PROJECT	ELECTRICAL ENERGY & SAFETY AUDIT REPORT

DOCUMENT TITLE

A REPORT
ON
ELECTRICAL ENERGY & SAFETY AUDIT

FOR PANDIT DINDAYAL PETROLIUM UNIVERSITY CAMPUS, GANDHINAGAR

DOCUMENT NO.	REPORT / 01

CONTENTS

RECORD OF REVISIONS

REV	DATE	DESCRIPTION	PREPARED BY	CHECKED BY
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FOREWORD

Electricity is one of the most essential requirements to sustain all activities, be it industrial sector, commercial, institute or domestic front. It is well known fact that the electricity is an excellent, clean and efficient servant, but ignored many a times. Numerous incidents happens that of fires caused due to electrical short circuits, as well as numerous cases of fatal/non-fatal accidents due to electric shock are observed in the areas where the electricity is utilized. Principle factors causing such mishaps are lack of awareness and carelessness about hazards of electricity and equipment. It is therefore of utmost importance to handle the electricity adopting correct procedure and to use proper equipment operated by electric power, never overlooking the safely aspects to minimize possibilities of electrical accidents.

In institute application, particularly for electrical system, the concept of SAFETY begins from the inception of the system or from design stage of the system. The concept is important from safety point of view is following.

- Personnel Safety
- Equipment Safety
- System Safety
- Operational Safety

At the inception or design stage, if the specified standards for system design, equipment selection, installation practices, stage inspection, testing and commissioning are strictly followed, the system provides safe, stable, satisfactory and reliable performance during its service life. Moreover, with adherence to prescribed maintenance practices for the equipment, the performance would be safe for operating personnel and equipment and consistent over almost entire service life.

Concept of safety works wonderfully, if it is considered as continuous process.

The Energy Audit campaign encompassed to study the existing pattern of energy use at the institute buildings & also identification of the areas where energy could be saved by employing suitable techno-economic measures.

This report comprises the details of observations along with appropriate recommendation with supporting calculations.

Our report is based on present operating status of the buildings & the recommendations are based on various operational parameters examined, measured data, information furnished to us.

INDEX

1.0 INTRODUCTION

Energy & Safety Audit is carried for the campus of Pandit Dindayal Petroleum University (PDPU) at Gandhinagar. The campus has various academic, administrative, recreational and hostel blocks.

The Institute has three campus areas.

i. Main Campus Institute Buildings with academic blocks, administrative block, Girls Hostel, Auditorium, Canteen & Play grounds
ii. UG Hostel Campus with Hostel blocks, small canteen, Innovative technology block
iii. High-rise Campus with 3 nos. multistory hostel blocks

The reasons for resorting to this essential and useful exercise of Electrical Safety Audit and Energy Audit are elaborately discussed in the Chapter “The Assignment”. The aim of Electrical Safety Audit and the methodology adopted have been specified.

It is known to one and all that the people, who cause accidents, can only prevent them. Unsafe conditions and acts pose a variety of hazards, which can be eliminated or minimized through scientifically organized program of prevention and control.

The Audit Team consisted of qualified and experienced safety professionals.

We acknowledge support of following person for their continuous support during our visit to the premises:

i. Mr. Akash Davda (GERMI) & Team
ii. Mr. Harish (PDPU Electrical Dept) & Team
iii. Mr. Vipul Patel (PDPU Utility Dept) & Team

We also acknowledge helping hand provided by team of final-year and pre-final year students of Electrical depart. Continuous interaction on their technical queries during measurements, eagerness to learn audit activities, promptness to provide support to our team and learning attitude is appreciated.

1.1 Electrical system Distribution network

There are three campuses and are separated by public road in between and hence as per prevailing local regulation of electricity, three separate HT services have been obtained from UGVCL (Uttar Gujarat Vij Corporation Limited) on 11 kV voltage level. All three services are:

Sr. No.	Campus	UGVCL Service No.
1	Main Institute Campus	18043
2	UG Hostel	18066
3	High-Rise hostel	18190

Power is further stepped down to 433V/415V (LT) with transformers. Description brief is as under.

Sr. No	Service	Contract Demand	Service Connection	Distribution Brief
1	Main Institute Campus	1600 KVA	Through 11 KV O/H Line VCB is Installed	LV PCC at 415V level 3-Ph APFCR Installed
2	UG Hostel	200 KVA	Through 11 KV O/H Line DP structure with Fuses	LV PCC at 415V level 3-Ph APFCR Installed
3	High Rise hostel	200 KVA	Through 11 KV O/H Line DP structure with Fuses	LV PCC at 415V level 3-Ph APFCR Installed

Capacitor panel for P.F. improvement is installed near Main LT panel of each service connection. PF is well maintained, however detail analysis are in following chapters.

Underground cabling is done from Main LT panel/ PCC to sub panel of each building block and further distributed to MCBDB of individual area for following loads:

i. Internal Lighting
ii. Room Air-condition
iii. Raw power distribution / socket power
iv. Lab equipments Power
v. External Lighting
vi. Sports Ground lighting
vii. Computer power through UPS

1 MW solar power plant is installed in adjoining land. This is part of captive solar power generation within campus and covered under rooftop solar policy. It is appreciated that, daily basis generation data is being maintained at institute level. Regular maintenance & cleaning leads to maximize generation of electricity through this renewable source.

Experience of GERMI helps in getting the benefit and reducing carbon foot print.

2.0 EXECUTIVE SUMMARY

The campuses are occupied for academic activities. It was observed during audit work that, few of the basic requirements, are being complied with The Indian Electricity Rules, 1956 (2014) and other applicable Indian standards. However, there is still scope of further improvement which is as listed in subsequent chapters.

The utility people are co-operative and it shall be appreciated if the management take keen interest to maintain safety of student and faculties, and shall implement the suggestions given to; will significantly improve overall level of safety with curtailment of hazards.

The following aims were set for the Energy Audit Team.

a. To examine and evaluate the amount and pattern of energy consumption.
b. To explore options to reduce energy consumption, wherever possible.
c. To provide suggestion which should techno-commercially viable.

Being Prominent Institute of Gujarat State, and accompanied by GERMI, energy is being utilised at better level, however, following are areas identified where in there is a potential of energy saving.

Sr. No.	Recommendations
1	Energy Measurement Level in Topic A.1 a) By reducing contract demand for Service no. 18043 - Nothing b) By upgrading PF for Service no. 18043 **– 3.78 Lacs/annum** c) By reducing contract demand for Service no. 18066 **– 1.06 Lacs/annum** d) By upgrading PF for Service no. 18066 **– 0.61 Lacs/annum** e) By reducing contract demand for Service no. 18190 **– 1.22 Lacs/annum** f) By upgrading PF for Service no. 18190 **– 0.65 Lacs/annum**
2	AC system a) By employing occupancy sensor – **Rs. 12500/Annum/Class room**

3.0 PART – A
ENERGY AUDIT

A.1 ENERGY SOURCES AND DISTRIBUTION SYSTEM

[A] MAIN INSTITUTE CAMPUS [SERVICE NO. – 18043]

1) ENERGY SOURCES:

Power is available to the campus from UGVCL, HT Service at 11 kV.

2) METERING SYSTEM:

The consumption of the power is being recorded at "Incoming Panel" for metering purpose.

3) ENERGY DETAILS:

1600 KVA transformer is used to step down the 11 kV power to 415V distributions to various load centers through underground cable.

From electricity bill analysis of Jan-18 to Oct-18; following is observed

i. The total contract Demand is 1600 kVA.

ii. The Actual Maximum Demand is 1811 kVA (May 18).

iii. A stand-by DG is provided.

iv. The average power factor is 0.967 at metering point.

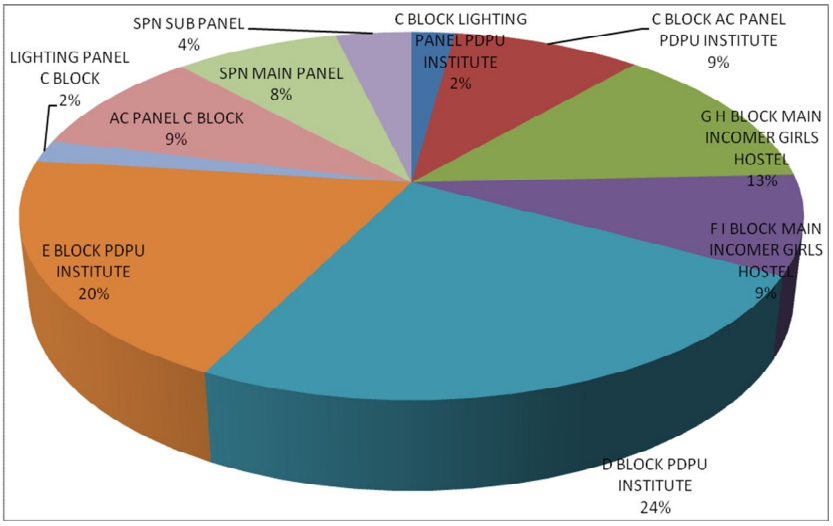
v. Total energy consumption of units for 454380 units was recorded maximum in the month of May 2018 and average unit consumption was 335232 during given period.

vi. The average total energy bill is Rs. 25,96,801. Maximum energy bill was Rs. 32,43,272 in the month of May-18.

vii. It is noted that maximum consumption was registered during peak summer which indicates dominance of Aircondition load in the system.

viii. The average cost of unit is worked out Rs. 7.855 during above period.

ix. The Profile of load distribution of the complex measured during audit is as per chart below

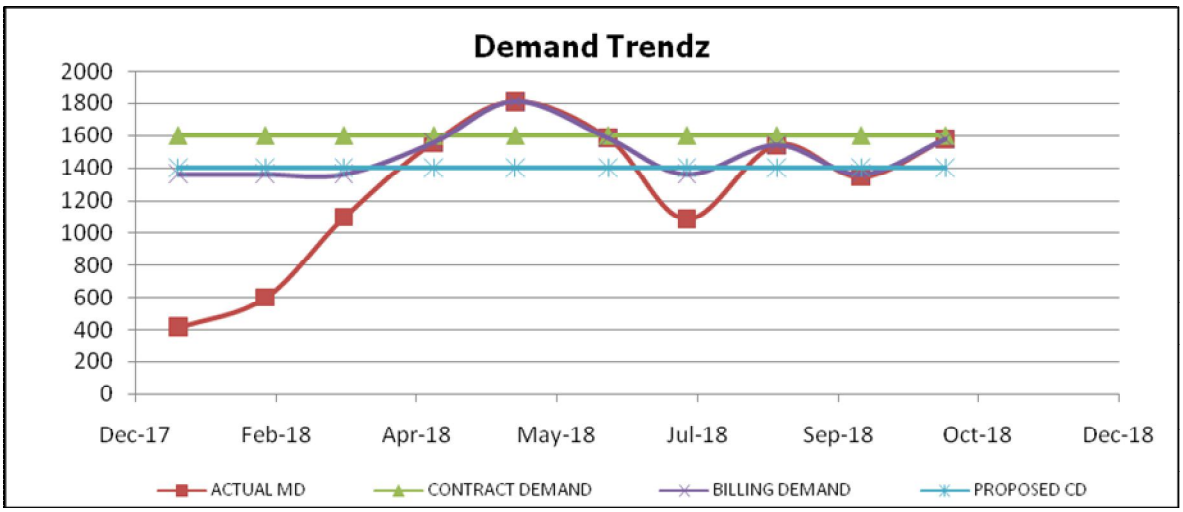


Above data is depicted in tabular form as below:

SERVICE NO : 18043 - PDPU INSTITUTE	LOAD	UNIT
C BLOCK LIGHTING PANEL PDPU INSTITUTE	17.888	**kW**
C BLOCK AC PANEL PDPU INSTITUTE	77.49	**kW**
G H BLOCK MAIN INCOMER GIRLS HOSTEL	107.42	**kW**
F I BLOCK MAIN INCOMER GIRLS HOSTEL	72.542	**kW**
D BLOCK PDPU INSTITUTE	203.766	**kW**
E BLOCK PDPU INSTITUTE	163.268	**kW**
LIGHTING PANEL C BLOCK	16.3	**kW**
AC PANEL C BLOCK	77.49	**kW**
SPN MAIN PANEL	67.6	**kW**
SPN SUB PANEL	31.15	**kW**

4) Energy Accounting:

The month wise actual MD & Billing MD for past 12 months have seen shown in below:

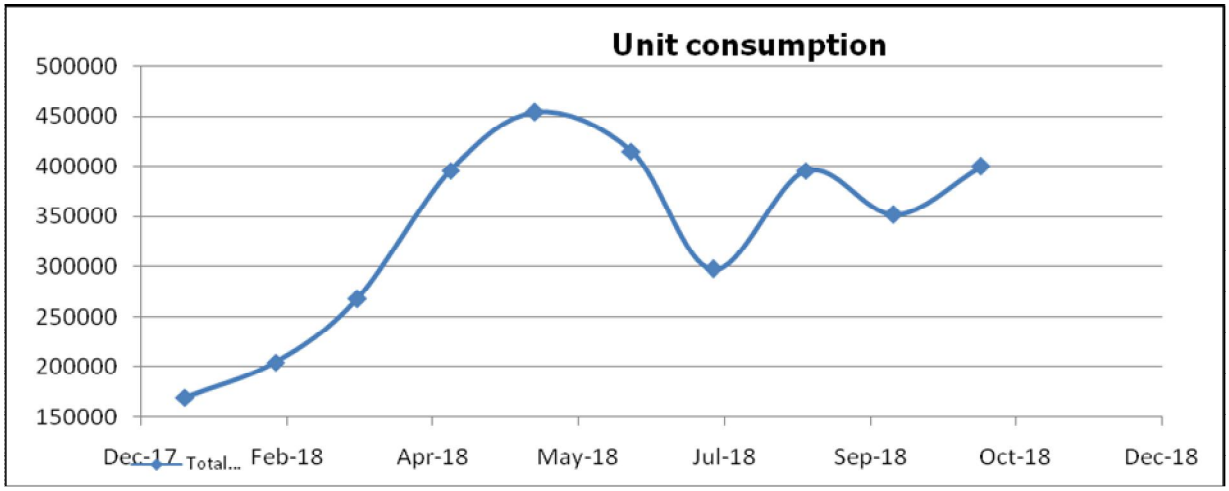


5) Observations:

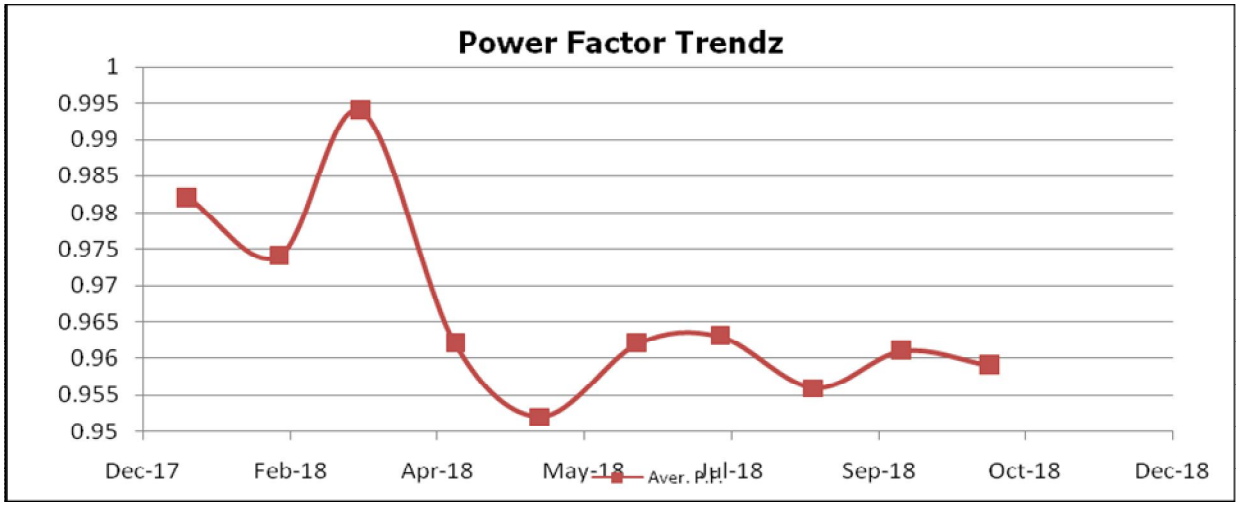
a) There is no redundancy in the sources. DG is kept for standby duty with auto-changeover facility.

b) The average billing demand was observed 1261 KVA for last 10 months, which is less than 85% of contract demand of 1600 kVA. There is drastic variation in demand (1811 kVA in May '18 to 1584 kVA in June'18). It is also observed that only 01 time Actual MD has crossed contract demand during last year, which has invited penalty rates of demand charges. So it is required to control the Contract Demand.

c) The variation of consumption (total units) is shown as per below.



d) The power factor variation is as per the chart below.



6) Saving Potential:

a) Controlling the contract Demand:

We suggest to reduce contract demand to 1400 KVA to have optimum demand charges.

Proposed CD	1400	1500	1600	1700	1800
Jan-18	Rs.2,95,250	Rs.3,35,625	Rs.3,76,000	Rs.4,16,375	Rs.4,56,750
Feb-18	Rs.2,95,250	Rs.3,35,625	Rs.3,76,000	Rs.4,16,375	Rs.4,56,750
Mar-18	Rs.2,95,250	Rs.3,35,625	Rs.3,76,000	Rs.4,16,375	Rs.4,56,750
Apr-18	Rs.4,82,690	Rs.4,74,690	Rs.4,70,050	Rs.4,70,050	Rs.4,70,050
May-18	Rs.6,23,105	Rs.6,15,105	Rs.6,07,105	Rs.5,99,105	Rs.5,91,105
Jun-18	Rs.4,97,120	Rs.4,89,120	Rs.4,82,400	Rs.4,82,400	Rs.4,82,400
Jul-18	Rs.2,95,250	Rs.3,35,625	Rs.3,76,000	Rs.4,16,375	Rs.4,56,750
Aug-18	Rs.4,73,810	Rs.4,65,810	Rs.4,62,450	Rs.4,62,450	Rs.4,62,450

Sep-18	Rs.3,67,450	Rs.3,67,450	Rs.3,76,000	Rs.4,16,375	Rs.4,56,750
Oct-18	Rs.4,93,235	Rs.4,85,235	Rs.4,79,075	Rs.4,79,075	Rs.4,79,075
TOTAL	**Rs.41,18,410**	**Rs.42,39,910**	**Rs.43,81,080**	**Rs.45,74,955**	**Rs.47,68,830**
SAVING	**Rs.2,62,670**	**Rs.1,41,170**	**Rs.0**	**-Rs.1,93,875**	**-Rs.3,87,750**

But, as learnt from management, major expansion is planned in near future. This will add additional power requirements and as per prevailing UGVCL norms, power demand reduced once can't be upgraded again within two years. Hence we suggest not to reduce demand now.

b) Improving Power Factor

By improving PF, PDPU can reduce the billing amount.

The P.F. of institute remains in the range of 0.952 to 0.994. PDPU has availed concession in unit cost however improving P.F. to the tune of 0.995 will yield more savings. The month wise P.F. is shown in the chart above.

There is a scope for improvement of P.F. by addition of new capacitor banks in dummy feeders available in existing panel. The saving per year is worked out **Rs. 3.78 lacs** with an investment of **Rs. 3.0 lacs** for additional capacitor panel of 300 KVAR with the payback period of 10 months.

