush type 0-2 A – 2 Nos.                      DC Voltmeter Flush type 0-500V – 1 No.</p> <p><b>The supplier should supply all meters of STANDARD make only.</b>                      Tubular Rheostat with good porcelain tube with chrome plated brass terminals and slider , green thermal resistant coating with metallic casted end supports duly painted, made of Constantan / Eureka                      Rheostat 300Ω / 2A – 2 Nos.</p>	01		
<b>Total (Setup 1)</b>					

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2.	<b>D.C. Motor-Compound Generator Setup</b>	<p><b>List of Experiment</b></p> <ol style="list-style-type: none"> <li>1) External Characteristics of a DC Compound Generator</li> <li>2) Magnetization characteristics of a DC Compound Generator</li> <li>3) Long shunt and short shunt DC Compound Generator</li> </ol> <p><b>D.C motor – Compound Generator Set- 1 No.</b></p> <p>DC Shunt Motor 3HP Coupled to DC Self Excited Compound generator, 2.2kW, 220V. The armature assembly of generator should be made from silicon steel laminated core with winding in slots of SE copper wire. Screen Protected Drip proof,</p> <ol style="list-style-type: none"> <li>a) Shunt Motor – 3HP Comp. Generator - 2.2 KW</li> <li>b) Voltage – 220 V</li> <li>c) Insulation class ‘B’ type</li> <li>d) RPM 1500 for maximum output (Approx)</li> <li>e) Screen protected, horizontal foot mounted, Internal fan cooled.</li> <li>f) Motor Generator should confirm to IS standard 4722</li> <li>h) Frame : 132 as per BIS</li> </ol> <p>The motor &amp; generator coupled with flexible LOVEJOY coupling &amp; fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted</p> <p>Provided with speed sensor and display</p> <p><b>The supplier should supply motors with CE certification only.</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                  MCB Two pole DC16 Amp. 250 Volt – 2 Nos.                  BTI Terminals                  HRC Fuse Bakelite type base with top 16A, 440V – 4 Nos.                  Indicating Lamps LED type 22.5mm size                  Hylem sheet with duly printed circuit diagram Poly carbonate                  Facia labeling and termination marking etc.</p> <p>4-Point DC starter flush mounted with no load and over load coils:01 No.</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.</p> <p>DC Voltmeter Flush type 0-300V – 2 Nos.                  DC Ammeter Flush type 0-5 A – 2 Nos.                  DC Ammeter Flush type 0-2 A – 2 Nos.                  DC Voltmeter Flush type 0-500V – 1 No.</p> <p><b>The supplier should supply all meters of STANDARD make only.</b></p> <p>Tubular Rheostat with good porcelain tube with chrome plated brass terminals and slider , green thermal resistant coating with metallic casted end supports duly painted, made of Constantan / Eureka</p> <p>Field Rheostat 300Ω / 2A – 2 Nos.</p>	<b>01</b>		
<b>Total (Setup 2)</b>					