Month	Aver. P.F.	Rebate given	P.F. Adju. Charges	Total con. charges	Set Point	% Rebate	Additional rebate
Jan-18	0.982	1.60%	-Rs.11,091	Rs.13,97,930	0.995	0.650%	Rs. 9,087
Feb-18	0.974	1.20%	-Rs.10,061	Rs.15,96,953	0.995	1.050%	Rs. 16,768
Mar-18	0.994	2.20%	-Rs.24,223	Rs.19,60,332	0.995	0.050%	Rs. 980
Apr-18	0.962	0.60%	-Rs.9,797	Rs.28,44,275	0.995	1.650%	Rs. 46,931
May-18	0.952	0.10%	-Rs.1,874	Rs.33,40,886	0.995	2.150%	Rs. 71,829
Jun-18	0.962	0.60%	-Rs.10,278	Rs.29,73,645	0.995	1.650%	Rs. 49,065
Jul-18	0.963	0.65%	-Rs.7,975	Rs.21,61,512	0.995	1.600%	Rs. 34,584
Aug-18	0.956	0.30%	-Rs.4,900	Rs.28,39,432	0.995	1.950%	Rs. 55,369
Sep-18	0.961	0.55%	-Rs.7,974	Rs.24,82,514	0.995	1.700%	Rs. 42,203
Oct-18	0.959	0.45%	-Rs.7,423	Rs.28,74,851	0.995	1.800%	Rs. 51,747
						Total savings	**Rs. 3,78,563**

7) Conclusion: The saving potential of **Rs. 3.78 lacs** can be achieved with an investment of **Rs. 3.0 lacs** for additional APFC panel having the payback period of 10 months.

[B] UG HOSTEL [SERVICE NO. – 18066]

1) ENERGY SOURCES:

Power is available to the campus from UGVCL, HT Service at 11 kV.

2) METERING SYSTEM:

The consumption of the power is being recorded at "Incoming Panel" for metering purpose.

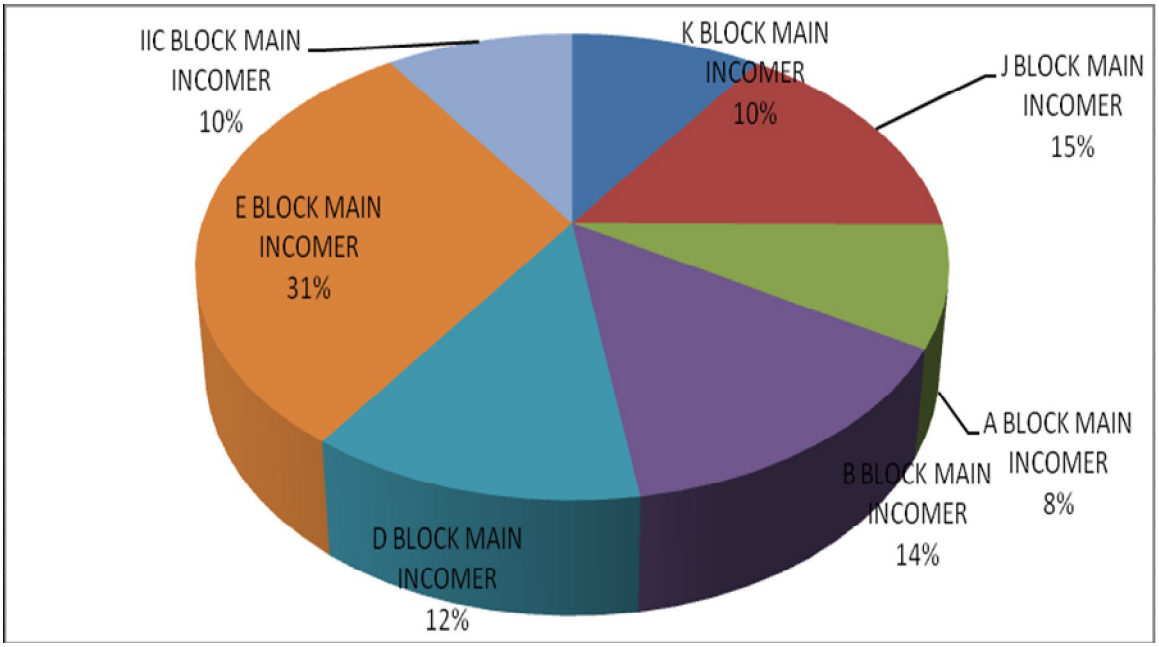
3) ENERGY DETAILS:

200 KVA Transformer is used to step down the 11 kV power to 415V distributions to various load centers through underground cable.

From electricity bill analysis of Jan-18 to Oct-18; following is observed:

i. The total contract Demand is 200 kVA.
ii. The Actual Maximum Demand is 381 kVA (JUNE 18).
iii. The average power factor is 0.972 at metering point.
iv. Total energy consumption of units for 145419 units was recorded maximum in the month of May 2018 and average unit consumption was 84485 during given period.
v. The average total energy bill is Rs. 5,65,325 Maximum energy bill was Rs. 9,39,900 in the month of May-18.
vi. It is noted that maximum consumption was registered during peak summer which indicates dominance of Air-condition load in the system.
vii. The average cost of unit is worked out Rs. 6.681 during above period.

The Profile of load distribution of the complex measured during audit is as per chart below:

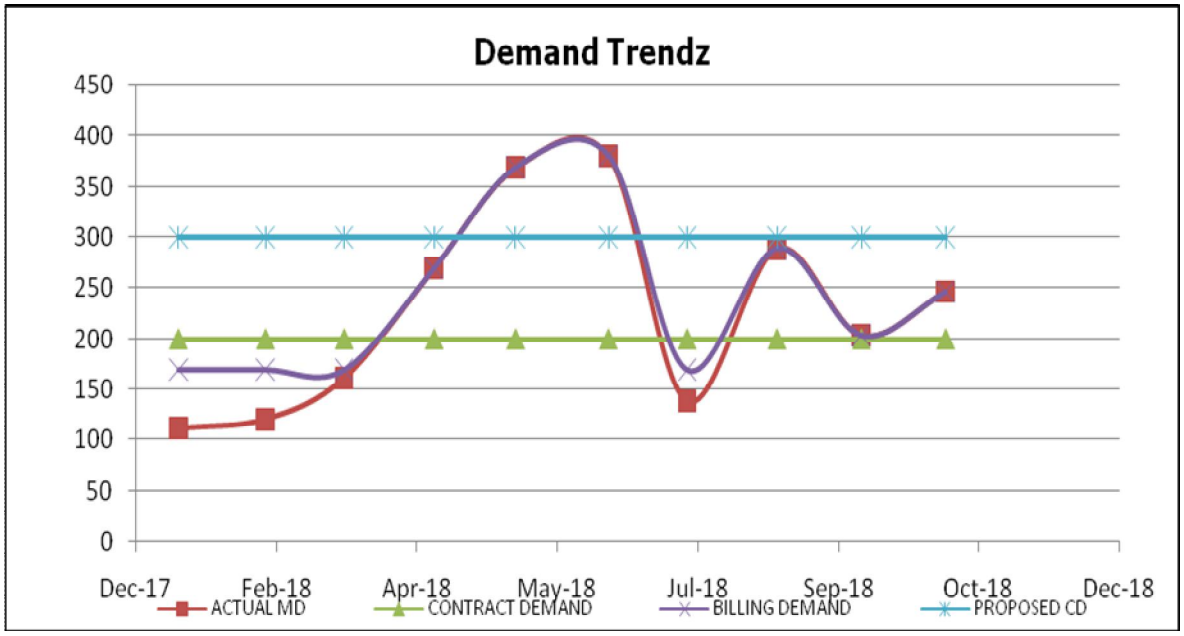


Above data is depicted in tabular form as below:

SERVICE NO : 18066 - UG HOSTEL	LOAD	
K BLOCK MAIN INCOMER	16.78	kW
J BLOCK MAIN INCOMER	26.246	kW
A BLOCK MAIN INCOMER	14.358	kW
B BLOCK MAIN INCOMER	24.21	kW
D BLOCK MAIN INCOMER	20.695	kW
E BLOCK MAIN INCOMER	52.609	kW
IIC BLOCK MAIN INCOMER	16.518	kW

4) Energy Accounting:

The month wise actual MD & Billing MD for past 10 months have seen shown in chart below



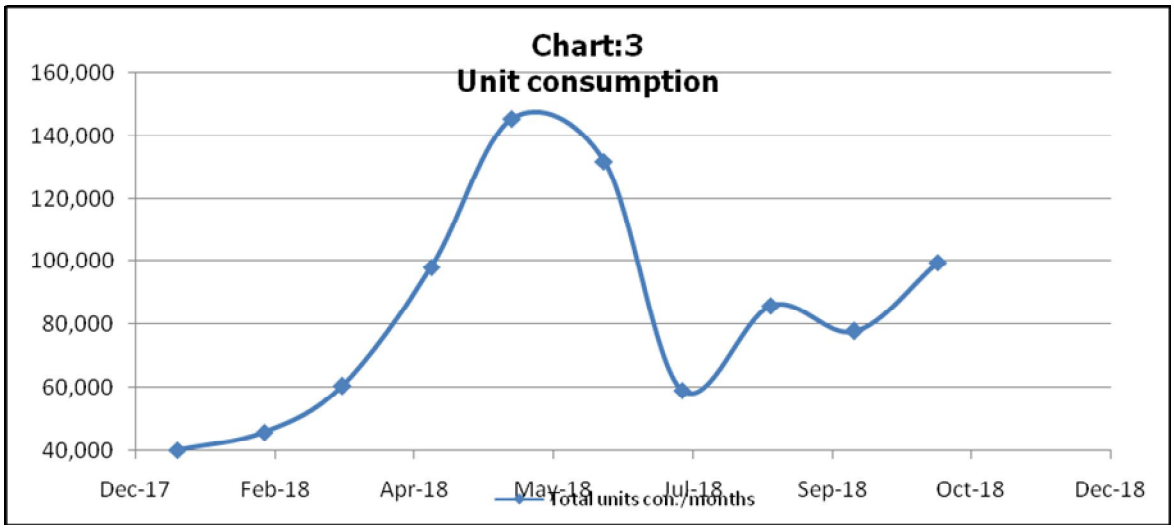
5) Observations:

a) There is no redundancy in the sources. DG is kept for standby duty with auto-changeover facility.

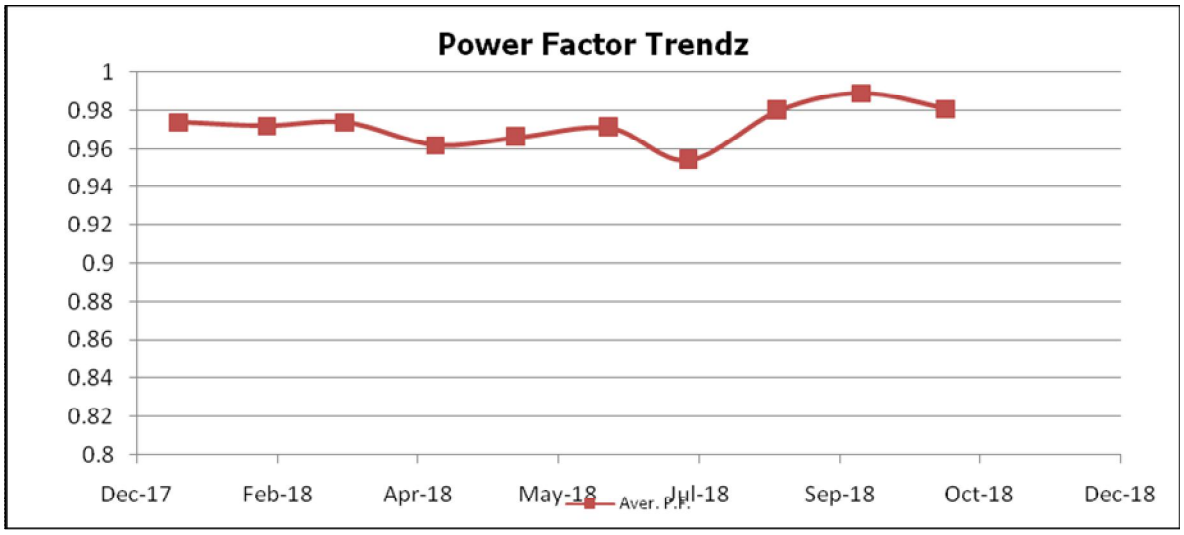
b) The average billing demand was observed 244 KVA for last 10 months, which is Greater than 85% of contract demand of 170 kVA. There is drastic variation in demand (381 kVA in June '18 to 170 kVA in July'18). It is also observed that only 06 times Actual MD has crossed

contract demand during last year, which has invited penalty rates of demand charges. So it is required to control the Contract Demand.

c) The variation of consumption (total units) is shown as per chart below



d) The power factor variation is as per the chart following:



6) Saving Potential:

a) Controlling the contract Demand

We suggest to increase contract demand to 300 KVA to have optimum demand charges.

Proposed CD	150	200	250	300	350	400
Jan-18	Rs.19,125	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Feb-18	Rs.19,125	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Mar-18	Rs.29,160	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Apr-18	Rs.89,100	Rs.68,850	Rs.48,600	Rs.40,500	Rs.44,625	Rs.51,000
May-18	Rs.144,045	Rs.123,795	Rs.103,545	Rs.83,295	Rs.63,045	Rs.55,350

Jun-18	Rs.150,705	Rs.130,455	Rs.110,205	Rs.89,955	Rs.69,705	Rs.57,150
Jul-18	Rs.20,850	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Aug-18	Rs.99,645	Rs.79,395	Rs.59,145	Rs.43,350	Rs.44,625	Rs.51,000
Sep-18	Rs.52,470	Rs.32,220	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Oct-18	Rs.76,335	Rs.56,085	Rs.37,050	Rs.38,250	Rs.44,625	Rs.51,000
TOTAL	**Rs.700,560**	**Rs.592,800**	**Rs.517,920**	**Rs.486,600**	**Rs.489,750**	**Rs.520,500**
SAVING	**-Rs.107,760**	**Rs.0**	**Rs.74,880**	**Rs.106,200**	**Rs.103,050**	**Rs.72,300**

We recommended to increase CD 200 KVA To 300 KVA for optimize the Billing M.D.

b) Improving Power Factor

By improving PF, PDPU can reduce the billing amount.

The P.F. of institute remains in the range of 0.972 to 0.995. PDPU has availed concession in unit cost however improving P.F. to the tune of 0.995 will yield more savings. The month wise P.F. is shown in the chart above.

There is a scope for improvement of P.F. by addition of new capacitor banks in dummy feeders available in existing panel. The saving per year is worked out **Rs. 61,177** with an investment of **Rs. 31000** for additional capacitor panel of 31 KVAR with the payback period of 10 months.

Month	Aver. P.F.	Rebate given	P.F. Adju. Charges	Total con. charges	Set Point	% Rebate	Additional rebate
Jan-18	0.974	1.20%	-Rs.1,874	Rs.255,605	0.995	1.050%	Rs. 2,684
Feb-18	0.972	1.10%	-Rs.1,960	Rs.284,460	0.995	1.150%	Rs. 3,271
Mar-18	0.974	1.20%	-Rs.2,805	Rs.364,259	0.995	1.050%	Rs. 3,825
Apr-18	0.962	0.60%	-Rs.2,270	Rs.618,506	0.995	1.650%	Rs. 10,205
May-18	0.966	0.80%	-Rs.4,479	Rs.935,822	0.995	1.450%	Rs. 13,569
Jun-18	0.971	1.05%	-Rs.5,338	Rs.866,916	0.995	1.200%	Rs. 10,403
Jul-18	0.954	0.20%	-Rs.458	Rs.359,841	0.995	2.050%	Rs. 7,377
Aug-18	0.98	1.50%	-Rs.4,973	Rs.557,225	0.995	0.750%	Rs. 4,179
Sep-18	0.989	1.95%	-Rs.5,851	Rs.463,313	0.995	0.300%	Rs. 1,390
Oct-18	0.981	1.55%	-Rs.5,969	Rs.610,435	0.995	0.700%	Rs. 4,273
						Total savings	**Rs. 61,177**

Conclusion: The saving potential of Rs.61,177 can be achieved with an investment of Rs. 31,000 for additional APFC panel having the payback period of 10 months.

[C] HIGH RISE HOSTEL [SERVICE NO. – 18190]

1) ENERGY SOURCES:

Power is available to the campus from UGVCL, HT Service at 11 kV.

2) METERING SYSTEM:

The consumption of the power is being recorded at "Incoming Panel" for metering purpose.

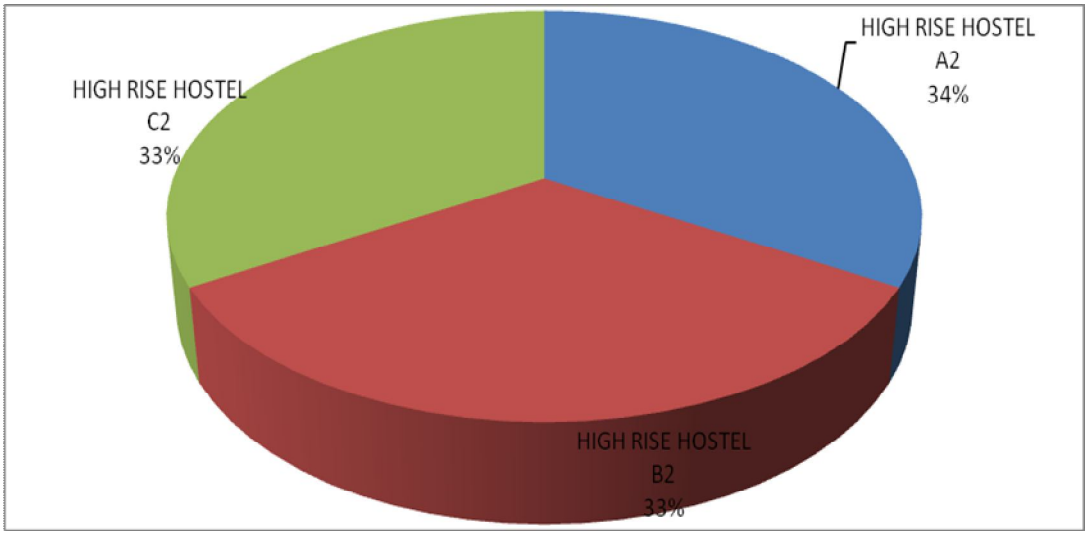
3) ENERGY DETAILS:

200 KVA Transformer is used to step down the 11 kV power to 415V distributions to various load centers through underground cable.

Following is observed in bill analysis for last ten months i.e. Jan-18 to Oct-18.

i. The total contract Demand is 200 kVA.
ii. The Actual Maximum Demand is 329 kVA (Oct 18).
iii. The average power factor is 0.967 at metering point.
iv. Total energy consumption of units for 136104 units was recorded maximum in the month of Oct 2018 and average unit consumption was 92778 during given period.
v. The average total energy bill is Rs. 7,09,753 . Maximum energy bill was Rs. 10,68,098 in the month of Oct-18.
vi. It is noted that maximum consumption was registered during oct-2018 which indicates dominance of Air-condition load in the system.
vii. The average cost of unit is worked out Rs. 7.645 during above period.