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3.	<p><b>D.C. Series Motor Setup</b></p>	<p><b>List of Experiments</b>                      1) Starting of DC Series Motor                      2) Load Characteristics of DC Series Motor</p> <p><b>D.C. Series Motor- 1 No.</b>                      DC Series Motor 3HP provided with drum brake aluminum pulley Friction belt brake loading arrangement with two Round Dial balances. The armature assembly of Motor should be made from silicon steel laminated core with winding in slots of SE copper wire. Screen Protected Drip proof,</p> <p>a) DC Series Motor – 3HP                      b) Voltage – 220 V                      c) Insulation class ‘B’ type                      d) RPM 1500 for maximum output (Approx)                      e) Screen protected, horizontal foot mounted, Internal fan cooled.                      f) Motor should confirm to IS standard 4722                      h) Frame : 132 as per BIS</p> <p>The motor fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted Provided with speed sensor and display</p> <p><b>The supplier should supply motors with CE certification only.</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                      MCB Two pole DC16 Amp. 250 Volt – 1 Nos.                      BTI Terminals                      HRC Fuse Bakelite type base with top 16A, 440V – 2 Nos.                      Indicating Lamps LED type 22.5mm size                      Hylem sheet with duly printed circuit diagram Poly carbonate Facia labeling and termination marking etc.                      3 Point DC starter flush mounted with no load and over load coils</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.                      DC Voltmeter Flush type 0-300V – 1 Nos.                      DC Ammeter Flush type 0-5 A – 1 Nos.</p>	01		
		<b>Total (Setup-3)</b>			
4	<p><b>D.C. Shunt Motor setup</b></p>	<p><b>List of Experiments</b>                      1) Starting of DC Shunt Motor                      2) Load Characteristics of DC Shunt Motor                      3) Speed Control by armature and field control method</p> <p><b>DC Shunt Motor – 01 No.</b>                      DC Shunt Motor 3HP provided with drum brake aluminum pulley Friction belt brake loading arrangement with two Round Dial balances. The armature assembly of Motor should be made from silicon steel laminated core with winding in slots of SE copper wire. Screen Protected Drip proof</p> <p>a) Shunt Motor – 3HP                      b) Voltage – 220 V                      c) Insulation class ‘B’ type</p>	01		



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		<p>d) RPM 1500 for maximum output (Approx)  e) Screen protected, horizontal foot mounted, Internal fan cooled.  f) Motor should confirm to IS standard 4722  h) Frame : 132 as per BIS  The motor fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted  Provided with speed sensor and display  <b>The supplier should supply motors with CE certification only</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:  MCB Two pole DC16 Amp, 250 Volt – 1 No.  BTI Terminals  HRC Fuse Bakelite type base with top 16A 440 – 2 Nos.  Indicating Lamps LED type 22.5mm size  Hylem sheet with duly <b>printed circuit diagram</b> Poly carbonate  Facia labeling and termination marking etc.</p> <p>3-Point DC starter flush mounted with no load and over load coils</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.  DC Voltmeter Flush type 0-300V – 1No.  DC Ammeter Flush type 0-5 A – 1No.  DC Ammeter Flush type 0-2 A – 1No.  <b>The supplier should supply all meters of STANDARD make only.</b></p> <p>Tubular Rheostat with good porcelain tube with chrome plated brass terminals and slider, green thermal resistant coating with metallic casted end supports duly painted, made of Constantan / Eureka  Rheostat 50Ω / 5A – 1No.  Field Rheostat 300Ω / 2A – 1No.</p>			
		<b>Total (Set up 4)</b>			
<b>5</b>	<b>DC Compo und Motor Setup</b>	<p><b>List of Experiments</b>  1) Starting of DC Compound Motor  2) Load Characteristics of DC Compound Motor (long and short shunt)  3) Speed Control by armature and field control method</p> <p><b>DC compound Motor- 01No.</b>  DC Compound Motor 3HP provided with drum break aluminum pulley Friction belt brake loading arrangement with two Round Dial balances. The armature assembly of Motor should be made from silicon steel laminated core with winding in slots of SE copper wire.  Screen Protected Drip proof  a) Compound Motor – 3HP  b) Voltage – 220 V  c) Insulation class 'B' type  d) RPM 1500 for maximum output (Approx)  e) Screen protected, horizontal foot mounted, Internal fan cooled.  f) Motor should confirm to IS standard 4722</p>	<b>01</b>		