The Profile of load distribution of the complex measured during audit is as per chart below:



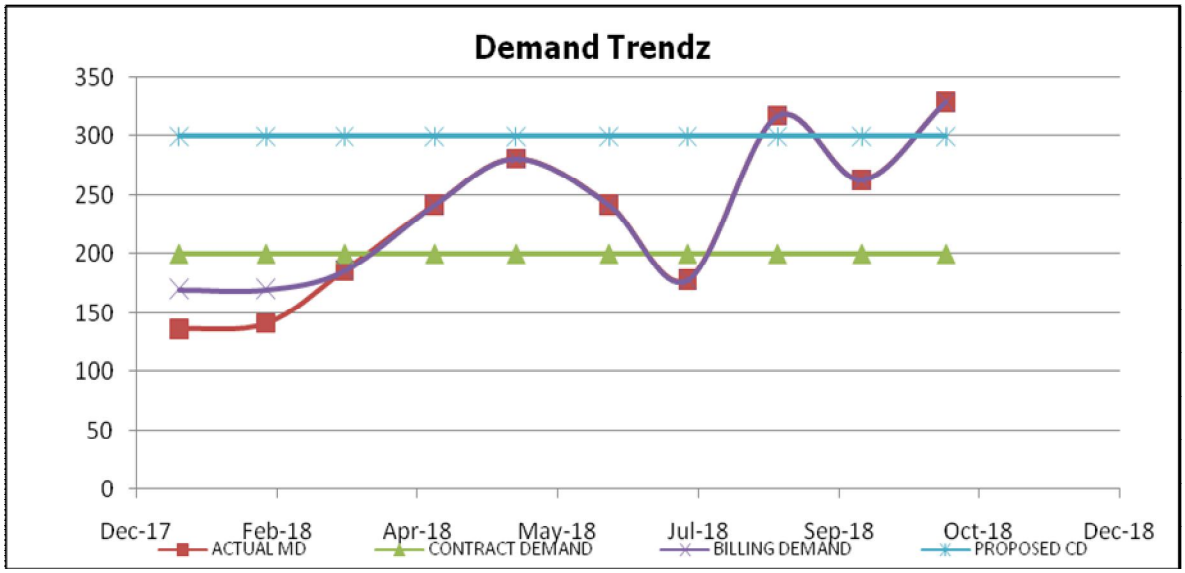
Above data is depicted in tabular form as below:

SERVICE NO : 18190 - HIGH RISE HOSTEL	LOAD	
HIGH RISE HOSTEL A2	77.33	kW

HIGH RISE HOSTEL B2	77.33	kW
HIGH RISE HOSTEL C2	77.33	kW

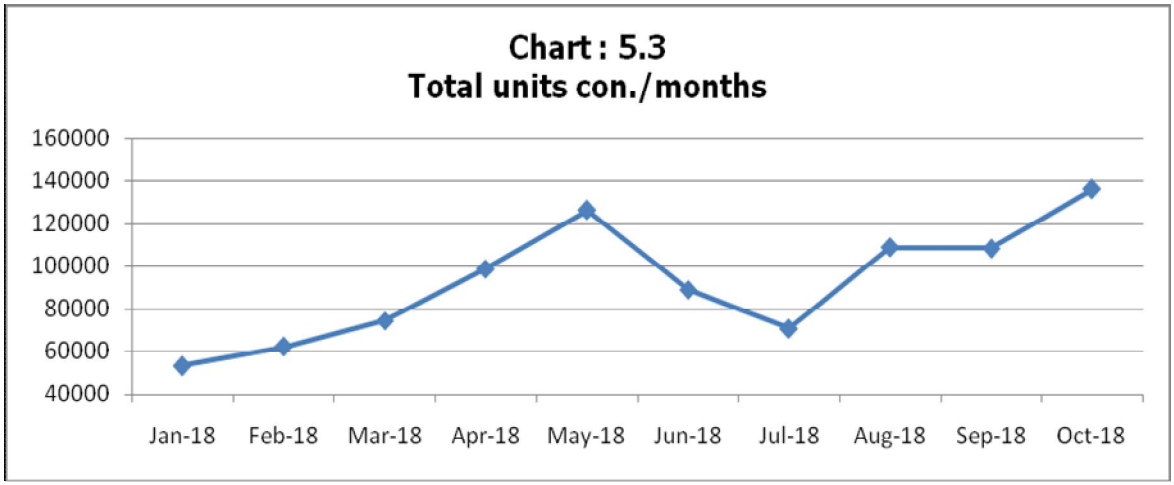
4) Energy Accounting:

The month wise actual MD & Billing MD for past 10 months have seen shown in chart below.

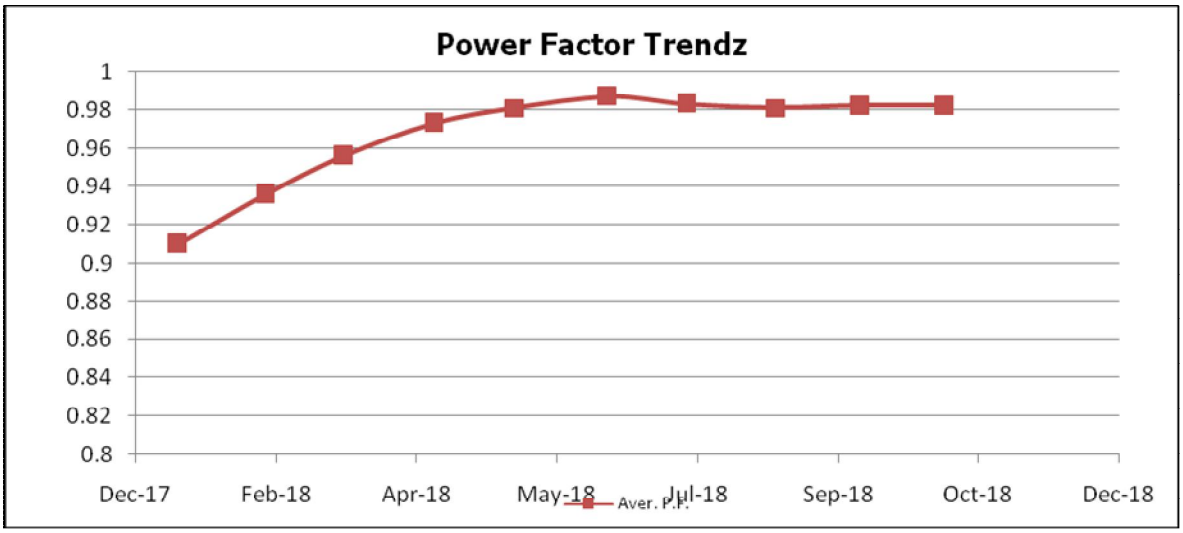


a) The average billing demand was observed 238 KVA for last 10 months, which is Greater than 85% of contract demand of 170 kVA. There is drastic variation in demand (170 kVA in Jan '18 to 329 kVA in Oct'18). It is also observed that 06 times actual MD has crossed contract demand during last year, which has invited penalty rates of demand charges. So it is required to control the Contract Demand.

b) The variation of consumption (total units) is shown as per chart below



The power factor variation is as per the chart below:



5) Observations:

a) There is no redundancy in the sources. DG is kept for standby duty with auto-changeover facility.

6) Saving Potential:

1. Controlling the contract Demand :

Proposed CD	150	200	250	300	350	400
Jan-18	Rs.20,400	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Feb-18	Rs.21,150	Rs.25,500	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Mar-18	Rs.42,480	Rs.27,900	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Apr-18	Rs.73,560	Rs.53,310	Rs.36,300	Rs.38,250	Rs.44,625	Rs.51,000
May-18	Rs.95,205	Rs.74,955	Rs.54,705	Rs.42,150	Rs.44,625	Rs.51,000
Jun-18	Rs.73,560	Rs.53,310	Rs.36,300	Rs.38,250	Rs.44,625	Rs.51,000
Jul-18	Rs.38,040	Rs.26,700	Rs.31,875	Rs.38,250	Rs.44,625	Rs.51,000
Aug-18	Rs.115,185	Rs.94,935	Rs.74,685	Rs.54,435	Rs.47,550	Rs.51,000
Sep-18	Rs.85,215	Rs.64,965	Rs.44,715	Rs.39,450	Rs.44,625	Rs.51,000
Oct-18	Rs.121,845	Rs.101,595	Rs.81,345	Rs.61,095	Rs.49,350	Rs.51,000
TOTAL	**Rs.686,640**	**Rs.548,670**	**Rs.455,550**	**Rs.426,630**	**Rs.453,900**	**Rs.510,000**
SAVING	**-Rs.137,970**	**Rs.0**	**Rs.93,120**	**Rs.122,040**	**Rs.94,770**	**Rs.38,670**

We recommended to increase CD 200 KVA to 300 KVA for optimize the Billing M.D.

2. Improving Power Factor

By improving PF, PDPU can reduce the billing amount.

The P.F. of institute remains in the range of 0.972 to 0.995. PDPU has availed concession in unit cost however improving P.F. to the tune of 0.995 will yield more savings. The month wise P.F. is shown in the chart above.

There is a scope for improvement of P.F. by addition of new capacitor banks in dummy feeders available in existing panel. The saving per year is worked out **Rs. 65,279** with an investment of **Rs. 35000** for additional capacitor panel of 35 KVAR with the payback period of 10 months.

Month	Aver. P.F.	Rebate given	P.F. Adju. Charges	Total con. charges	Set Point	% Rebate	Additional rebate
Jan-18	0.91	-2.00%	Rs.0	Rs.329,115	0.995	4.250%	Rs. 13,987
Feb-18	0.936	-0.70%	Rs.0	Rs.375,785	0.995	2.950%	Rs. 11,086
Mar-18	0.956	0.30%	-Rs.859	Rs.445,720	0.995	1.950%	Rs. 8,692
Apr-18	0.973	1.15%	-Rs.4,363	Rs.603,376	0.995	1.100%	Rs. 6,637
May-18	0.981	1.55%	-Rs.7,525	Rs.776,557	0.995	0.700%	Rs. 5,436
Jun-18	0.987	1.85%	-Rs.6,341	Rs.547,801	0.995	0.400%	Rs. 2,191
Jul-18	0.983	1.65%	-Rs.4,473	Rs.418,401	0.995	0.600%	Rs. 2,510
Aug-18	0.981	1.55%	-Rs.6,461	Rs.695,613	0.995	0.700%	Rs. 4,869
Sep-18	0.982	1.60%	-Rs.6,653	Rs.663,987	0.995	0.650%	Rs. 4,316
Oct-18	0.982	1.60%	-Rs.8,371	Rs.854,478	0.995	0.650%	Rs. 5,554
						Total savings	**Rs. 65,279**

7) Conclusion: The saving potential of **Rs.65,279** can be achieved with an investment of **Rs.35000** for additional APFC panel having the payback period of 10 months.

A.2 ILLUMINATION

A.2.1 Introduction:

The power consumption in Illumination is comparatively very low in % of entire electricity consumption in academic institutes as major load is air-condition and lab equipment-UPS computers.

There is significant scope of saving in this area by using energy efficient lighting option, new or retrofit application, controlling voltage level, using daylight option, by controlling light by sensors etc.

A.2.2 Installed Capacity:

The details of various power measurements done at DB level are summarized as under. This was done with all lightings “ON”, hence we can estimate connected lighting load from this summary**.**

This is present status as of now.

Majority illumination is achieved by Fluorescent lights in indoor areas.

A.2.3 Present Status:

It is found that PDPU is using fluorescent tube-light at various locations. The use of LED lights which are more efficient is started for upcoming buildings.

A.2.4 Energy saving:

Retrofit with LED fixtures is practically not possible looking at huge cost involved and downtime required with other allied civil & false ceiling expenses involved.

A.2.5 Conclusion:

No substantial energy saving potential is found.

However, it is recommended to have replacement of existing lights with LED lights on failures in future.
Refer Annexure-A for sample calculation for payback.

A.3 AIRCONDITION SYSTEM

A.3.1 Introduction:

An A/c system is essential system, which has very important primary function is to maintain conditions that are (i) conductive to human comforts or (ii) required by a process or product within the space.

The A/c is not only control air temperature but also maintains humidity to the set values.

The A/c system mainly comprises of refrigeration system plant, heat exchangers, compressors, pumps, air distribution system including ducting air handling units, blowers, associated piping, valves, instruments, capacity & safety controls and electrical system such as motors.

A.3.2 Present Status:

PDPU is using window type Air conditioners of 1, 1.5 TR, package AC 10 TR & some of the split A/c of 3 TR capacities at various locations. They are also using ceiling fan for cooling system. The A/C is used for maintaining cooling at desired temperature using wired/wire-less remote in following areas.

i) all class rooms
ii) all labs except mechanical workshop
iii) Administrative block
iv) All computer labs
v) Central auditorium
vi) Few hostel rooms

A.3.3 Observations:

Following are the observations for AC utilization in campus.

i) Some areas are having AC systems since inception of college
ii) Later on date some other areas are added
iii) Development of AC areas are in gradual and hence development of electrical load is also in gradual manner.
iv) There is no centralized plant (e.g. with chiller, cooling tower) where in efficiency of the system can be worked out with measurements.
v) Many areas are having split and window ACs. Power measurement is done and is given in **ANNEXURE-3**. The details which are not available at the time of measurement are left blank.
vi) Some locations are having VRV system. Majority big classes and labs are having it.

vii) **In refrigerant cooled system (typically split & VRV) it is not possible to workout system efficiency due to measurement limitations of all the parameters. E.g. flow and Rh.**

Pl. refer ANNEXURE-4 for typical calculation to work out energy efficiency ratio of a air-condition unit.

viii) It is observed that M/s. PDPU is maintaining & servicing the A/c regularly. They are also conserving energy by switching off the A/c when the cabin is unoccupied or not in use. PDPU maintains record AC services however, the same is found scattered. It is recommended to keep at central level data for current measurement of each unit pre-service and post service.

ix) Security personal sitting next to each wing generally operates ACs in class rooms and labs.

A.3.2 Saving Potential:

i) There is no log-book found which mentions checking of thermostat working. It is generally observed that, lacking in thermostat largely affects air-condition unit performance. Aprox. 10-15 % energy can be save if thermostat is regularly checked and maintained.

ii) During measurement surveys, many a time it is observed that, ACs are working when the class is not occupied by the students. Security persons takes few minutes to reach at respective room for checking and switch-off. A saving potential is worked out and is as under:

Now a day an occupancy sensor is available which automatically switches on & off the AC and other lighting loads also. The sensor identifies human presents, movements and absence in the given range of about 105 degree and proceeds to signal the control unit to switch the AC on and off respectively. Thus eliminates wasteful power consumption.

Pl. refer ANNEXURE-5 which elaborates calculations for one such class room.

A.3.3 Conclusion:

1. By carrying out maintenance / cleaning of filter i.e. regularly services of AC ODU, IDU & thermostat can save about 8~10% energy in package and window A/c. Pre-service & post-service current measurement will help in internal bench marking between two similar rating ACs power consumption and further diagnosis.
2. By employing occupancy sensor as mentioned in ANNEXURE-5, there is substantial saving can be obtained.

A.4 HARMONICS

A.4.1 Introduction:

The harmonic study was conducted in major areas to find out its magnitude & its effect.

Harmonics is nothing but a distortion of fundamental waveform due to superimposed of an integral multiple of fundamental frequency periodic waveform component. This is caused by nonlinear load. Due to superimposition of odd harmonics on the main frequency, higher amount of current will flow. Its leads to heating because of skin effect & Eddy current effect. By skin effect losses, increases as the frequency increases & the effective area of conductor is getting reduce due to flow of current near to the outer age of conductor. While Eddy current is a circulating current that are induced in metallic part of the system due to magnetic field generated by current carrying conductor & which is proportional to square of the frequency.

A.4.2 Effects of harmonics:

The ill effects of harmonics are over hearting of conductor, false tripping of circuit breaker, higher flow of current in neutral conductor, over heating of Induction motor, transformer, panel board, & increase hysteresis losses & copper losses. Failure of capacitor, error in humming in KW & KVAR meter, disturbance in telecommunication equipment & relays, premature failure of fuses derating the generator, failure of ballast in lighting humming in fan motors etc.

The Effect of Harmonics on various equipments are as under.

Sr. No.	Equipment	Effect
1.	Transformer	Decreases the rating of the transformer as kVA rating of the transformer is designed based on the 50 Hz liner load. It also increases the stress in insulation which cause the failure / break down it also increases the iron losses & eddy current losses hence increase the temperature and noise level.
2.	Capacitor & Reactor	Capacitor impedance is inversely proportional to frequency. Therefore, it offers low impedance to harmonic current. Hence, draw the more current than the normal, which over load the capacitor and cause the resonance in the system.
3.	Cable	Due to skin effect, the effective cross section area for cable / conductor is reduced; hence it increases the I^2R losses in turn increase the temperature also.
4.	Motors	The Copper losses are increase due to skin effect and Iron losses are increase as it is proportional to the square of frequency. This result in to the overheating of the motor. This will de-rate the motor.

5.	Circuit breaker	Non-liner needs high pick current during stating which can cause for striping.
6.	Power Fuses	Due to skin effect, the effective cross section area for fuse element reduces, hence the fuse will blow below the rated value of the current.
7.	Relays	Many electronics relays are sensitive to the frequency and mal function because of harmonics.

A.4.3 Study & Measurement:

Harmonic measurement is carried out at various points in the campus. The major power distribution points are selected. Main panel of each building, AC panels where bulk power is transferred/utilised are selected for harmonic measurements.

ANNEXURE – 6 gives measurement details in values

ANNEXURE – 7 gives measurement details in graphs for better understanding.

A.4.4 Conclusion:

There is no substantial saving potential is found in this area. However, to arrive upon installation of Harmonic Filters/Mitigation technique at a particular locations, cyclic measurement of 24 hour is required. The exercise is required where harmonic harms the system.

A.5 ENERGY MONITORING SYSTEM

A.5.1 Introduction:

Energy Monitoring System (EMS) provides utility engineers greater insight into their in-plant distribution and utilization networks, with the ability to bifurcate the use of energy in various areas at different time frames.

A.5.2 Advantages:

Continuous monitoring of Electrical System parameters help in following:

Sr. No.	Effect
1.	Unified view of complete network on one dashboard
2.	Real time data monitoring (and controlling if required)
3.	Specialized report generation on parameters, part of system etc.
4.	Creating Historian, Data analysis & remote data display
5.	Load forecasting
6.	Predictive Maintenance
7.	Fault Diagnosis and Preventive measures
8.	Works as Dedicated O&M Personal

A.5.3 Methodology:

EMS is proposed for entire campus to achieve above goals. It is proposed to have monitoring of all instantaneous and energy parameters of electrical supply system at following important load center.

(i) Monitoring Proposed At:

a. All building incomer

b. Device with connected Load > 50 kW

c. All 4 Electrical Substation panel outgoings, APFCRs, TR and HT breaker panel

(ii) Monitoring Parameters:

a. 3-Ph Electrical Instantaneous Values V, I, W, VA, VAR, PF

b. 3-Ph Energy Parameters kWh, kVAh, kVARh

c. 3-Ph Odd Harmonic V & I up to 21st order with Vthd, Ithd

d. Device Status - ON/OFF/TRIP/Service/Panel Door Open/Remote-Local

(iii) Devices To Use:

a. RTUs / Remote IOs – aprox. 15 nos.

b. Gateway – 3 nos.

c. EMS Software on PC – 1 no. license with 1000 Tags for life time

A.5.4 Conclusion:

Above is proposed based on general methodology. Aprox. Cost for implementation is Rs. 12.50 Lacs. PDPU can decide upon the implementation methodology for cost optimization.

PART – B
SAFETY AUDIT

B.1 THE ASSIGNMENT

B.1.1 Legal Requirements:

a) It is appreciated that the Institute is vigilant about the safety of the student and people working within their premises and initiated the process of Safety and energy Audit. Third party Safety Audit is essential, though not mandatory, as per the provisions in Indian Electricity Rules, 1956, Rule No. 29 to ensure that the electrical installation is safe to operate from technical angle.

"**All Electric Supply Lines & Apparatus Shall be of Sufficient Ratings for Power, Insulation and Estimated Fault current and of Sufficient Mechanical Strength, for the Duty Which They May Be Required to Perform Under The Environmental Conditions of Installation, and Shall be Constructed, Installed Worked and Maintained in Such a Manner so as to Ensure Safety of Human Beings, Animals and Property."**

b) **IS: 14489, 1998** – Code of Practice on Occupational Safety & Health Audit lays down the requirements for safety audit.

c) Safe electrical installations will provide accident free working environment and will increase the personnel efficiency. It is known fact that electrical fault, generally termed as short circuit, is the principle cause of fire in more than 40% of incidents of fire. **IS: 1646-1997** - Code of Practice for Fire safety of Building (General): Electrical Installations also specifies requirements to make the electrical installation safe.

d) The energy audit at every three years is mandatory for institutional premises having demand above 75 KW as per Government of Gujarat regulations.

B.1.2 Aims of the safety audit

a) Physically check, measure, test existing system for its adequacy.

b) To examine and evaluate the accident prevention measures taken in the electrical system installed.

c) To analyze the safety procedures, systems and practices.

d) To observe the working conditions and operating methods, including storage and handling of raw materials and finished products.

e) To comment upon applicable statutory compliances.

B.1.3 Methodology:

In general, the safety objective can be fulfilled with:

a) Subjective Evaluation:

   i. Physical Inspection

ii. Statutory Compliance
iii. Operations review
iv. Equipment layout in various areas
v. Parameter Measurements

b) Objective Evaluation:
   i. Earth Resistance test
   ii. Earth loop test
   iii. Maintenance practices, i.e. periodic visual inspection, cleaning, insulation resistance measurement if possible

c) The major areas to be dealt under this audit are,
   i. Code compliance – IE rules, CEI, Indian standards
   ii. Electrical Shock / Flash / Injury hazard
   iii. Electrical fire hazard
   iv. Safety training to operating personnel
   v. Earthing system
   vi. Insulation resistance measurement
   vii. Competency and adequacy of operating personnel
   viii. Preventive maintenance
   ix. Lightning protection system
   x. Electrostatic hazard & control
   xi. Electrical protection system
   xii. Study of electrical single line diagram and equipment layout plan

d) In order to fulfill the safety objectives, following methodology was adopted.
   i. Critical scrutiny of all the documents, records pertaining to Safety, Health and Environment made available by the Company.
   ii. Review of electrical system and survey of electrical equipment installed in the Office and make thorough observations and bringing unsafe conditions to the notice of the officials and supervisors.
   iii. In-depth discussions with the officials on the matter pertaining to the electrical safety audit.

e) In order to fulfill the Energy audit objectives, following methodology was adopted.
   i. Last one year electricity company bill analysis for various parameters was carried out.
   ii. The biggest portion of energy consumption, air-condition units measured for performance analysis. Lighting consumption for various areas is also measured.
   iii. Harmonic content for different load centers also recorded.

B.1.3 Reports:

The observations made through review of electrical system and during survey rounds are as a part of the Audit are presented in the form of tables. Many useful and practical suggestions and recommendations have also been made, which, as and when be implemented, will supplement the institute's efforts to further improve the level of safety of the premises and to achieve an ultimate objective of concerting the institute as the best safe place to work.

B.2 COMPLIANCE, OBSERVATIONS AND RECOMMENDATIOS

B.2.1 Electrical Safety Policy and Statutory Compliances:

Sr. No.	Check point	Remarks
1.0	**Safety Policy**	
		Electrical safety policy is documented at institute level by institute management.
		Safety awareness training programs are not conducted for staff on regular basis. It is essential to conduct to create aware of occupational safety amongst staff. A mock drill is conducted on non-regular basis.
		Training of firefighting equipment operation is yet to be given to Faculty members/staff members. Fire fighting department is separate then electrical maintenance and handling all fire related activities.
		Danger sign boards are placed over electrical panels and panel rooms. Gathering place in case of emergency is not defined yet.
2.0	**Reporting process for electrical faults and work permit system**	
		It is appreciated that, electrical system faults are reported immediately. Entire facility is managed by central team of utility. Electrical maintenance is part of this team. Any kind of electrical fault is reported to this team for entire campus. For hostel campuses, separate reporting system is in place. Reported fault is immediately conveyed to electrical sub contractor whose men-power is deployed round the clock to attend the fault. It is recommended to have proper documentation of above process using “log-books” for future use. (Electrical faults and repairs log-book). The book shall cover: 1. Date and time of fault 2. Type of fault 3. Attended by 4. Down time 5. Possible cause of fault through root-cause analysis 6. Preventive action taken to avoid repetitive faults
		Fault attending system is fully manual. There is no system adopted for “Line Clearance Procedure” as of now. Whenever fault occurs, a person is kept on panel breaker side to watch continuously on the breaker whose feeder is taken under maintenance. This is manual procedure and has many loop holes. It is recommended to adopt “line clearance” system using sign boards on panels. Maintenance persons acquaintances are required.
		Operating manuals of majority equipments are not available since manu installations are as old as 10 years. Equipment operating manuals for all the equipments supplied by contractor is to be made available to all maintenance staff.
3.0	**Statutory Compliances**	

		Relevant drawings for electrical system, i.e. single line diagrams, layouts, etc. are shown by operational staff; but are not matching with the existing network. As built drawings are submitted by Electrical designer, however, updations are still required.
		A certificate is to be obtained from electrical contractor validating the electrical installation as per statute. A copy of same will be retained by Institute at management level and with maintenance team.
4.0	**Personal Protective Equipment (PPE) as per statutory requirements**	
		Personal Protective Equipment (PPE) are available at substation. 1. Electrical safety shoes 2. Helmets 3. Insulated hand gloves 4. Insulated earth rod etc 5. Fire buckets 6. Fire extinguishers Except fire extinguishers, everything is in good shape. Operating personals are not aware of Fire extinguisher operations. Enough training shall be imparted for it. Maintenance team is acquainted with PPE however, preventing themselves using it.
		Rubber mats in electrical room are provided.
		First aid box and shock treatment chart are provided in Electrical room.
5.0	**Electrical O&M**	
		While sub-letting O&M of electrical system work to the external agency, competency level of employed person is to be verified by institute management for holding minimum wireman's permit certificate issued by govt.
6.0	**Preventive Maintenance Program**	
		Preventive maintenance documentation and schedule is completely missing. Regular O&M documents are maintained for major equipments, however, at many panel and DB level, preventive maintenance schedule is not available.
		Level of dust deposits are observed on LV distribution boards, lighting fixtures, cable ducts, trenches etc. The same needs to be cleaned.

B.2.2 Power Distribution Compliances:

Following is the details of major power distribution devices:

Sr. No.	Equipment	Specifications	Redundancy
1	Transformer Service NO 18043	1 x 1600 kVA +1 x 800 kVA	N
2	Transformer Service NO 18066	1 x 1000 kVA	N
3	Transformer Service NO 18190	1 x 750 Kva	N

4	D.G. Set	1 x 380 kVA	N
5	D.G. Set	1 x 500 kVA	N
6	D.G. Set	1 x 500 kVA	N

Sr. No.	Check point	Remarks
1.1	**LV switchgear**	
1.1.1	Type of LV switchgear Enclosure	Panels & DBs
1.1.2	Type of control device	ACB/MCCB/MCB/Contactor/SFU/Isolator
1.1.3	Actual loading/current in incomer switchgear/fuse	Adequate
1.1.4	Whether rating of incomer is adequate w.r.t. full load current and system fault current (Amp)	Adequate
1.1.5	Type of protective devices provided and check whether it is adequate to provide protections	Adequate
1.1.6	Check earthing of switchgear at both ends, size of earth protective conductor	Ok
1.1.7	Whether outgoing feeders identified as required	Ok
1.1.8	Check all required safety interlocks are provided and are adequate	Ok
1.1.9	Whether unused holes for cable entry are sealed	Needs attentions at some locations
1.1.10	**Surge Protection Device (SPD)**	**Not Installed.**
	As per latest technological developments installation of SPDs shall be made at following locations to prevent all devices against voltage surges. **1. Main LT Panel Incomer (4P-Encapsulated type)** **2. Incomer of each building main panel (4P)** **3. Input panel & output panel of UPS**	
1.2	**Incoming & Outgoing cables**	
1.2.1	Type & size of incomer cable and nos. of parallel lengths	Adequate
1.3.2	Check rating of incoming conductor and adequacy of rating (Amp)	Adequate
1.3.3	Whether cables are terminated using glands and lugs of correct type/size	Adequate

1.3.4	Check condition of outer sheath for traces of heating	Ok
1.3.5	Check for earthing of cable armour thro' glands	Ok
1.3.6	Cable identification and proper dressing 	**Dressing is not found proper at some places.**
1.3.6	Whether O/G cables are provided with identification tags for easy traceability	**Cable Tagging System is completely missing in entire campus.**
1.3	**MV switchgear**	
1.3.1	Type of MV switchgear Enclosure	Indoor Panels
1.3.2	Type of control device	VCB
1.3.3	Actual loading/current in incomer switchgear/fuse	Adequate
1.3.4	Whether rating of incomer is adequate w.r.t. full load current and system fault current (Amp)	Adequate
1.3.5	Type of protective devices provided and check whether it is adequate to provide protections	Adequate
1.3.6	Check earthing of switchgear at both ends, size of earth protective conductor	Ok
1.3.7	Protection coordination Calculation, reports	Not Available No significant problem is observed.
1.3.8	Check all required safety interlocks are provided and are adequate	Ok
1.3.9	Whether unused holes for cable entry are sealed	Ok
1.3.10	Statutory compliance certificate is obtained from authority	Yes but not updated
1.4	**Transformer**	
1.4.1	Type of Transformer installation	ONAN
1.4.2	Type of control device	VCB
1.4.3	Actual loading on Transformer capacity wise	Adequate

1.4.4	Transformer general working condition	Adequate
1.4.5	Auxiliary device general observation	Silica gel needs maintenance
1.4.6	Check earthing of switchgear at both ends, size of earth protective conductor	Ok
1.4.7	Check all required safety interlocks are provided and are adequate	Ok
1.4.8	Whether unused holes for cable entry are sealed 	No
1.4.9	Statutory compliance certificate is obtained from authority	Yes but not updated

B.2.3 Electrical Room Compliances:

2.0	**General observations for incoming power supply on HT**	
2.1	In case of indoor room, check for adequacy of ventilation for cooling of equipment	Exhaust Arrangement is ok
2.2	Whether rooms are provided with two doors	YES
2.3	Whether the clearances around indoor HV/LV switchboards are complying with IE Rules/IS	Adequate
2.4	Whether outdoor area/switchgear room is properly cleaned and maintained	Cleaning is ok. Dusting is observed on panel and floor.
2.5	Whether covers are provided over trench for protection of working personnel against accidental fall	Ok
2.6	Whether any material is stored in the indoor substation room	Yes Material dumping is observed in the room

B.2.4 Earthing System Compliances:

Sr. No.	Check point	Remarks
1.0	**General**	
1.1	Whether earthing system is designed complying to IS:3043 or any other international standard	Yes
2.0	**Earthing stations**	

2.1	Type of Earthing Stations and material of construction of earth electrode	STRIP/WIRE
2.2	Nos. of Earthing Stations	Adequate
2.3	Whether identification tags are duly painted on each earthing station for ease of traceability	**NO. Required.**
2.4	Is the chamber around Earthing Station is properly constructed	Yes
2.5	Whether proper equi-potential bonding among all Earthing Stations is made	No. Not Required.
2.6	Whether distance between adjacent Earthing Stations for electrical system is greater than 2.5m	Ok
2.7	Whether distance between walls or structures and all Earthing Stations is greater than 1.5m	Ok
2.8	Is the test link is provided between Earthing Station and grid conductor to facilitate isolation for testing	Ok
2.9	Whether Earthing Stations are properly maintained and earth pits are properly cleaned	**NO. Many places observed unattended since long back.**
2.10	Whether records for testing of earthing system resistance are properly maintained and check interval of periodic testing	**NO**
2.11	Check whether pipes/funnel are provided in Earthing Stations for water pouring	Yes
2.12	Whether hinged CI cover with frame is provided over chamber of Earthing Station	Yes
2.13	**Earthing Stations for electronic sensitive equipment**	
i.	Whether dedicated Earthing Stations are installed for earthing of electronic sensitive equipment	Yes
ii.	Whether all electronics equipments are earthed as per the vendor's requirements/IS Specification	Yes
2.13	**Earthing Stations for lightning protection system**	
i.	Whether dedicated Earthing Stations are installed for lightning protection system	Yes
3.0	**Earth mat conductors and Equi-potential bonding conductors**	
3.1	Material of construction of mat conductors and size	NA
3.2	Check that all the earthing cables (Wherever used) are with green colour insulation	Yes
3.3	Whether earthing cables (Wherever used) are properly identified for ease of traceability	Yes
3.4	Whether fire blocks are provided in opening made for passing of cables to contain fire propagation	**No. All gaps are to be filled with FR material.**
3.5	Whether non-current carrying metallic enclosures, chassis of equipment, etc. are earthed at two distinct points as required	Yes almost all points
4.0	**Earthing pit measurements**	

4.1	Measured value	As per ANNEXURE-1
5.0	**Additional Remarks**	
5.1	An extensive survey for earthing is done. Entire campus at every DB level and point level is checked for available of earthing connection at that point through Earth Loop Tester. Column Zloop reflects the measurement values in ANNEXURE-A. ELCBs are also checked for their working conditions. Problems are highlighted in Remarks column. ANNEXURE-8 reflects Zloop of earthing connection at various sockets. Sockets are randomly chosen and measured using earth-loop tester. Problematic points are highlighted. During measurement, our team has given details of each and above problem to the utility team.	

B.2.5 Electrical Wiring Compliances:

Sr. No.	Check point	Remarks
1.0	**Switchboard installed in various indoor areas**	
1.1	Types of switchboards installed in various indoor areas	Concealed/Modular
1.2	Whether components such as switches, sockets, fan regulators, etc. complying with applicable IS	YES
1.3	Whether any switchboard installation is in open or loosely fitted	NO
1.4	Is each switchboard provided with effective isolating device in case of fault in O/G circuits and, if provided, check for adequacy of its rating	YES
1.5	Are blanking plates used to plug unused openings on switchboard	YES
1.6	Whether all switchboards are easily accessible	YES
1.7	Are all 1-pole switches for outgoing circuits wired in phase	OK
1.8	How many fixtures are controlled by one switch (Random checks)	OK (2,3,4,6)
2.0	**Circuit wiring**	
2.1	Type of circuit wiring	Majority Concealed
2.2	Check types and quality of wires used for lighting circuit wiring and/or power circuit wiring	OK
2.3	Are all wires, cables and raceway connections intact and secure	OK
2.4	Observations for any area where exposed wires, if any, need dressing	As per Remarks column in ANNEXURE-1
2.5	Whether any exposed wiring is observed with frayed or deteriorated insulation repaired or replaced	OK

2.6	Is earthing wire is run along all the lighting/power circuits as required	OK
3.0	**Lighting fixtures**	
3.1	Is all light fixtures of appropriate type as per area requirement	OK
3.2	Whether any loosely fitted lighting fixture observed	OK
3.3	Whether lighting fixtures are extended earthing connection wherever provision is made in fixture for earthing connection	OK
4.0	**Separate Power Points**	
4.1	Are high rated electrically operated items plugged directly into power points (not on power boards)	OK
4.2	Check ratings of sockets outlets in switchboards w.r.t type of load/ appliance connected	OK
4.3	Are power points easily located and unobstructed	OK
4.4	Is each power point provided with effective isolating device in case of fault in O/G circuit and, if provided, check for adequacy of its rating	OK
4.5	Check present condition of power point switches and sockets	OK
4.6	Are power points identified with the circuit details	OK
4.7	Whether electrical appliances such as photocopiers, AC, etc. have their own power point	OK
4.8	Is earth continuity satisfactory in socket outlets	OK
4.9	Whether use of multiple plug adapters prohibited or permitted	NA
5.0	**General**	
5.1	Is any electrical installation located in the building area with excessive dampness and humid atmosphere	No
5.2	Are metallic parts, junction boxes, etc. used in interior wiring systems provided with earthing	No
6.0	**Procedure adopted for extension of temporary power supply**	
6.1	In case of extension of temporary power supply, whether that circuit is protected by suitable switches or plug connectors at junction with permanent wiring	Yes
6.2	Whether extension wires are of suitable length, i.e. not too long/ coiled up or too short	OK

B.2.6 Distribution Board Compliances:

Following detailed exercise is done with Each DB in Entire Campus: (Sample Case)

1	DB Name :	BLOCK-A POGRAMMING OFFICE LIGHTING DB
2	Technical Compliances	
2.1	Body Earthing (Dual)	Provided through wires
2.2	Danger Sign	Provided
2.3	Incomer Protection – FP MCB	Yes
2.4	DP ELCB Provided (One in Each Phase)	Yes

2.5	Locking Arrangement – Pad Locking					Yes. Double door Completely locked Access to authorized persons only
2.6	Wiring Dressing					Ok
2.7	Incoming and Outgoing Cable/Wire Labeling					Not Done
2.8	Circuit Identification					Not Done
2.9	Phase wise Neutral and Earthing Busbar					Separate
3	Load Current Measurement in Amp					
3.1	**R**	2.11	**Y**	2.05	**B**	1.85
					N	2.68
3.2	Amp in Neutral (100% Load on R-Y-B Phases)					87
4	Voltage Measurement in Volts					
4.1	**RN**	252	**YN**	252	**BN**	252
	RE	252	**YE**	251	**BE**	251
	BR	378	**BN**	219	**BE**	218
4.2	**NE**			0		
5	**Body Earthing in Ohm**			7		
6	Remarks					
6.1	ELCB Not Checked due to ongoing functionality					

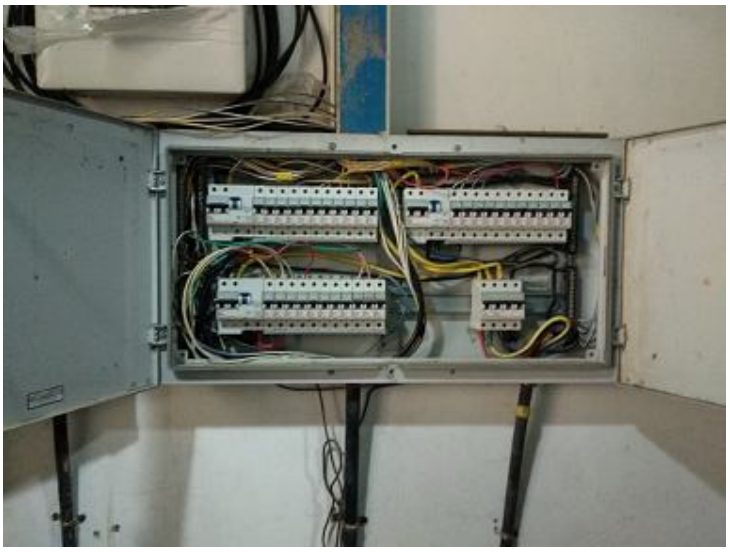
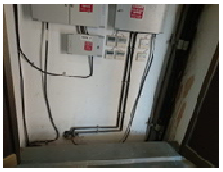
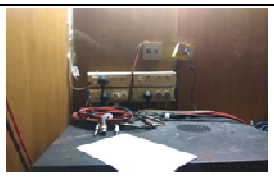
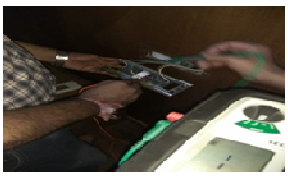
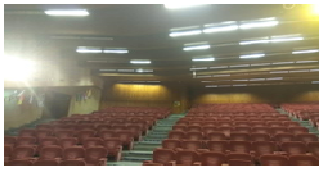
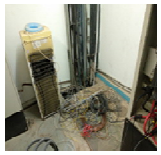
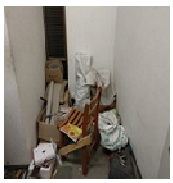


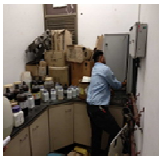
Fig. Wiring Dressing problem in DBs

Above is a sample case given for understanding extent of exercise done for each DB. Summarized values are shown in ANNEXURE-1 for each DB.

B.2.7 On Site Observations:

Sr. No.	Building Name	Level	Area	DB/Panel Name	PHOTO	Remarks
1	E block	2F	203	SLDB		Number to outgoing circuits are not done
2	E block	2F	204	SLDB		Safety griil is required in cutout at floor level
3	E block	2F	203	SLDB		Safety griil is required in cutout at floor level
4	E block	2F	203, 202	SLDB		Need to be clean space on floor
5	B block	GF	Audi	Sockets		Loose socket
6	B block	GF	Audi	Sockets		Earthing not proper at door side socket
7	B block	GF	Audi	LIGHTS		Many lights not working
8	A block	GF	A 004	LDB		No door on panel

9	C BLOCK	ADMIN		SLDB		Need to be clean space on floor
10	WORKSHOP	WORKSHOP		LDB		Cover the un-necesary hole From downside of ldb
11	WORKSHOP	WORKSHOP		LDB		Cover the un-necesary hole From downside of ldb
12	WORKSHOP	WORKSHOP		WORKSHOP MAIN PANEL		Cover the cable-pipe with metalic plate or make it underground
13	GIRLS HOSTEL	GF	F BLOCK	GIRLS HOSTEL F BLOCK	 	Safety griil is required in cutout at floor level
14	UG HOSTEL	GF		C BLOCK		Need to be clean space on floor
15	UG HOSTEL	GF		D BLOCK		Need to be clean space on floor
16	UG HOSTEL	GF		E BLOCK	 	Need to be clean space on floor
17	D BLOCK	MAIN PANEL		D BLOCK		Meter are not working

18	CHEMISTRY LAB	ACDB	D BLOCK			Need to be clean space on floor

B.3 THERMOGRAPHY

B.3.1 Basic:

Thermography is the imaging or viewing of an object or process through sensing of infrared radiation emitted by it. Heat flow by conduction and radiation may be observed and used to locate material discontinuities. Infrared thermography is imaging of a temperature field through the emitted infrared radiation.