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		<p>The motor fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted                  Provided with speed sensor and display  <b>The supplier should supply motors with CE certification only</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                  MCB Two pole DC16 Amp.250 Volt – 1No.                  BTI Terminals                  HRC Fuse Bakelite type base with top 16A 440 – 2Nos.                  Indicating Lamps LED type 22.5mm size                  Hylem sheet with duly printed circuit diagram labeling and termination marking etc.</p> <p>3 Point DC starter flush mounted with no load and over load coils                  Three Point starter</p> <p>DC Voltmeter Flush type 0-300V – 1No.                  DC Ammeter Flush type 0-2 A – 1No.                  DC Ammeter Flush type 0-5 A – 1No.                  Field Rheostat 300Ω / 2A – 1No.                  Rheostat 50Ω / 5A – 1No.</p>			
		<b>Total (Setup 5)</b>			
<b>6.</b>	<b>Single-Phase Transformer Setup</b>	<p><b>List of Experiments</b>                  1) OC and SC Test of Single Phase Transformer                  2) Polarity check of Single Phase Transformer                  3) Regulation of Single Phase Transformer direct loading method.</p> <p><b>Single Phase Transformer- 01No.</b>                  1 kVA, 220/110V 50Hz                  Naturally air cooled, copper double wound Core type. Transformer is housed in MS Sheet Box Enclosure with rubber footing , all the terminals are brought over to Bakelite/Acrylic sheet fitted on the top of the box through insulated terminals</p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                  MCB Two pole AC16 Amp, 250 Volt – 1No.                  BTI Terminals                  Indicating Lamps LED type 22.5mm size                  Hylem sheet with duly <b>printed circuit diagram</b> Poly carbonate Facia labeling and termination marking etc.</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.                  AC Ampere meter 5A – 1 No. Flush type                  AC Ampere meter 1A – 1 No. Flush type                  AC Voltmeter 300V – 1 No. Flush type                  AC Voltmeter 30V – 1 No. Flush type                  Flush Wattmeter Single Phase Single Element                  Dual Voltage 75/150 Dual current 2.5/5A UPF                  Flush Wattmeter Single Phase Single Element                  Dual Voltage 300/600 Dual current any range upto 30A LPF</p>	<b>01</b>		

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		<p><b>The supplier should supply all meters of STANDARD make only Resistive load 1-Phase, 3kW 10 steps -01</b></p> <p>Resistive Load Specifications</p> <ul style="list-style-type: none"> <li>• Fully power coated</li> <li>• Loaded with number of Quality rotary switches</li> <li>• Suitable to continuous applications</li> <li>• Durability and safety, Mounted on castor wheels</li> </ul> <p>4 Amp Single-Phase Continuously variable Autotransformer flush mounted</p>		
		<b>Total (Setup 6)</b>		
<b>7.</b>	<b>Three-Phase Transformer Setup</b>	<p><b>List of Experiments</b></p> <p>1) OC and SC Test on Three-Phase Transformer</p> <p>2) Different configurations of Three-Phase transformer</p> <p>3) Regulation of Three-Phase Transformer direct loading method</p> <p>Three-Phase transformer 1kVA 50Hz Input 0-230V per phase Output 110V-0-110V per phase</p> <p>Naturally air cooled, copper double wound Shell type. Transformer to be housed in MS Sheet Box Enclosure with rubber footing, all the terminals are brought over to Bakelite/Acrylic sheet fitted on the top of the box through insulated terminals</p> <p>Hylem Sheet Panel with Connector &amp; Accessories:</p> <p>MCB Three pole AC16 Amp, 415 Volt – 1 No.</p> <p>BTI Terminals</p> <p>Indicating Lamps LED type 22.5mm size</p> <p>Hylem sheet with duly printed circuit diagram Poly carbonate Facia labeling and termination marking etc.</p> <p>AC Wattmeter 3-Phase Digital flush type – 1No.</p> <p>Input Voltage Range 600V AC</p> <p>Input Current Range 10A AC</p> <p>Applicable for both UPF &amp; LPF load</p> <p>All meters should have Microcontroller based accurate &amp; reliable True RMS technology and class 0.2 Accuracy.</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.</p> <p>AC Ampere meter 5A – 1No. flush type</p> <p>AC Ampere meter 1A – 1No. flush type</p> <p>AC Voltmeter 500V – 1No. flush type</p> <p>AC Voltmeter 50V – 1No. flush type</p> <p>8 Amp Continuously variable Three-Phase Variac Closed type – 1 No.</p> <p><b>The supplier should supply all meters of STANDARD make only.</b></p>	<b>01</b>	
		<b>Total (Setup 7)</b>		
<b>8.</b>	<b>D.C. Motor-Alternator</b>	<p><b>List of Experiments</b></p> <p>1) OCC and SCC of Synchronous Generator</p> <p>2) <math>X_d</math> and <math>X_q</math> using Slip Test</p>	<b>01</b>	