Thermography is a part of preventive & predictive maintenance technique. Thermal imaging of an electrical apparatus gives heat flow in terms of temperature gradients.

Through this, present loading condition, abnormal working condition can be detected and failure/damage can be prevented.

Thermography exercise in campus is done at major load center. Presently, the system is working below its full rated capacity and hence, temperature gradient is found in order and no abnormalities observed.

In future the same results shall be verified with then thermal images for getting an idea of any kind of abnormality.

ANNEXURE-9 gives software output of thermal imaging camera's measured parameters at with location details.

ANNEXURE-1

DOCUMENT: DB WISE MEASUREMENTS

SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
BLOCK-A																	
1	22-03-19	GF	POGRAMMING	ADMIN LTG DB	252	252	252	252	251	251	1	2.11	2.05	1.85	2.68	1.89, 2.31, 0.11	ELCB NOT CHECKED
2	22-03-19	GF	A 001	G-FLOOR LTG DB	252	251	251	252	251	251	1	3.83	6.53	8.32	3.33	0.64, 0.66, 0.64	Y AND B P ELCB NOT WORKING
3	22-03-19	GF	A 004	LDB	253	252	237	252	250	249	1	2.3	0.32	0.5	4.3	2.64, 2.53, 2.54	NO DOOR ON PANEL
4	22-03-19	1F	A 101	LTG DB	254	252	253	254	253	252	1	5.7	5.48	6.88	2.96	1.1, 1.1 1.1	
5	22-03-19	GF	SPM ELEC ROOM	PANEL 1	NOT AVAILABLE											0.1, 0.1, 0.18	
6	22-03-19	GF	SPM ELEC ROOM	PANEL 2	NOT AVAILABLE											0.1, 0.23, 0.33	
BLOCK-B																	
1	22-03-19	GF	AUDI-G (RIGHT)	LDB	251	251	251	252	252	251	1	4.94	5.8	4.57	2.09	1.32, 1.34, 1.29	ALL ELCB BYPASSES, DIST. NOT ACCRD TO COLOR,NO LABEL ON PANEL
2	22-03-19	GF	AUDI-G (LEFT)	LDB	253	252	252	253	253	251	1	2.1	2.58	0.64	1.83	1.48, 1.54, 1.43	MANY TUBELIGHTS NOT WORKING
3	22-03-19	GF	AUDI-1 (STAGE	LDB	249	258	249	249	249	249	1	0.65	0	0	0.62		
4	22-03-19	GF	AUDI-1 (STAGE	LDB	249	258	249	249	249	249	1	17.3	16.1	16.1	0.4		
5	22-03-19	GF	AUDI-1 (STAGE	LDB	249	258	249	249	249	249	1	0.02	0.2	0.1	0		
6	22-03-19	GF	AUDI-1 (STAGE	LDB	249	258	249	249	249	249	1	0.1	0.1	0.2	0		
7	22-03-19	GF	LT-1	LDB-1 (MAIN)	249	247	253	249	249	250	1	6.13	9.67	0.21	8.38	1.73, 1.72, 1.66	OUTDOOR PLUG NOT WORKING
8	22-03-19	GF	LT-1	LDB-2 (1-PH)				251			2	4.8				1.82	ELCB BYPASSED, NOT WORKING
9	22-03-19	1F	B-101	LDB	254	252	254	253	252	248	1	0.53	0.17	8.32	7.88	1.62, 1.63, 1.54	R-PH ELCB NOT S13WORKING, PATHWAY LIGHTS NOT WORKING
10	22-03-19	1F	B-101	LDB													NO HANDLE/KNOB FOR PANEL DOOR
BLOCK-C																	
1	22-02-19	GF	C-001,008	GLDB	251	249	248	248	251	248	2	0	8.8	9.2	10.1	1.29,1.37,1.24	VNE = 2V,R,Y PH ELCB BYPASS,R PH ELCB DAMAGE.
2	22-02-19	GF	C-002,3,7,CP	GLDB	248	250	249	248	251	248	1	8.84	7.76	7.61	4.59	0.91,0.85,0.69	VNE = 1V
3	22-02-19	GF	ADMIN 1	GLDB	250	251	250	250	252	249	1	2.71	3.49	2.23	2.36	1.50,0.99,1.11	VNE = 1V,ELCB-R,Y,B DAMAGE
4	22-02-19	GF	ADMIN 2	GLDB	252	253	250	251	252	251	1	1.11	1.42	0.5	1.55	0.75,0.74,0.73	VNE = 1V

ANNEXURE-1																	
DOCUMENT: DB WISE MEASUREMENTS																	
SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
5	27-02-19	1F	C-101,108,10	FLDB	250	254	250	251	251	251	1	5.2	3.6	6.9	0	0.52,0.52,0.51	ELCB NOT CHECKED
6	27-02-19	1F	C-105,106,10	FLDB	250	250	253	251	251	251	1	4.2	9.3	0	0.3	1.85,1.95,1.85	ELCB ELCB OK
7	27-02-19	1F	C-103,107,10	FLDB	250	254	249	250	255	250	1	9.5	0.1	8.6	10.7	2.2, 1.78, 1.88	Y-PH ELCB NOT WORKING
8	27-02-19	1F	109(1)	FLDB	251	251	251	251	252	250	1	2.39	9.2	3.5	6.3	1.11,1.01,1.03	ELCB OK
9	27-02-19	1F	109(2)	FLDB	252	255	253	252	254	253	1	3.2	2.6	2.3	1.6	2.53,0.52,0.54	
10	27-02-19	2F	C-203, 204	SLDB	249	255	249	249	253	250	1	0.5	0.2	5.2	0	1.64, 1.78, 1.79	
11	27-02-19	2F	C-201,206(LI	SLDB	252	251	250	259	246	249	0.3	1	5	7.8	7.8	3.51, 2.30, 2.63	
12	27-02-19	2F	C-202,205,20	SLDB	251	250	250	250	252	250	0.01	0.1	8.4	4.9	5	409, 406, 408	EARTHING PROBLEM, ELCB NOT CHECKED
13	27-02-19	2F	OLD ACC, ADMIN	SLDB	230	232	229	230	231	230	1	1.8	2.7	5	4.6	2.97, 2.92, 2.38	ELCB NOT CHECKED
BLOCK-D																	
1	15-02-19	GF	D-001,002,00	GLDB	251	247	251	251	247	251	1	4.8	22.5	8.3	16	0.3	IY, IN VERY HIGH,VNE =1V,DB NAME AND NAME PLATE REQUIRED,PROBLEM IN
2	15-02-19	GF	D-005.006 W.R.	GLDB	251	250	244	249	250	246	2	1.3	6.3	14.1	10.2	1.06	VNE =2V,DB NAME AND NAME PLATE REQUIRED
3	15-02-19	GF	D-003.004	GLDB	247	249	250	247	249	249	1	1.16	12.5	6.2	4.5	0.51	VNE =1V,DB NAME AND NAME PLATE REQUIRED
4	15-02-19	1F	D-101,102,10	FLDB	248	252	249	248	251	248	1	12.23	6.48	12.86	10.3	0.35	VNE =1V,R PH ELCB NOT WORKING
5	15-02-19	1F	D103, 106	FLDB	252	242	256	250	248	252	5	2.7	23.6	0.7	16.9	0.46	VNE =5V
6	15-02-19	1F	D-104, 105	FLDB	244	252	252	246	251	248	2	15.66	6.67	5.71	9.12	1.26	VNE =2V,R PH ELCB BYPASSED
7	15-02-19	1F	FACULTY WING	FLDB	249	250	250	249	250	249	1	3.3	0	1.7	3.7		VNE =1V
8	15-02-19	2F	D-208, LIBRARY	SLDB	247	251	252	248	252	249	2	16.1	10.2	1.3	15.2		VNE =2V,R,Y PH ELCB BYPASSED &DB EARTHING NOT PROPER(BODY EARTHING
9	15-02-19	2F	D-203, 204, 207	SLDB	246	250	247	248	251	248	1	8.7	7.02	8.6	4.8	0.55	VNE =1V
10	15-02-19	2F	FACULTY WING-1	SLDB	245	251	249	248	251	248	1	5.4	1.1	1.6	4.8	2.08	VNE =1V
11	15-02-19	2F	FACULTY WING-2	SLDB	248	251	248	251	249	247	2	2.3	4.6	11.8	9.2	>2000	VNE =4V,Y PH ELCB DAMAGE,NOT PROPER EARTHING.
12	20-02-19	1F	FACULTY WING 1	FLDB	247	249	247	247	250	247	1	1.55	1.53	1.76	1.23	2.06,1.67,1.33	VNE =1V,INDOOR COVER NOT GIVEN,R PH ELCB DAMAGE,B,Y PH NOT WORKING.
13	20-02-19	1F	FACULTY WING 2	FLDB	245	249	248	243	251	245	4	5.03	3.09	0.01	5.5	2.20,2.25,2.32	VNE =4V

ANNEXURE-1

DOCUMENT: DB WISE MEASUREMENTS

SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
14	20-02-19	2F	D-205,206,W	FLDB	232	224	225	228	227	225	3	1.37	2.17	11.4	9.69	1.2,1.25,1.37	VNE =3V,R PH ELCB DAMAGE
				BLOCK-E													
1	30-01-19	2F	E - 204	SLDB - 3	247	252	248	247	250	247		6.45	2.84	6.19	6.39		VNE = 4V GROSS = 1.1
2	30-01-19	2F	E - 201	SLDB -1	247	254	254	249	253	251		8.2	0.46	0.44	8.18		VNE = 4V BPH ELCB NOT WORKING
3	30-01-19	2F	E - 201	SLDB -1								9.08	0.94	0.33	8.47		INLCUSING WASH ROOM LIGHTS
5	01-02-19	2F	E - 202 & 20	SLDB -1	246	256	248	248	253	248		13.14	0.53	8.1	12.92		YPH ELCB NOT WORKING
6	01-02-19	2F	E - 202 & 20	SLDB -1 WITH R-								12.98			13		
7	01-02-19	2F	E - 202 & 20	SLDB -1 WITH B-										8.52	8.35		YPH ELCB NOT WORKING 3RD 6A MCB IS UNDERRATED; TO BE
8	01-02-19	2F	- 207,208,2	SLDB-2	252	250	248	249	251	248		3.1	7.7	9.51	9.86		BPH 1ST MCB IS UNDERRATED; TO BE CHANGED TO 16A
9	01-02-19	2F	E - CE LAB	SLDB-1	254	248	251	251	251	249		0.42	18.31	4.44	15.2		EARTHING TO BODY NOT PROVIDED RPH ELCB IS NOT WORKING
10	01-02-19	2F	AUTOMATION &	-AUTOMAT	247	250	251	249	230	249		3.9	4.03	0.45	3.25		230 LUX MAX. ILLUMINATION DISTRIBUTION IS NON-
10	01-02-19	2F	FACULTY WING		249	251	249	248	251	248		1.2	3.1	3.67	1.7		YPH & BPH ELCB NOT WORKING
11	01-02-19	2F	CP LAB (CDB	CDB-1	230	229	230	228	229	229		3.65	6.38	5.08	4		VNE = 4V ELCB OPERATIONS NOT CHECKED AS AREA IS UNDER
12	01-02-19	2F	CP LAB (LDB	LDB-1	247	252	249	248	251	247		5.49	6.46	4.39	3.08		VNE = 3V ELCB OPERATIONS NOT CHECKED AS AREA IS UNDER
13	06-02-19	1F	E- EEE (FACULTY	FLDB -1	252	248	251	250	251	249		1.5	9.1	4.2	6.5		VNE = 3V
14	06-02-19	1F	- 108,109,11	FLDB -2	249	253	246	248	251	246		6.9	4.5	7.2	4.5		VNE= 3V YPH ELCB NOT WORKING
15	06-02-19	1F	E - 101	FLDB -1	248	255	250	248	253	249		7.75	1.96	2.17	5.48		VNE= 3V RPH & BPH ELCB NOT WORKING
16	06-02-19	1F	FACULTY W	FLDB -1	251	254	251	251	254	250		1.5	1.4	3.1	2.6		VNE= 3V RPH & YPH ELCB NOT WORKING
17	06-02-19	1F	E - 102,103	FLDB -2	249	254	246	248	252	246		5.14	5.5	8.26	3.89		VNE = 3V
18	06-02-19	1F	E - 104,105	FLDB -3	249	253	248	251	253	250		5.6	6.2	6.3	2.6		BPH & YPH ELCB NOT WORKING
19	06-02-19	1F	E - 112,113	FLDB -1	251	255	254	252	254	252		10.84	5.25	3.97	6		RPH ELCB NOT WORKING
20	08-02-19	GF	E - 007,006	GLDB -1	252	255	252	252	255	252		9.4	1.02	4.2	7.5	0.35,0.35,0.46	VNE = 3V
21	08-02-19	GF	- 008,009,01	GLDB -2	252	253	251	251	253	250		8.48	8.72	7.58	4.07	0.91,0.90,0.87	VNE = 3V

ANNEXURE-1																	
DOCUMENT: DB WISE MEASUREMENTS																	
SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
22	08-02-19	GF	01+WASHR	GLDB -1	249	253	254	250	253	251		7.9	1.4	1.4	5.9	0.64,0.66,0.61	VNE = 3V
23	08-02-19	GF	- 003 & 00	GLDB -3	253	248	252	251	251	250		3.29	8.09	6.1	4.65	0.86,0.88,0.85	VNE = 3V
24	08-02-19	GF	- 002 & 00	GLDB -2	255	250	251	287	236	232		1.4	8.2	7.9	8.3	0.71,0.70,0.67	VNE = 33V HIGH,EARTHING NOT PROVIDED PROPERLY ON RIGHT HAND
25	13-02-19	GF	LAB + FACU	GLDB-1	246	248	251	247	249	247		8.4	7.1	2.3	6.6		VNE = 4V
HIGH RISE HOSTEL BLOCK-C2																	
1	05-04-19	GND	C2	EMERGENCY	228	227	227	226	227	228	1	4.6	9.7	12.9	10.6	0.52, 0.53, 0.56	
2	05-04-19	1	C2	MAIN	228	226	228	227	228	228	1	0.67	0.68	1.62	1.03	2.08, 2.07, 2.04	
3	05-04-19	1	C2	EMERGENCY	226	227	227	226	226	227	1	0.17	7.8	0.65	7.8	3.23, 1, 3.09	
4	05-04-19	2	C2	MAIN	227	227	229	226	226	230	1	1.18	0.73	0.66	0.47	7.13,2.7,3.03	
5	05-04-19	2	C2	EMERGENCY	225	229	229	226	226	230	1	0.98	8.93	0.83	7.15	0.9,4.5,2.09	
6	05-04-19	3	C2	MAIN	227	227	229	226	226	230	1	0.21	0.19	0.22	0.15	5.85,2.6,4.9	
7	05-04-19	3	C2	EMERGENCY	228	226	228	227	228	228	1	0.2	0.834	0.7		2.42,1.12,1	
8	05-04-19	4	C2	MAIN	226	227	227	226	226	227	1	1.35	2.76	1.23	2.4	3.62,1.67,3.42	
9	05-04-19	4	C2	EMERGENCY	228	226	228	227	228	228	1	16.9	5.9	0.2		2.93,4.45,4.58	
10	05-04-19	5	C2	MAIN	229	228	231	229	227	233	1	0.37	0.28	0.12	0.28	0.7,0.71,0.72	
11	05-04-19	5	C2	EMERGENCY	226	230	233	229	227	234	2	0.4	0.1	0.3	0.37	0.73,0.71,0.72	
12	05-04-19	6	C2	MAIN	228	227	231	229	227	233	2	0.46	0.13	0.17	0.48	0.65,0.63,0.66	
13	05-04-19	6	C2	EMERGENCY	227	229	233	228	226	227	2	0.6	0.26	1.27	0.97		
14	05-04-19	7	C2	MAIN	228	228	229	227	228	231	2	0.37	0.7	0.23	0.62	0.75,0.72,0.71	MAT REQUIRED
15	05-04-19	7	C2	EMERGENCY	228	227	231	229	227	233	2	0.7	8	3.55	5.8	0.74,0.68,0.74	MAT REQUIRED
16	05-04-19	8	C2	MAIN	227	229	231	228	227	231	2	0.37	0.2	0.08	0.53	0.76,0.76,0.80	MAT REQUIRED
18	05-04-19	9	C2	MAIN	228	228	229	228	227	231	2	0.18	0.29	6.35	6.26	0.6,3.68,0.64	MAT REQUIRED
19	05-04-19	9	C2	EMERGENCY	226	229	230	228	227	230	1	0.62	0.65	0.2	0.46	5.29,1.97,1.14	MAT REQUIRED

ANNEXURE-1																	
DOCUMENT: DB WISE MEASUREMENTS																	
SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
20	05-04-19	10	C2	MAIN	228	228	229	227	228	231	1	0.39	1.04	1.03	1.06	4.29,3.74,3.81	MAT REQUIRED
21	05-04-19	10	C2	EMERGENCY	226	227	227	226	226	227	1	0.26	0.28	0.12	0.11	3.05,1.72,2.50	
22	05-04-19	11	C2	MAIN	228	226	228	227	228	228	1	0.53	0.6	0.11	0.5	1.49,6.54,3.27	
23	05-04-19	11	C2	EMERGENCY	228	227	231	229	227	233	1	6.6	6.97	0.42	5.6	1.32,1.6,2.85	
HIGH RISE HOSTEL BLOCK-B2																	
1	10-04-19	GND	B2	MAIN	231	231	232	232	232	234	1	17.6	18.4	11.9	10.7	4.79,2.03,3.57	
2	10-04-19	GND	B2	EMERGENCY	229	230	232	228	229	230	1	17.8	16.1	6.1	8	0.88,1.92,5.57	
3	10-04-19	1	B2	MAIN	229	230	232	228	229	230	1	NA	NA	NA	NA	3.23,1,3.09	KEYS NOT FOUND
4	10-04-19	1	B2	EMERGENCY	229	230	232	228	229	230	1	NA	NA	NA	NA	2.08,2.07,2.04	KEYS NOT FOUND
5	10-04-19	2	B2	MAIN	235	235	236	235	235	235	1	1.12	0.45	1.76	1.1	7.1,2.7,3.03	
6	10-04-19	2	B2	EMERGENCY	233	231	236	233	234	234	1	1.29	0.45	0.87	0.65	0.9,4.5,2.09	
7	10-04-19	3	B2	MAIN	234	235	235	236	234	234	1.65	1.86	0.9	0.9	0.96	5,85,2.6,4.9	
8	10-04-19	3	B2	EMERGENCY	232	230	232	234	232	232	2	1	0.7	0.4	0.4	2.42,1.12,1	
9	10-04-19	4	B2	MAIN	231	232	232	231	231	232	2	0.2	0.7	0.1	0.5	2.93,0.45,4.58	
10	10-04-19	4	B2	EMERGENCY	230	230	233	231	230	231	1	1.37	3.9	0.05	2.4	3.62,1.67,3.42	
11	10-04-19	5	B2	MAIN	232	232	232	233	233	232	1.7	1.65	2.14	1.56	1.26	0.69,0.70,0.68	
12	10-04-19	5	B2	EMERGENCY	231	231	233	230	230	232	1	0.8	0.9	0.6	0.1	0.73,0.71,0.72	
13	10-04-19	6	B2	MAIN	232	232	233	231	232	232	1.6	1.61	1.19	1.06	0.72	0.65,0.63,0.66	
14	10-04-19	6	B2	EMERGENCY	230	230	232	231	230	232	1	0.97	0.86	0.02	1.04	0.73,0.70,0.71	
15	10-04-19	7	B2	MAIN	232	232	233	232	232	232	1.7	1.87	1.52	1.25	0.95	0.75,0.72,0.71	
16	10-04-19	7	B2	EMERGENCY	230	232	233	232	231	231	1	2.6	0.46	1.14	1.57	0.74,0.68,0.74	
18	10-04-19	8	B2	MAIN	232	232	233	232	232	233	1.7	2.67	2.15	0.63	1.96	0.76,0.76,0.80	
19	10-04-19	8	B2	EMERGENCY	231	232	233	232	231	231	2	1.23	1.2	0.36	0.66	NA	

ANNEXURE-1																	
DOCUMENT: DB WISE MEASUREMENTS																	
SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
20	10-04-19	9	B2	MAIN	233	233	234	234	233	233	1.8	1.88	1.76	1.16	1.58	2.91,3.68,0.74	
21	10-04-19	9	B2	EMERGENCY	231	232	233	232	231	232	1	1.09	1.19	0.5	0.68	5.29,1.97,1.14	
22	10-04-19	10	B2	MAIN	233	233	234	233	233	234	2	2.66	2.26	0.1	2.9	3.05,1.72,2.5	
23	10-04-19	10	B2	EMERGENCY	232	232	234	230	230	232	1	1.89	1.18	0.26	1.22	4.29,3.74,3.81	
24	10-04-19	11	B2	MAIN	233	233	234	234	233	233	2	1.3	2.1	0.03	1.85	1.32,1.60,2.85	
25	10-04-19	11	B2	EMERGENCY	230	232	232	230	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.49,2.89,3.27	
HIGH RISE HOSTEL BLOCK-A2																	
1	03-04-19	GND	A2	MAIN	NOT DONE											2.14,2.95,1.86	TRIPPING OF PANEL HAPPENS WHILE CHECKING IMPEDANCE THROUGH EARTH
2	03-04-19	GND	A2	EMERGENCY	NOT DONE											2.1,2.3,1.67	Off Load Condition
3	03-04-19	1	A2	MAIN	NOT DONE											2.68,2.38,2.69	Off Load Condition
4	03-04-19	1	A2	EMERGENCY	NOT DONE											1.25,1.22,3.05	Off Load Condition
5	03-04-19	2	A2	MAIN	NOT DONE											2.13,0.32,5.85	Off Load Condition
6	03-04-19	2	A2	EMERGENCY	NOT DONE											1.65,1.73,1.46	Off Load Condition
7	03-04-19	3	A2	MAIN	NOT DONE											1.23,2.04,2.09	AMMETER AND VOLTAGE READING METERS NOT PROPERLY CALIBRATED
8	03-04-19	3	A2	EMERGENCY	NOT DONE											1.10,1.47,4.09	Off Load Condition
9	03-04-19	4	A2	MAIN	NOT DONE											2.45,4.53,4.09	PASSAGE & PANTRY ELCB NOT WORKING
10	03-04-19	4	A2	EMERGENCY	NOT DONE											4.2,3.9,4.7	Off Load Condition
11	03-04-19	5	A2	MAIN	NOT DONE											3.67,4.89,5.18	IMPEDANCE Z(BE) MORE THAN 5 OHMS
12	03-04-19	5	A2	EMERGENCY	NOT DONE											4.08,4.25,4.49	Off Load Condition
13	03-04-19	6	A2	MAIN	NOT DONE											4.20,4.35,3.84	Off Load Condition
14	03-04-19	6	A2	EMERGENCY	NOT DONE											4.23,3.69,4.32	Off Load Condition
15	03-04-19	7	A2	MAIN	NOT DONE											4.09,4.14,4.13	Off Load Condition
16	03-04-19	7	A2	EMERGENCY	NOT DONE											4.42,4.38,4.32	Off Load Condition

ANNEXURE-1

DOCUMENT: DB WISE MEASUREMENTS

SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
18	03-04-19	8	A2	MAIN	NOT DONE											4.07,4.57,4.05	AMMETER READING METER NOT WORKING PROPERLY
19	03-04-19	8	A2	EMERGENCY	NOT DONE											4.42,4.22,4.05	Off Load Condition
20	03-04-19	9	A2	MAIN	NOT DONE											4.38,4.22,4.47	Off Load Condition
21	03-04-19	9	A2	EMERGENCY	NOT DONE											4.66,4.12,4.10	Off Load Condition
22	03-04-19	10	A2	MAIN	NOT DONE											4.12,4.27,4.14	2 ELCB NOT WORKING OF PASSAGE LDB
23	03-04-19	10	A2	EMERGENCY	NOT DONE											4.03,4.78,4.78	Off Load Condition
24	03-04-19	11	A2	MAIN	NOT DONE											3.90,3.80,4.23	Off Load Condition
25	03-04-19	11	A2	EMERGENCY	NOT DONE											4.32,4.29,4.67	Off Load Condition
GIRLS HOSTEL BLOCK																	
1	24-04-19	GF (I/C)	F & I - BLOCK	-	NOT DONE												Off Load Condition
2	24-04-19	GF	F-BLOCK	LDB-GF	NOT DONE											1.84,1.86,1.9	Off Load Condition
3	24-04-19	1F	F-BLOCK	LDB-1F	NOT DONE											2.03,1.92,1.86	Off Load Condition
4	24-04-19	2F	F-BLOCK	LDB-2F	NOT DONE											1.81,1.8,1.81	Off Load Condition
5	24-04-19	3F	F-BLOCK	LDB-3F	NOT DONE											1.91,1.91,1.97	Off Load Condition
6	24-04-19	GF-A	I-BLOCK	LDB-GF-A	NOT DONE											0.94,1.01,0.84	Off Load Condition
7	24-04-19	GF-B	I-BLOCK	LDB-GF-B	NOT DONE											0.93,0.95,1.04	Off Load Condition
8	24-04-19	1F-A	I-BLOCK	LDB-1F-A	NOT DONE											0.9,0.98,0.98	Off Load Condition
9	24-04-19	1F-B	I-BLOCK	LDB-1F-B	NOT DONE											0.92,0.98,0.98	Off Load Condition
10	24-04-19	2F-A	I-BLOCK	LDB-2F-A	NOT DONE											0.91,0.93,0.95	Off Load Condition
11	24-04-19	2F-B	I-BLOCK	LDB-2F-B	NOT DONE											0.93,0.84,0.89	Off Load Condition
12	24-04-19	3F-A	I-BLOCK	LDB-3F-A	NOT DONE											1.11,1.13,1.08	Off Load Condition
13	24-04-19	3F-B	I-BLOCK	LDB-GF	NOT DONE											0.89,0.93,0.89	Off Load Condition
14	24-04-19	GF	G-BLOCK	LDB-GF	NOT DONE											1.28,1.29,1.44	Off Load Condition

ANNEXURE-1																	
DOCUMENT: DB WISE MEASUREMENTS																	
SR. NO.	DATE	LEVEL	AREA	DB/PANEL NAME	VOLTAGE PROFILE							LOAD PROFILE				ZLOOP	REMARKS
					VRN	VYN	VBN	VRE	VYE	VBE	VN	IR	IY	IB	IN		
15	24-04-19	1F	G-BLOCK	LDB-GF	NOT DONE											1.37,1.33,1.3	Off Load Condition
16	24-04-19	2F	G-BLOCK	LDB-GF	NOT DONE											1.45,1.25,1.36	Off Load Condition
17	24-04-19	3F	G-BLOCK	LDB-GF	NOT DONE											1.28,1.27,1.34	Off Load Condition
18	24-04-19	GF-A	H-BLOCK	LDB-GF	NOT DONE											1.18,1.26,1.23	Off Load Condition
19	24-04-19	GF-B	H-BLOCK	LDB-GF	NOT DONE											1.31,1.31,1.31	Off Load Condition
20	24-04-19	1F-A	H-BLOCK	LDB-GF	NOT DONE											1.17,1.19,1.16	Off Load Condition
21	24-04-19	1F-B	H-BLOCK	LDB-GF	NOT DONE											1.28,1.31,1.27	Off Load Condition
22	24-04-19	2F-A	H-BLOCK	LDB-GF	NOT DONE											1.18,1.23,1.19	Off Load Condition
23	24-04-19	2F-B	H-BLOCK	LDB-GF	NOT DONE											1.33,1.39,1.34	Off Load Condition
24	24-04-19	3F-A	H-BLOCK	LDB-GF	NOT DONE											1.4,1.42,1.39	Off Load Condition
25	25-04-19	3F-B	H-BLOCK	LDB-GF	NOT DONE											1.33,1.32,1.33	Off Load Condition

ANNEXURE-2

TECHNO-COMMERCIAL COMPARISION BETWEEN EXISTING FITTINGS TO BE REPLACED WITH LED FITTINGS (TYPICAL FOR CLASS ROOM)

Sr. No.	Details.	OPTION-1	OPTION-2
[A]	**PROJECT/AREA DETAILS**		
1.1	Name of area	Class Room	
1.2	Length of Area (Mtr)	5	
1.3	Width of Area (Mtr)	5	
1.4	Area (Sq Mtr)	25	
1.5	Area (Sq Ft)	269	
1.6	Lux Required	300	
[B]	**LAMP DETAILS**		
2.1	Make	Existing	CROMPTON
2.2	Type	T5	LED
2.3	Lamp Details	2x28W T5	1x28W LED
2.4	Lumens Per Fixture	2400	2900
2.5	Llife of Lamp in Hours	8000	18000
2.6	Type of Reflector	High Purity Aluminium	High Purity Aluminium
2.7	Coating of Reflector	anodized	anodized
2.8	Type of Ballast (Electronic / Regular)	CU	Electronic Control Gear
2.9	Harmonics Level	N.A.	33%
2.10	Power Factor of Ballast	0.7 Lag	0.9 Plus
2.11	Warrenty of Ballast/Control gear	1 year	1 year
2.12	Make of Ballast	Existing	Same
2.13	Charge / Discharge Time of Fixture	Instant	Instant
[C]	**ILLUMINATION DESIGN**		
3.1	Arrangement	6x4	6x4
3.2	Light Power Density (LPD) W/sqft	4.28	2.86
3.3	Average Lux	310	290
3.4	Uniformity Ratio (Lmin/Lavg)		
[D]	**CAPEX & OPEX**		
4.1	Electricity Cost (Rs/kWH)	8	
4.2	No. of hours of operation / Day	6	
4.3	Operating days/year	350	
4.4	No. of hours/year	2100	
4.5	Quantity Required	24	24
4.6	Consumption per Fixture	48	32
4.7	Total Power Consumption (kW)	1.152	0.8
4.8	Fixture Price/Unit (Rs.)	Rs.0	Rs.1,500
4.9	Total Installation Cost (Rs.) - CAPEX	Rs.0	Rs.36,000
4.10	Annual Consumption (kWH/Year)	Rs.2,419	Rs.1,613
4.11	Total Running Cost/Annum (Rs.) - OPEX	Rs.19,354	Rs.12,902
4.12	Difference in CAPEX w.r.t. Option-1		Rs.36,000
4.13	Difference in OPEX w.r.t. Option-1		Rs.6,451
4.15	**Simple Payback (Years)**		**5.6**

Note:

1. Quatity estimation is made based on photometry of WIPRO/PHILIPS/BAJAJ/CROMPTON make fixture available. To evaluate exactly on particular make/fixture, photometry of same shall be provided to us.
2. Prices are budgetory.
3. Wiring estimation is not required to change.

ANNEXURE-3										
ELECTRICAL PARAMETER MEASUREMENTs OF AC UNITs										
Sr No	Date	Location	TR	KW/HP	I (1 PH)	IR	IY	IB	IN	Iavg
C BLOCK										
1	09-05-19	LH1,LH2,LH3 MAIN (GND)	39			67.1	58.8	62.4	9.4	62.77
2	09-05-19	LH1	7.5			11.2	15.3	16.3		14.27
3	09-05-19		5.5			9	9.6	11.2		9.93
4	09-05-19	LH2	7.5			11.6	14.7	16.7	2.9	14.33
5	09-05-19		5.5			8.7	9.9	10.9	1.1	9.83
6	09-05-19	LH3	5.5			11.5	6.6	9.4		9.17
7	09-05-19		7.5			18	12	15.7		15.23
8	09-05-19	LH4,LH5 MAIN (GND)				59.5	55.9	51	13.7	55.47
9	09-05-19	LH4	5.5			10.4	9.7	9		9.70
10	09-05-19		7.5			13.8	14.1	11.1		13.00
11	09-05-19	LH5	7.5			13.9	15.7	13.9		14.50
12	09-05-19		5.5			5.2	5.3	7.6		6.03
13	09-05-19	LH6(CP LAB 3)	8.5			19.3	17.2	19.9		18.80
14	09-05-19					14.8	13.7			14.25
15	09-05-19	LH6 (MAIN)				33	33.2	39.7	6.1	35.30
16	09-05-19	LH7 (CP LAB 2)	8.5			17.5	16.8	20.3		18.20
17	09-05-19					10.8	7.5	10.5		9.60
18	09-05-19		1.5		8.5					
19	09-05-19	LH8 (CP LAB 1)	8.5			18.5	14.9	20.7		18.03
20	09-05-19					11.6	16.7	10.9		13.07
21	09-05-19		1.5		7.5					
22	09-05-19	LH 101,102,103 (FF) ACDB-3 MAIN				68.7	68.4	66.1	12.9	67.73
23	09-05-19	LH 101	7.5			19.2	16	15		16.73
24	09-05-19		5.5			11	10.7	9.9		10.53
25	09-05-19	LH102	5.5			10	10.9	8.8		9.90
26	10-05-19		7.5			8.3	11.9	14.3		11.50
27	10-05-19	LH 103	5.5			10.2	9.5	8.6		9.43
28	10-05-19		7.5			11.1	15.9	13.2		13.40
29	10-05-19	LH 104,LH 105 (FF) MAIN				31.2	30	24	7.4	28.40
30	10-05-19	LH 104	5.5			10.9	9.8	10.5		10.40
31	10-05-19		7.5			16.2	17.3	15.2		16.23

ANNEXURE-3										
ELECTRICAL PARAMETER MEASUREMENTs OF AC UNITs										
Sr No	Date	Location	TR	KW/HP	I (1 PH)	IR	IY	IB	IN	Iavg
32	10-05-19	LH 105	PENDING							
33	10-05-19	LH 106(FF)	8.5			15.3	11.2	8.5	6.3	11.67
34	10-05-19					20.3	18	15.9		18.07
35	10-05-19		1.5		9.1					
36	10-05-19	LH 107	8.5			18	19.3	15		17.43
37	10-05-19					19	18.5	16.2		17.90
38	10-05-19		1.5		8.5					
39	10-05-19	LH 108 (FF) MAIN				38.5	35.8	35.4	6	36.57
40	10-05-19	LH 108 (FF)	8.5			19.2	18	16.8		18.00
41	10-05-19					18.8	18.8	21		19.53
42	10-05-19		1.5		8.2					
43	10-05-19	LH 201 (SF)	7.5			17	15.5	13.3		15.27
44	10-05-19		5.5			9.5	9.8	8.9		9.40
45	10-05-19		5.5			10.3	10.2	9.5		10.00
46	10-05-19		7.5			16.9	15.7	13.5		15.37
47	10-05-19		5.5			10.1	11.8	9.3		10.40
48	10-05-19		7.5			16.6	15.2	15		15.60
49	10-05-19	Main				55.8	54.8	48.2	12.1	52.93
50	10-05-19	LT 202	5.5			10.3	9.5	8.2		9.33
51	10-05-19		7.5			16.9	16.3	16.4		16.53
52	10-05-19	203	5.5			10.7	11.6	8.9		10.40
53	10-05-19		7.5			16.7	15.5	14.8		15.67
54	10-05-19	204 (Accounts)	8.5			21.6	20.5	18.3		20.13
55	10-05-19		8.5			11.5	10.3	9.6		10.47
56	10-05-19	Main				34	33	27	8.3	31.33
57	10-05-19	205 (Main)				43.6	44.3	40.3	13.1	42.73
58	10-05-19	Right lower				17.4	17.7	15.8		16.97
59	10-05-19	Right Upper				17.5	18.1	16.9		17.50
6	10-05-19	206 (Main)				45.3	46.5	40.3	8.4	44.03
61	10-05-19		8			30.1	44.3	20.9		31.77
62	10-05-19		8			22.5	19.2	17.4		19.70
63	10-05-19	Terrace Main VRV				20.6	29.4	35.4	0.4	28.47
64	10-05-19	VRV1				21.2	19.9	20.2		20.43

ANNEXURE-3										
ELECTRICAL PARAMETER MEASUREMENTs OF AC UNITs										
Sr No	Date	Location	TR	KW/HP	I (1 PH)	IR	IY	IB	IN	Iavg
65	10-05-19	VRV2				9.04	9.4	9.5		9.31
66	10-05-19	Reception (SF) (Main ACDB)				18.3	20.6	12.1	7.2	17.00
67	10-05-19	Reception (SF) (ACDB-2)				0.4	10.8	0.15		3.78
68	10-05-19	Reception (FF) (ACDB)				26.9	9.4	1.4		12.57
69	10-05-19	Reception (FF) (ACDB-Main)				51.3	10	50	41	37.10
70	10-05-19	SF ACDB1			0.19					
71	10-05-19	GF ACDB2			0.5					
72	10-05-19	SF ACDB2			0.4					
73	10-05-19	Lab Area		67		8.76	5.2	7.1	3.41	7.02
74	10-05-19					14.67	9.414.8	4.9		9.79
75	10-05-19			48	8.1	8.95	9	10.2		9.38
76	10-05-19	FF ACDB1		0						
77	10-05-19	FF ACDB2		1.4						
78	10-05-19	GF ACDB1		0						
79	10-05-19	GF ACDB2		0.9						
80	10-05-19	SF ACDB1		0						
81	10-05-19	SF ACDB2		0.15						
82	10-05-19	R&D and Lab		67		11.1	8	10	3.8	9.70
83	10-05-19			33.5		1.6	8.32	10.5	4.9	6.81
84	10-05-19			33.5		14.2	12.95	14.3	3.85	13.82
85	10-05-19			95		0	0	0	0	0.00
86	10-05-19			56		0.13	0.13	0.14	0.1	0.13
87	10-05-19					0.3	0.3	0	0	0.20
88	10-05-19			145.5		0.20.5	0.52	0.4		0.46
89	10-05-19			89.8		10.4	17.8	19.7	2.9	15.97
90	10-05-19			56		0.27	0.3	0.28	0.3	0.28
91	10-05-19			128.5		20.4	16.2	19.4	6.6	18.67
D BLOCK										
93	11-05-19	FF-LAB,LT-1 CLASS ROOM		117						
94	11-05-19	SF-LAB-1		67						
95	11-05-19	LT-1-SF				3.2	2.4	2.3	1	2.63
96	11-05-19	LT-1-FF-GF				8.7	7.7	8	1.9	8.13
97	11-05-19					0	7.9	8.1	1.9	5.33