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<b>Setup</b>	<p>3) Sequence Impedance of Alternator 4) Regulation efficiency of alternator using direct loading, synchronous impedance method and ZPF method</p> <p><b>DC Shunt Motor 5HP Coupled to AC Synchronous Generator 3-Phase, 3.5kVA, 220 V – 1 Set</b> The armature assembly of generator should be made from silicon steel laminated core with winding in slots of SE copper wire.</p> <p><b>DC Motor Specifications</b></p> <ol style="list-style-type: none"> <li>a) Shunt Motor – 5HP</li> <li>b) Voltage – 220 V</li> <li>c) Insulation class ‘B’ type</li> <li>d) RPM 1500 for maximum output (Approx)</li> <li>e) Screen protected, horizontal foot mounted, Internal fan cooled</li> <li>f) Motor should conform to IS standard 4722</li> <li>g) Frame : 132 as per BIS</li> </ol> <p><b>Synchronous Generator Specifications</b></p> <ol style="list-style-type: none"> <li>1. Capacity 3.5 kVA</li> <li>2. Voltage 415V, 3-phase, 4 wire</li> <li>3. Frequency 50 Hz</li> <li>4. Class “B” type and above insulation, copper wound, Horizontal foot mounted internal fan cooled</li> <li>5. Rated power factor 0.85</li> <li>6. Degree of protection IP-55, Conforming to IS -12615:2011</li> <li>7. Salient pole type</li> </ol> <p>The motor &amp; generator coupled with flexible LOVEJOY coupling &amp; fitted on M.S. channel of size 75 x 40 mm. 6 mm thick on fabricated frame with coated &amp; painted provided with speed sensor and display</p> <p><b>The supplier should supply motors and generators with CE certification only.</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories: MCB Three pole AC16 Amp, 415 Volt – 1No. MCB Two pole AC16 Amp, 250 Volt – 1No. BTI Terminals Indicating Lamps LED type 22.5mm size Hylem sheet with duly printed circuit diagram Poly carbonate Facia labeling and termination marking etc. DC Drive 5 HP linear cosine firing for driving motors – 1No. Variable DC Excitation source for alternator – 1No.</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.</p> <p>AC Ampere meter 5 A – 1No. flush type AC Volt Meter 500V – 1No. flush type DC Voltmeter Flush type 0-300V –1No. DC Ammeter Flush type 0-5 A – 1No. DC Ammeter Flush type 0-2 A – 1No.</p> <p><b>The supplier should supply all meters of STANDARD make only.</b></p>			
<b>Total (Setup 8)</b>				

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9.	<b>3-Phase Induction Motor (Squirrel Cage) Setup</b>	<p><b>List of Experiments</b></p> <ol style="list-style-type: none"> <li>1) Load test on Induction Motor</li> <li>2) No load and Blocked Rotor Test</li> <li>3) Running and reversing of induction motor</li> <li>4) Speed Torque curves of Induction Motor</li> </ol> <p>5HP, 415V AC Squirrel Cage Induction motor directly coupled to mechanical load with belt, pulley and round dial balance loading arrangement with brake drum and friction belt, mounted on a MS base Frame</p> <ol style="list-style-type: none"> <li>a. Capacity 5 HP</li> <li>b. RPM 1420</li> <li>c. Insulation class 'F'</li> <li>d. AC Squirrel cage induction, 3 phase</li> <li>e. Degree of protection IP-55, Conforming to IS -12615:2011</li> <li>f. Volt 400/415 AC Hz</li> <li>g. Power factor 0.85</li> <li>h. Totally enclosed Fan cooled</li> <li>i. Continuous duty constant rating</li> <li>j. Efficiency at rated load 85%</li> <li>k. Energy Efficiency Class IE3 with ISI Marking</li> </ol> <p>Provided with speed sensor and display</p> <p>The supplier should supply motors with CE certification only</p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                  MCB Three pole AC 32 Amp.415 Volt – 1 No.                  BTI Terminals                  Indicating Lamps LED type 22.5mm size                  Hylem sheet with duly printed circuit diagram Poly carbonate                  Facia labeling and termination marking etc.                  DOL Starter with overload protection-01No.                  Reversing switch-01No.</p> <p>AC Wattmeter 3 phase Digital flush type – 1No.                  Input Voltage Range 600V AC                  Input Current Range 10A AC                  Applicable for both UPF &amp; LPF load                  Microcontroller based accurate &amp; reliable                  True RMS technology Class 0.2 Accuracy</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.</p> <p>AC Ampere meter 10 A – 1 No. flush type                  AC Volt Meter 250/500V – 1 No. flush type                  8 Amp Three-Phase Continuously variable Variac Closed type</p> <p><b>The supplier should supply all meters of STANDARD make only.</b></p>	01		
<b>Total (Setup 9)</b>					

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10.	<b>Three-Phase Slip Ring Induction Motor setup</b>	<p>List of Experiments                      1) Load test on Induction Motor                      2) No load and Blocked Rotor Test                      3) Speed Torque curves of Induction Motor                      4) Starting of Slip ring Motor</p> <p><b>Three phase slip ring Induction Motor -1No.</b>                      3.5HP, 415V AC Slip ring Induction motor directly coupled to mechanical load with belt, pulley and round dial balance loading arrangement with brake drum, mounted on a MS base Frame supplied with control panel. Three phase Rotor resistance type starter, air break Type, suitable for 5 Hp Slip ring Induction motor. starter should have provision for DOL Start system, no volt &amp; over load protection .Rotor resistance starter with 3 step resistance including 3 contactor 415 V, 2 timer ( on delay) 0-30 seconds.</p> <p>a. Capacity 3.5 HP                      b. RPM 1420                      c. Insulation class 'F'                      d. AC Wound Rotor induction, 3 phase                      e. Degree of protection IP-55,Conforming to IS -12615:2011                      f. Volt 400/415 AC Hz                      g. Power factor 0.85                      h. Totally enclosed Fan cooled                      i. Continuous duty constant rating                      j. Energy Efficiency Class IE3 with ISI Marking                      Provided with speed sensor and display</p> <p><b>The supplier should supply motors with CE certification only</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                      MCB Three pole AC16 Amp.415 Volt – 1 No.                      BTI Terminals                      Indicating Lamps LED type 22.5mm size                      Hylem sheet with duly printed circuit diagram Poly carbonate Facia labeling and termination marking etc.</p> <p>AC Wattmeter 3 phase Digital flush type – 1 No.                      Input Voltage Range 600V AC                      Input Current Range 10A AC                      Applicable for both UPF &amp; LPF load                      Microcontroller based accurate &amp; reliable                      True RMS technology Class 0.2 Accuracy</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.</p> <p>AC Ampere meter 10 A – 1 No. flush type                      AC Volt Meter 250/500V – 1 No. flush type  <b>The supplier should supply all meters of STANDARD make only.</b></p>	01		
<b>Total (Setup 10)</b>					