ANNEXURE-3										
ELECTRICAL PARAMETER MEASUREMENTs OF AC UNITs										
Sr No	Date	Location	TR	KW/HP	I (1 PH)	IR	IY	IB	IN	Iavg
98	11-05-19	MAIN D-BLOCK-CASET AC PANEL				161.2	155.7	156	25.5	157.63
99	11-05-19	LT-1-SF 2 PANEL				16.9	15.6	16.5	1.9	16.33
100	11-05-19	LT-2-GF-FF(A) PANEL				16.1	15	15.6	1.9	15.57
101	11-05-19	LT-2-SF PANEL				15.5	8	9.1	1.9	10.87
102	11-05-19	LT-2-GF-FF(B) PANEL				16.2	15.7			15.95
103	11-05-19	LH-1,LH-2,LH-3		117						
104	11-05-19	MEDIA LAB		28						
105	11-05-19	FF-LT-4	5.5							
106	11-05-19	LT-5	17							
107	11-05-19	MAIN D-BLOCK-1				167	115.6	119.2	65	133.93
108	11-05-19	MAIN D-BLOCK-2				93.14	66	60.6	42.8	73.25
SPM BUILDING										
110	11-05-19	SPM-A-BLOCK-CLASS ROOM		123						
111	11-05-19	AUDITORIUM LT-2 MAIN				72.5	46.8	51	27.5	56.77
112	11-05-19	LT-2(1) PANEL				14.1	16.5	16.6	2.1	15.73
113	11-05-19	LT-2(2) PANEL				15.7	14.5	16.6	2.9	15.60
114	11-05-19	LT-2(3) PANEL				39.9	12.4	14.8	2.1	22.37
115	11-05-19	LT-1(1) PANEL				12.3				12.30
116	11-05-19	LT-1(2) PANEL				33.2	30.1	29.7	3.1	31.00
117	11-05-19	LT-1(3) PANEL				18.3	15	16	3.7	16.43
118	11-05-19	LT-1(4) PANEL				2				2.00
119	11-05-19	AUDITORIUM LT-1 MAIN				68	45	47	15	53.33
120	11-05-19	SPM MAIN				41	39.6	46.2	0.3	42.27
E BLOCK										
121	10-05-19	**ADMIN AREA**		308		13.6	9	10	6.1	
122	10-05-19					26	15.6	15	8.2	
123	10-05-19					20.9	17	20.9	6.1	
124	10-05-19	FF ACDB-1			0.76					
125	10-05-19	FF ACDB-2			0.58					
126	10-05-19	GF ACDB-1			0.4					
127	10-05-19	SF ACDB-1			0.9					
128	10-05-19	GF ACDB-2			0.5					
129	10-05-19	SF ACDB-2			0.4					

ANNEXURE-3										
ELECTRICAL PARAMETER MEASUREMENTs OF AC UNITs										
Sr No	Date	Location	TR	KW/HP	I (1 PH)	IR	IY	IB	IN	Iavg
130	10-05-19					36.9	32.1	35.1	9.5	
131	10-05-19					-	-	-	-	
132	10-05-19	**CLASSROOM**				35	27.5	30.8	10.5	
133	10-05-19					12.1	11	13.3	2.7	
134	10-05-19					9.9	7.3	9	2.8	
135	10-05-19	FF ACDB-3		120	0.27					
136	10-05-19	GF ACDB-1			2.27					
137	10-05-19	GF ACDB-2			1.35					
138	10-05-19	GF ACDB-3			0.23					
139	10-05-19	SF ACDB - 1			1.99					
140	10-05-19	SF ACDB - 2			2.46					
141	10-05-19	SF ACDB - 3			1.57					
142	10-05-19					8.7	5.2	7.1	3.4	
143	10-05-19	**LAB AREA**				14.6	9.4	11.8	4.9	
144	10-05-19					8.1	8.95	9	0.2	
145	10-05-19	GF ACDB-1			-					
146	10-05-19	GF ACDB-2		115	0.9					
147	10-05-19	FF ACDB-1			-					
148	10-05-19	FF ACDB-2			1.4					
149	10-05-19	SF ACDB-1			-					
150	10-05-19	SF ACDB-2			0.15					
151	10-05-19					11.1	8	10	3.8	
152	10-05-19					12.6	8.32	10.5	4.9	
153	10-05-19					14.2	12.75	14.3	3.85	
154	10-05-19					-	-	-	-	
155	10-05-19	**R & D AND LAB**		704.8		-	-	-	-	
156	10-05-19					-	-	-	-	
157	10-05-19					0.2	0.5	0.5	0.4	
158	10-05-19					19.4	17.8	19.7	2.9	
159	10-05-19					0.27	0.3	0.28	0.3	
160	10-05-19					20.4	16.2	19.4	6.6	

ANNEXURE - 4

DOCUMENT : CALCULATION OF EFFICIENCY OF AIR CONDITIONING UNIT

SR. NO.	DESCRIPTION	Legend	UNIT	VALUE	Considerations
1	Dry Bulb Temp. of air entering into filter (Return air)	T1	°C	45.0	
1.1	Dry Bulb Temp. of air entering into filter (Return air)		°F	113.00	
2	Dry Bulb Rh% of air entering into filter (Return air)	Rh1	%	65.0	Measurement Limitation at site
3	Dry Bulb Temp. of air entering into filter (Supply air)	T2	°C	28.0	
3.1	Dry Bulb Temp. of air entering into filter (Supply air)		°F	82.40	
4	Dry Bulb Rh% of air entering into filter (Supply air)	Rh2	%	30.0	Measurement Limitation at site
5	Altitude (From MSL)	Alt	Mtr	10.0	
5.1	Atmosphere Pressure		kPa	101.2	
6	Air Velocity across filter (Return air)	Va	Mtr/Sec	3.0	Measurement Limitation at site
6.1	Air Velocity across filter (Return air)		Feet per minute (FPM)	590.6	
7	Filter Area	Af	Sq Ft.	1.5	
8	Supply Air Enthalpy	H1	Btu/Lb	50.9	From psychrometric chart
9	Return Air Enthalpy (H2)	H2	Btu/Lb	47.9	From psychrometric chart
10	Change In Enthalpy	ΔH	Btu/Lb	3.0	Enthalpy lines on Psychrometric chart are parallel to wet bulb
11	Air Quantity	Q	Ft3/min (CFM)	885.8	
12	Tonnage in BTU/Hr.	TR1	BTU/Hr.	11,790.6	Derived from 4.5*ΔH Btu/lb*Air Quantity CFM
13	Tonnage value (TR) of the unit	TR2	TR	1.0	Btu/Hr/12000
14	AC Unit Power Drawn				
14.1	Measured Voltage	V	Volts	220.0	
14.2	Measured Current	I	Amp	6.0	
14.3	Power factor (cosΦ)	PF		0.8	
14.4	Phase	Ph		1	
14.5	Power Drawn	P	kW	**1.1**	
15	Efficiency of the unit	Eff	kW/TR	**1.1**	
16	Energy Efficiency Ratio			**3.3**	Tons in kW divided by Power in kW

ANNEXURE-5				
PAYBACK CALCULATION FOR OCCUPANCY SENSOR BASED A.C. CONTROL SYSTEM				
Sr No	**Description**	**Value**	**Unit**	**Remarks**
1	**Location**	Class Room		
2	Connected Lighting Load	0.90	kW	16 Nos. x 56 W Lights
3	Connected A.C. Load - ODUs	16	kW	7.5 TR+5.5 TR
4	Connected A.C. Load - IDUs	0.7	kW	6 Nos. x 115W
5	Total Load	17.2	kW	
6	Idle working hours without occupancy	15	Min.	
7	Average Idle Working Hours/Day	30	Min.	2 Classes/Day
8	Load Factor during this period	70	%	
9	Energy Loss/Day for Idle working	6.0	kWH	
10	Average working Days/Month	20	Days	
11	Energy Loss/Month	120	kWH	
12	Energy Loss/Month	1035	Rs	@8.6 Rs./Unit
13	Cost of Occupancy Sensor	15000	Rs	SITC -2 nos. with change in wiring
14	Payback Period	14	Months	

ANNEXURE- 6

DOCUMENT: HARMONIC MEASUREMENTs CONDUCTED AT SITE AND OBSERVATIONS MADE AS PER IEEE:519

Sr No	Date	Start Time	Stop Time	Location	VL	Vr	Vy	Vb	Ir	Iy	Ib	In	% In	kVA	W1	W2	W3	kW	PF	3rd (%)	5th (%)	7th (%)	9th (%)	V Thd (%)	I Thd (%)	Remarks on Harmonics
1	12-04-19	3.20	3.30	MAIN INCOMER (MAIN CAMPUS PCC)		432	380	380	2160	1925	1955	450	22.35		-	-	-	317.4	0.956	8.967	-	-	-	2.6	10	Marginal Higher
2	12-04-19	3.40	3.50	LIGHTING PANEL C BLOCK		236	241	240	56	46	36	30	65.22		-	-	-	16.3	0.976	-	-	-	-	2.6	20	Higher
3	12-04-19	3.55	4.05	AC PANEL C BLOCK		236	240	240	435	357	345	105	27.7		-	-	-	77.49	0.839	-	-	-	-	2.2	4.5	
4	12-04-19	4.30	4.40	SPN MAIN PANEL		239	240	239	402	462	378	72	17.39		-	-	-	67.6	0.951	-	-	-	-	1.6	3.5	
5	12-04-19	4.45	4.55	SPN SUB PANEL		240	241	240	37	45	48	1	2.308		-	-	-	31.15	0.991	-	-	-	-	1.6	11	Marginal Higher
6	26-04-19	12.24	12.29	UG MAIN INCOMER	423	244	244	244	294	180	206	128	56.47	89.9	71.74	43.92	50.26	165.9	0.990	8.967	-	-	-	1.1	12.8	Marginal Higher
7	26-04-19	12.42	12.47	PUMP ROOM OG	420	243	242	243	17	16	17	0	0	12.15	4.131	3.872	4.131	12.13	0.630	-	1.394	-	-	1	2.3	Very low
8	26-04-19	13.26	13.31	K BLOCK MAIN INCOMER	420	242	243	244	19	18	32	14	60.87	11.93	4.598	4.374	7.808	16.78	0.980	5.385	-	-	-	1	9	
9	26-04-19	14.23	14.28	J BLOCK MAIN INCOMER	414	239	239	238	35	31	44	14	38.18	25.57	8.365	7.409	10.47	26.25	0.900	3.966	-	-	-	1.5	12	Marginal Higher
10	26-04-19	14.38	14.43	A BLOCK MAIN INCOMER	415	239	239	240	13	29	18	14	70	13.2	3.107	6.931	4.32	14.36	0.970	8.143	-	-	-	1	15.8	Higher
11	26-04-19	14.48	14.53	B BLOCK MAIN INCOMER	412	237	239	237	43	18	41	28	82.35	23.2	10.19	4.302	9.717	24.21	0.960	10.3	-	-	-	1.6	16	Higher
12	26-04-19	15.00	15.05	C BLOCK MAIN INCOMER	412	235	239	239	18	35	55	46	127.8	36.48	4.23	8.365	13.15	25.74	0.970	7.687	-	-	-	2	19.3	Higher
13	26-04-19	15.15	15.20	D BLOCK MAIN INCOMER	410	236	231	237	35	21	32	12	40.91	20.9	8.26	4.851	7.584	20.7	0.980	3.588	-	-	-	1.5	12.4	Marginal Higher
14	26-04-19	15.28	15.33	E BLOCK MAIN INCOMER	407	233	236	236	85	65	74	41	54.91	52.64	19.81	15.34	17.46	52.61	0.970	15.99	-	-	-	2.8	23.2	Higher
15	26-04-19	15.39	15.44	IIC BLOCK MAIN INCOMER	410	236	235	237	26	23	21	14	60	16.12	6.136	5.405	4.977	16.52	0.900	-	33.9	-	-	1.7	46	Very High
16	26-04-19	16.05	16.10	G H BLOCK MAIN INCOMER GIRLS HOSTEL	402	227	233	230	190	124	154	78	50	55.96	43.13	28.89	35.42	107.4	0.990	7.149	-	-	-	2.1	10.7	Marginal Higher
17	26-04-19	16.16	16.21	F I BLOCK MAIN INCOMER GIRLS HOSTEL	401	228	233	229	126	76	114	48	45.57	34.89	28.73	17.71	26.11	72.54	0.990	4.888	-	-	-	1.8	8.6	
18	26-04-19	16.47	16.52	D BLOCK PDPU INSTITUTE	402	228	233	233	348	264	270	32	10.88	44.41	79.34	61.51	62.91	203.8	0.960	3.669	-	-	-	3	7.1	
19	26-04-19	17.07	17.12	E BLOCK PDPU INSTITUTE	404	228	235	235	176	256	268	174	74.57	48.71	40.13	60.16	62.98	163.3	0.930	-	27.81	-	-	4.2	37	Very High
20	26-04-19	17.59	18.04	SOLAR PLANT	410	237	235	236	90	75	87	51	60.71	20.16	21.33	17.63	20.53	59.49	0.870	-	-	17.72	-	1.5	39.2	Very High
21	26-04-19	18.28	18.33	C BLOCK PDPU INSTITUTE	421	240	242	244	28	28	18	0	0	9.74	6.72	6.776	4.392	17.89	0.980	12.22	-	-	-	1.9	14.9	Higher

NOTE:

1 ABOVE IS SUMMARY OF MEASUREMENTs TAKEN AT VARIOUS PLACES USING POWER ANALYSER ALM-35 (INSTANTENEOUS VALUES DURING PERIOD OF MEASUREMENTs)

2 MAJOR OBSERVATIONs ON POWER QUALITY (HARMONICS) IS INDICATED AND HIGHLIGHTED BY YELLOW

3 HARMONIC CONENTEs ARE OBSERVED HIGHER MAINLY DUE TO NON-LINEAR LOADS I.E. COMPUTERS, UPS, INVERTER DRIVEs OF A.C. UNITs

4 TO DECIDE ON HARMONIC FILTERs/MITIGATION TECHNIQUE AT A PARTICULAR LOCATION, CYCLIC MEASUREMENT OF 24 HOUR IS REQUIRED.

5 NEUTRAL CURRENT IS OBSERVED HIGHER THAN THE NORMAL VALUES AT SEVERAL POINTS (HIGHLIGHTED BY YELLOW) . THIS IS COMBINED EFFECT OF HARMONICs & UNBALANCED LOAD

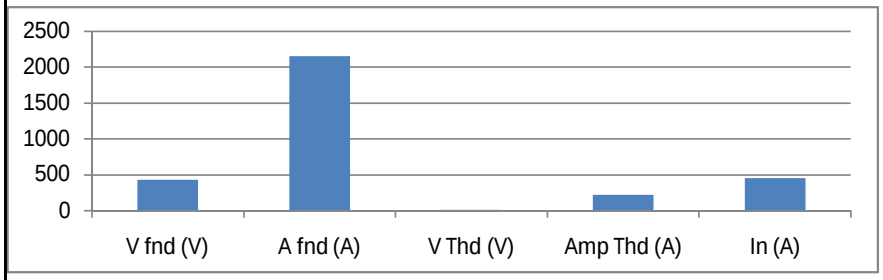
ANNEXURE - 7

DOCUMENT: HARMONIC MEASUREMENTs CONDUCTED AT SITE REPRESENTED IN GRAPHICAL FORMAT

STANDARD TO USE: IEEE 519

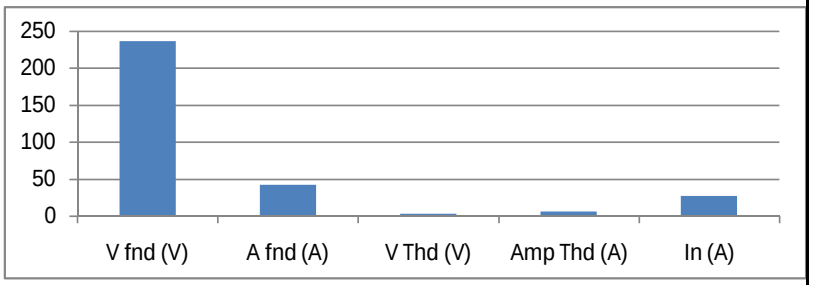
INSTITUTE : PCC PANEL AT SUBSTATION : MAIN INCOMER

	V fnd (V)	A fnd (A)	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	432	2160	11.232	216	450



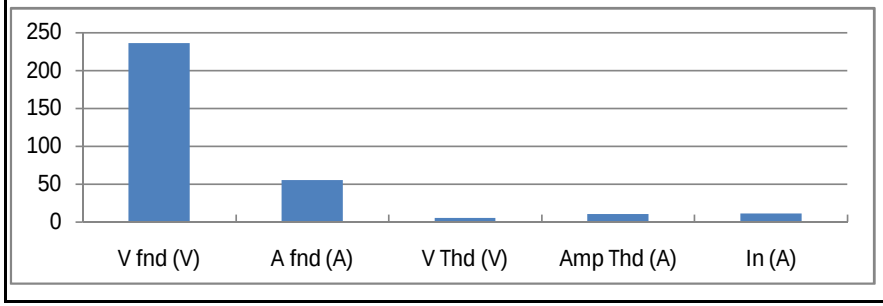
UG HOSTEL: B BLOCK : MAIN INCOMER

	V fnd (V)	A fnd (A)	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	237	43	3.792	6.88	28



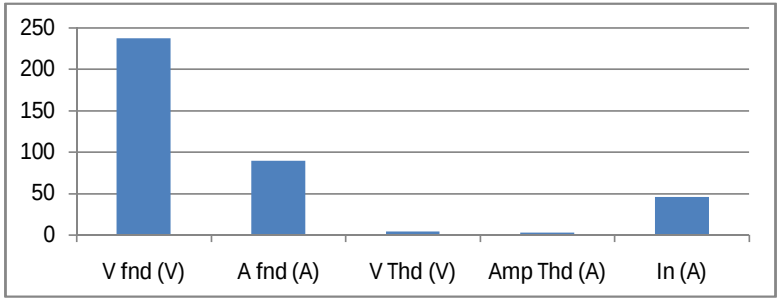
INSTITUTE : C BLOCK : LIGHTING PANEL

	V fnd (V)	A fnd (A)	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	236	56	6.136	11.2	12

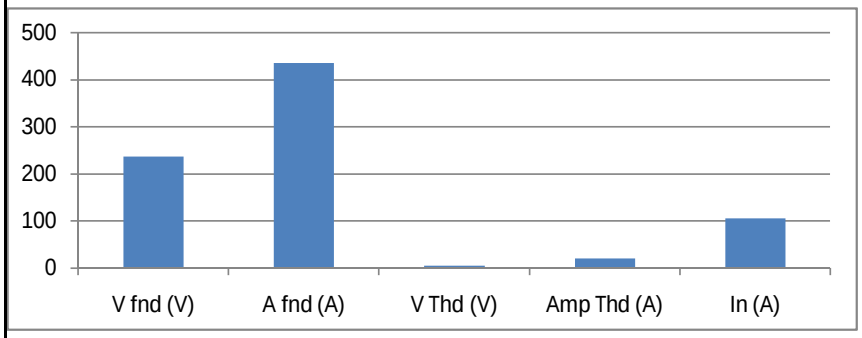


UG HOSTEL: C BLOCK : MAIN INCOMER

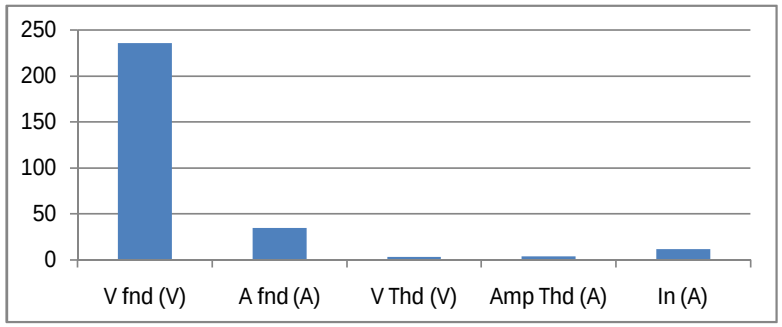
	V fnd (V)	A fnd (A)	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	237	90	4.7	3.474	46



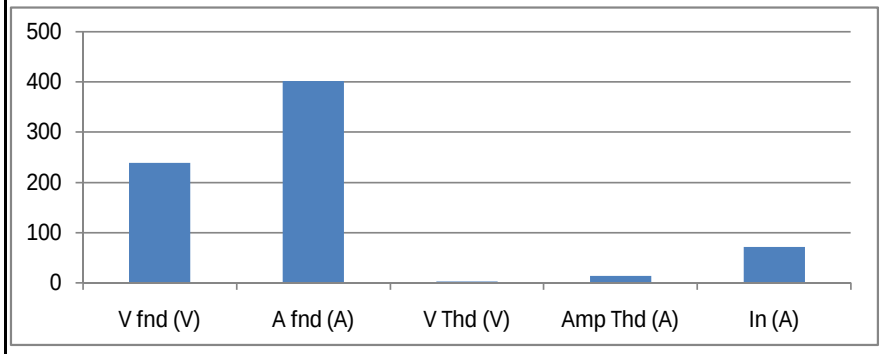
INSTITUTE : C BLOCK : AC PANEL					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	236	435	5.192	19.575	105