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<b>11.</b>	<b>Single-Phase Induction Motor Setup</b>	<p><b>List of Experiments</b></p> <ol style="list-style-type: none"> <li>1) Load test on Induction Motor</li> <li>2) No load and Blocked Rotor Test</li> <li>3) Speed Torque curves of Induction Motor</li> </ol> <p>3HP, 230V AC Squirrel Cage Capacitor start Induction motor directly coupled to mechanical load with belt, pulley and round dial balance loading arrangement with brake drum, mounted on a MS base Frame supplied with control panel.</p> <ol style="list-style-type: none"> <li>a. Capacity 3HP</li> <li>b. RPM 1420</li> <li>c. Insulation class 'F'</li> <li>d. AC Squirrel cage Induction Motor, 1- Phase</li> <li>f. Volt 230 AC Hz</li> <li>h. Totally enclosed Fan cooled</li> <li>i. Continuous duty constant rating</li> <li>k. Energy Efficiency Class IE3 with ISI Marking</li> </ol> <p>Provided with speed sensor and display</p> <p><b>The supplier should supply motors with CE certification only.</b></p> <p>Hylem Sheet Panel with Connector &amp; Accessories:                  MCB Single pole AC16 Amp, 250 Volt – 1 No.                  BTI Terminals                  Indicating Lamps LED type 22.5mm size                  Hylem sheet with duly printed circuit diagram Poly carbonate Facia labeling and termination marking etc.                  DOL Starter with overload protection                  AC Wattmeter 1 phase Digital flush type – 1 No.                  Input Voltage Range 300V AC                  Input Current Range 10A AC                  Applicable for both UPF &amp; LPF load                  Microcontroller based accurate &amp; reliable                  True RMS technology Class 0.2 Accuracy</p> <p>Meters should be MC/MI Flush type (as required) suitable for laboratory and field applications good damping, knife edge pointer with mirror back to avoid parallax error with Accuracy Class 1% , robust Plastic housing, to work well in horizontal as well as 450 inclined.                  AC Ampere meter 10 A – 1 No. flush type.                  AC Volt Meter 250/500V – 1 No. flush type</p> <p>15 Amp Single-Phase Continuously Variable Variac Flush Mounted</p> <p><b>The supplier should supply all meters of STANDARD make only.</b></p>	<b>01</b>		
		<b>Total (Setup 11)</b>			
<b>12.</b>	<b>Resistive Load 1-phase, 3-phase</b>	<p><b>Resistive Load Specifications</b></p> <ul style="list-style-type: none"> <li>• Fully power coated</li> <li>• Loaded with number of Quality rotary switches</li> <li>• Suitable to continuous applications</li> <li>• Durability and safety, Mounted on castor wheels</li> </ul>			

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		<b>Resistive Load 1-Ph 3kW 10 steps</b> <b>Resistive Load 3-Ph 5kW</b>	01 01		
		<b>Total (Setup 12)</b>			
13.	<b>Inductive Load 1-phase 3-phase</b>	<b>Inductive load 1-phase, 3-phase</b> Continuously variable 3-phase inductive load mounted on castor wheels for easy movement housed in duly powder coated box and provided with MCB and protection. One driving handles to vary the air core gap inside the inductor with same rate of change of magnetic flux in all the three coils.  <b>Inductive load 1-phase , 15A Continuously Variable Type</b>  <b>Inductive load 3-phase 5A Continuously Variable Type</b>	02  02		
		<b>Total (Setup 13)</b>			
14.	<b>Three-Phase Auto Transformers</b>	<b>Three-phase Auto transformer (Make: Standard Quality)</b> Rating 1kVA  <b>Three phase Auto transformer</b> Rating 3kVA	02  02		
		<b>Total (Setup 14)</b>			
15.	<b>Ammeters Moving Coil/ Moving Iron type</b>	<b>Measuring instruments (Make: Standard Quality)</b> <b>Portable DC Ammeter</b> Single Range up to 5A Single Range up to 2A  <b>Portable AC Ammeter</b> Single Range up to 5A Single Range up to 2A Double range up to 10A	02 02  02 02 02		
		<b>Total (Setup 15)</b>			
16.	<b>Voltmeters Moving Coil/ Moving Iron type</b>	<b>Portable DC Voltmeter</b> Single Range up to 500V Double range up to 300/500V  <b>Portable AC Voltmeter</b> Single Range up to 100V Triple range up to 250/500V	02 02  02 02		
		<b>Total (Setup 16)</b>			
17.	<b>Wire Wound Rheostats</b>	<b>Rheostat 300Ω / 2A</b> 50 Ω/ 5A Rheostat  300Ω / 3A Rheostat	02  02		
		<b>Total (Setup 17)</b>			
18.	<b>Double Element Wattmeter</b>	<b>Measuring instruments (Make: Standard Quality)</b> <b>Portable Wattmeter Single-Phase Single Element</b> Dual Voltage 75/150V Dual current any range 2.5/5A UPF	02		



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		Dual Voltage 300/600 Dual current any range up to 30A LPF	02		
		<b>Portable Wattmeter Three-Phase Double Element</b>			
		Dual Voltage 300/600 Dual current any range up to 30A UPF	02		
		Dual Voltage 300/600 Dual current any range up to 30A LPF	02		
<b>Total (Setup 18)</b>					
19.	<b>Power factor meter</b>	<b>Measuring instruments (Make: Standard Quality)</b> <b>Portable PF Meter</b> Single Range 300V/600V 10A	01		
<b>Total (Setup 19)</b>					
20.	<b>Starters</b>	<b>Three-Point starter</b> <b>Four-Point Starter</b> <b>DOL starter</b>	02 01 01		
<b>Total (Setup 20)</b>					
21.	<b>DC Rectifier</b>	<b>Variable DC excitation Source 220V DC,100A</b>	01		
<b>Total (Setup-21)</b>					
22.	<b>Item wise Cabling earthing of motors and panel</b>	Cabling and earthing of panels and motors is required to be done by the supplier Connections of Motors to the panels , panels to the MCB Boxes and cabling necessary to mains supply box of the lab, this will include supply of MCB's with proper ratings and box cabling using conduits and flexible pipes as and where necessary  Proper earthing of panels, motors etc to earth using aluminum flat and GI wire of proper thickness and resistance (see Annexure-II)			
<b>Total (Setup-22)</b>					
23.	<b>Experimental Table</b>	Experimental Table to fix panel with required instrumentation for related experiment and to fix machine/ apparatus under it. (see Annexure-III)			
<b>Total (Setup-23)</b>					
<b>Total (Setup- 1 to 23)</b>					
<b>Taxes (GST, Sales tax, Freight &amp; Insurance etc ) as applicable</b>					
<b>Grand Total</b>					

# Vender must specify the make and model of each item and provide the list of experiments, performed using various Setups.

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## Annexure II

### Installation & Commissioning of Machine Lab Equipments:

The Machines & panels should be interconnected from AC panel through UG Cable of size 20 / 4 sq mm for 32 Amps switches and 10 / 4 sq mm for 16 Amps switches (depending upon rating of the machine as indicated in the schedule). The make of the underground cable should be of well known standard quality.

### Grounding/Earthing:

At least two points of Rod and Plate type of grounding of proper rating as per National Electrical Code, to keep the earth resistance less than 5 ohms are to be provided. In case the earth resistance is more than 5 ohm, Bentonite should be added to each point to keep earth resistance within 5 ohms. Funnel type of cups should be provided for water injection. All the Machines & Panels should be properly connected to these ground/earth points.

### Meters and Switch Gears:

All digital meters used should be of well-known standard quality. The Switch gears connected should be of well-known standard quality make. Where ever possible Multi Data Monitoring unit should be connected for Machines.

## Annexure III

- Experimental Table to fix panel with required instrumentation for related experiment and to fix machine/ apparatus under it.
- The Table should have heavy MS channel base and have the provision to mount machines under it with necessary gear and firmly fixed.
- The loading arrangements (Drum brake pulley type) wherever necessary should be provided alongwith fitted itself in the Experimental Table.
- A cabinet closet with 2 or more shelves for storing accessories.
- Table top should be wooden /plywood sun-mica coated.
- The tenderer should enclose the detailed design of the Experimental Table.

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