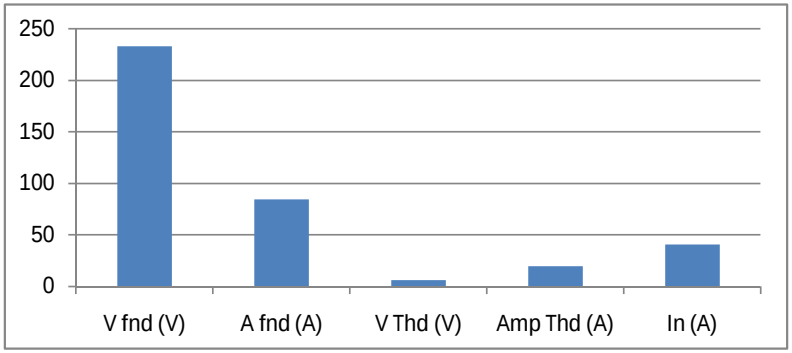
UG HOSTEL: D BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	236	35	3.54	4.34	12



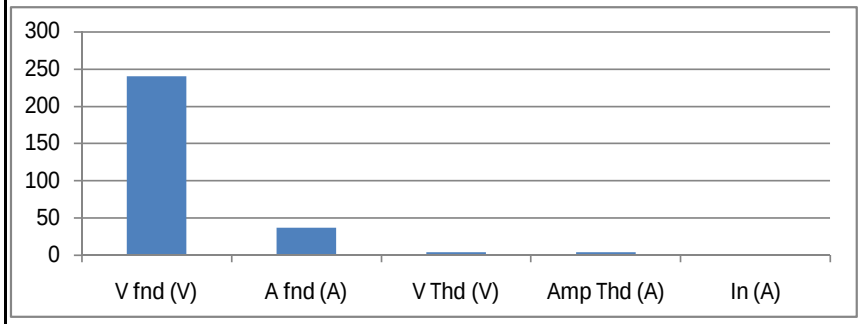
SPN BUILDING : MAIN PANEL					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	239	402	3.824	14.07	72



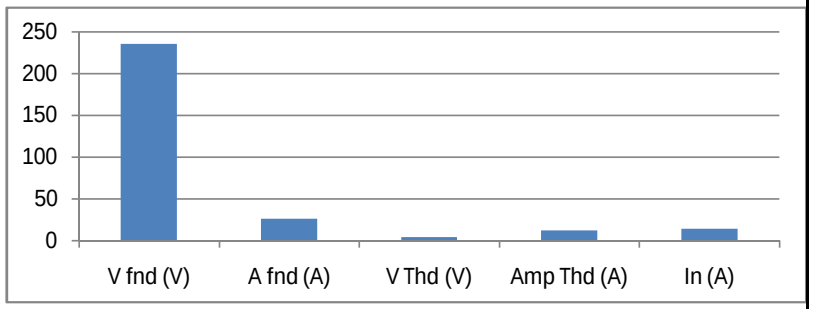
UG HOSTEL: E BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	233	85	6.524	19.72	41



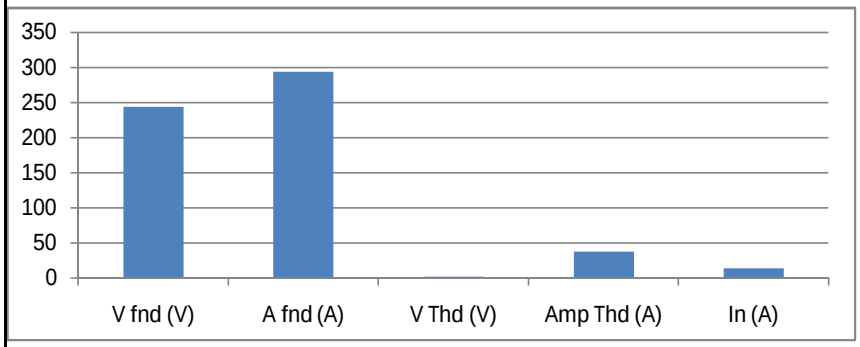
SPN BUILDING : SUB PANEL					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	240	37	3.84	4.07	1



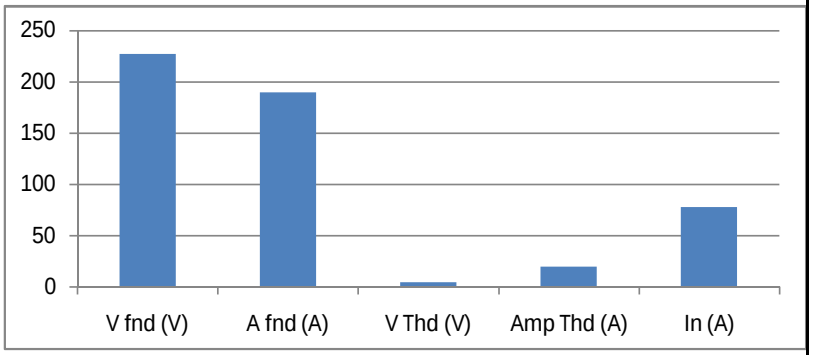
UG HOSTEL: IIC BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	236	26	4.012	11.96	14



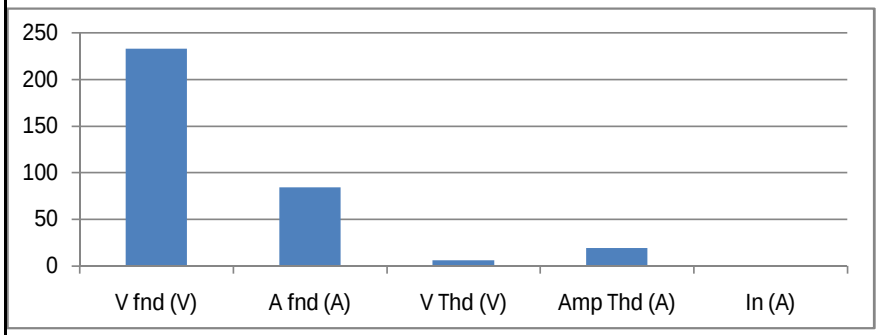
UG HOSTEL : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	244	294	2.684	37.632	14



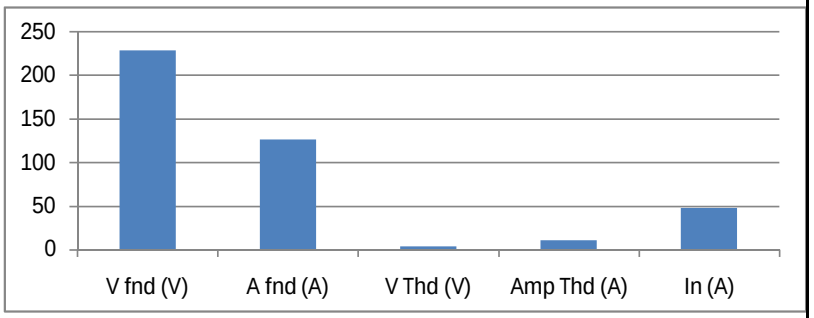
INSTITUTE : BLOCK G & H: MAIN INCOMER GIRLS HOSTEL					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	227	190	4.767	20.33	78



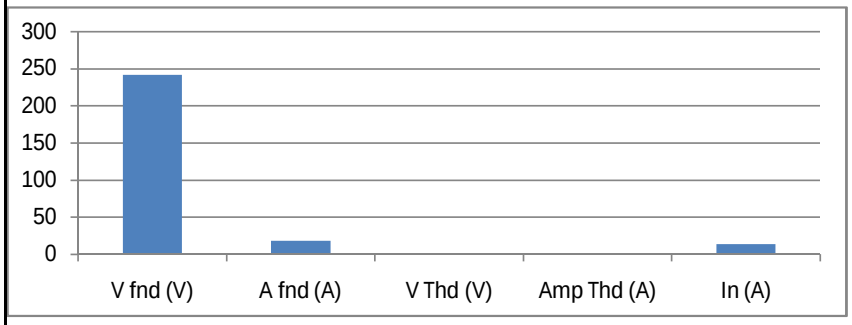
INSTITUTE: PUMP ROOM OG					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	233	85	6.524	19.72	0



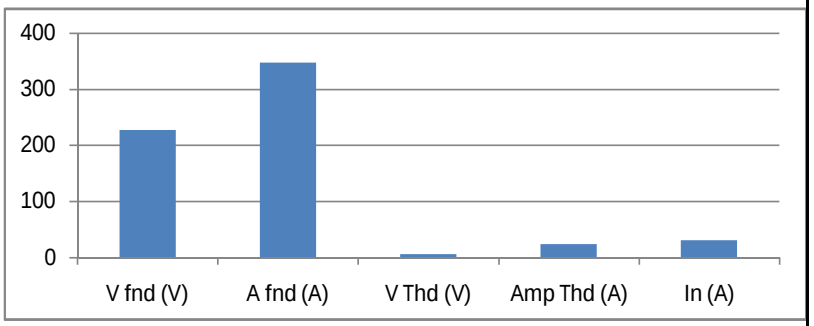
INSTITUTE : BLOCK F & I :MAIN INCOMER GIRLS HOSTEL					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	228	126	4.104	10.836	48



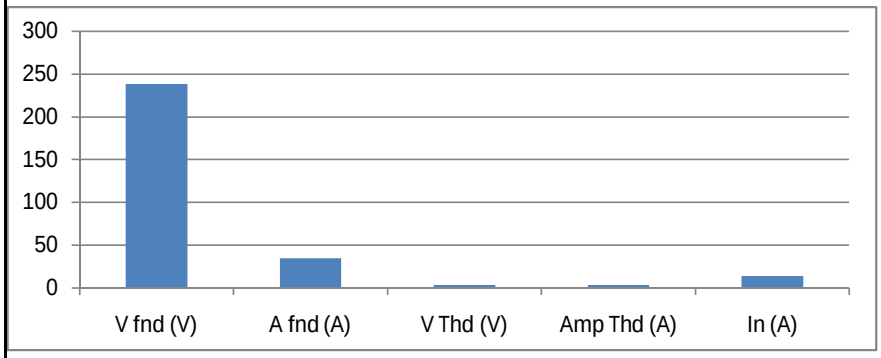
UG HOSTEL: K BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	242	19	2.42	1.71	14



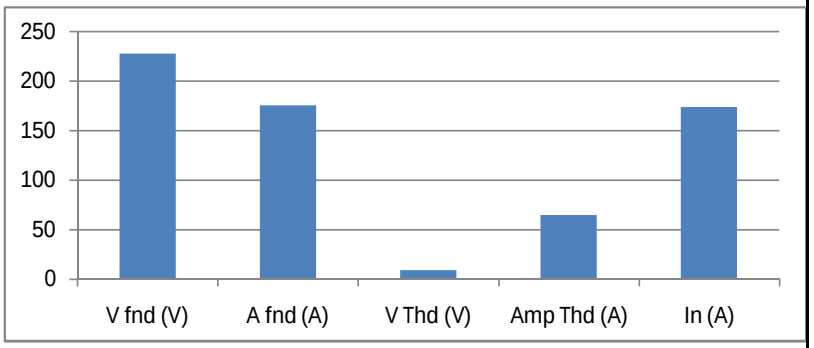
INSTITUTE : D BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	228	348	6.84	24.708	32



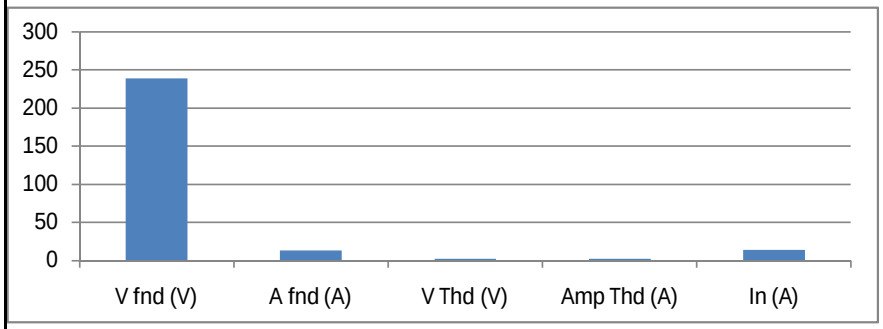
UG HOSTEL: J BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	239	35	3.585	4.2	14



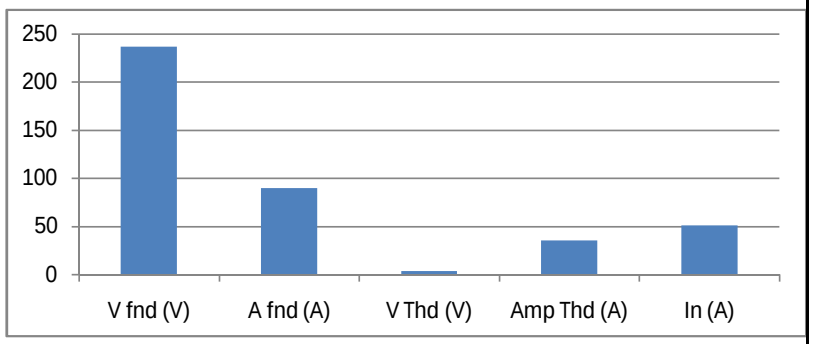
INSTITUTE : E BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	228	176	9.576	65.12	174



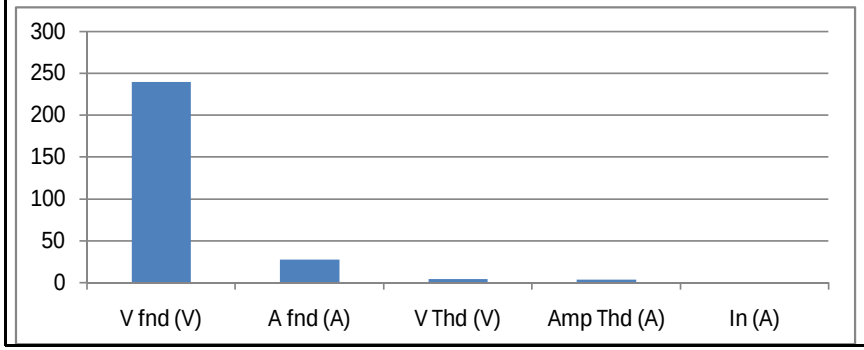
UG HOSTEL: A BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	239	13	2.39	2.054	14



SOLAR PLANT : INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	237	90	3.555	35.28	51



INSTITUTE: C BLOCK : MAIN INCOMER					
	V fnd (V)	**A fnd (A)**	V Thd (V)	Amp Thd (A)	In (A)
3-Ph	240	28	4.56	4.172	0



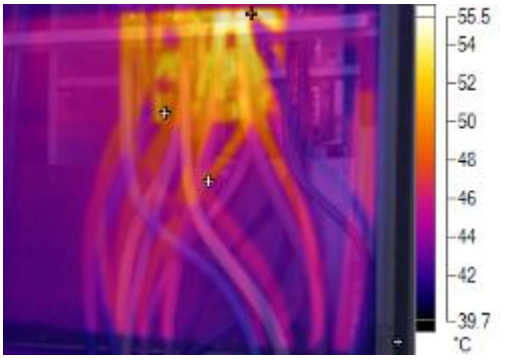
ANNEXURE - 8							
DOCUMENT: MEASUREMENT OF EARTH LOOP IMPEDANCE AT SOCKET LEVEL							
SR. NO.	DATE	LEVEL	AREA	Meas. Location-1	Meas. Location-2	Meas. Location-3	Meas. Location-4
D-BLOCK							
1	20-02-19	SF	FACULTY WING	0.55	0.52	1.68	1.17
2	20-02-19	SF	206	1.25			
3	20-02-19	SF	204	1.07	1.09		
4	20-02-19	SF	203	0.9			
5	20-02-19	SF	207	0.99			
6	20-02-19	SF	D-LIB	0.69	0.79	0.76	
7	20-02-19	SF	PASSAGE	0.69			
8	20-02-19	SF	208	1.4			
9	20-02-19	FF	ADMIN	0.64			
10	20-02-19	FF	107	0.8	0.7		
11	20-02-19	FF	102	0.83			
12	20-02-19	FF	103	1.22	1.4		
13	20-02-19	FF	105	1.48			
14	20-02-19	FF	104	1.37	2000+		
15	20-02-19	GF	ADMIN FACULTY	1.2	1.26	0.82	
16	20-02-19	GF	FACULTY WING	0.5			
17	20-02-19	GF	D-008	0.89	1.12		
18	20-02-19	GF	D-003	1	1.2	1.13	
19	20-02-19	GF	D-007	1.03	1.26		
20	20-02-19	GF	D-002	0.7			
21	20-02-19	GF	PASSEGE - SOCKET	**13.52**			
22	20-02-19	SF	LAB S-7 - SOCKET	**11.06**			
23	20-02-19	SF	LAB S-7 - SOCKET	10.47			
24	20-02-19	SF	LAB S-7 - SOCKET	12.18			
25	20-02-19	SF	LAB S-7 - SOCKET	9.42			
26	20-02-19	SF	LAB S-7 - SOCKET	8.19			
27	20-02-19	SF	LAB S-7 - SOCKET	8			
28	20-02-19	SF	LAB S-6 - SOCKET	7.35			
29	20-02-19	SF	LAB S-6 - SOCKET	**13.9**			
30	20-02-19	SF	LAB S-6 - SOCKET	7.27			
31	20-02-19	SF	LAB S-6 - SOCKET	7.46			
32	20-02-19	SF	LAB S-6 - SOCKET	7.74			
33	20-02-19	SF	LAB S-6 - SOCKET	8.29			
34	20-02-19	SF	LAB S-6 - SOCKET	7.33			
35	20-02-19	SF	LAB S-5 - SOCKET	8.22			
36	20-02-19	SF	LAB S-5 - SOCKET	8.27			
37	20-02-19	SF	LAB S-5 - SOCKET	8.32			
38	20-02-19	SF	LAB S-5 - SOCKET	8.4			
39	20-02-19	SF	LAB S-5 - SOCKET	7.89			
40	20-02-19	SF	LAB S-5 - SOCKET	7.45			
41	20-02-19	SF	LAB S-5 - SOCKET	7.48			
42	20-02-19	SF	CLASS ROOM - S-4 - SOCKET	7.13			
43	20-02-19	SF	CLASS ROOM - S-4 - SOCKET	7.49			
44	20-02-19	SF	CLASS ROOM - S-4 - SOCKET	7.07			
45	20-02-19	SF	CLASS ROOM - S-4 - SOCKET	7.14			
46	20-02-19	SF	CLASS ROOM - S-4 - SOCKET	6.69			
47	20-02-19	SF	CLASS ROOM - S-2 - SOCKET	8.04			
48	20-02-19	SF	CLASS ROOM - S-2 - SOCKET	7.11			
49	20-02-19	SF	CLASS ROOM - S-2 - SOCKET	7.35			
50	20-02-19	SF	CLASS ROOM - S-2 - SOCKET	6.9			
51	20-02-19	SF	CLASS ROOM - S-1 - SOCKET	6.57			

52	20-02-19	SF	CLASS ROOM - S-1 - SOCKET	7.6			
53	20-02-19	SF	CLASS ROOM - S-1 - SOCKET	7.19			
54	20-02-19	SF	CLASS ROOM - S-1 - SOCKET	6.5			
55	20-02-19	SF	PASSEGE - SOCKET	6.08			
56	20-02-19	FF	PASSEGE NEAR WATER COOLER	**1000**			
57	20-02-19	FF	COMPUTER LAB F-5 - SOCKET	7.76			
58	20-02-19	FF	COMPUTER LAB F-5 - SOCKET	7.68			
59	20-02-19	FF	COMPUTER LAB F-5 - SOCKET	7.56			
60	20-02-19	FF	COMPUTER LAB F-5 - SOCKET	7.71			
61	20-02-19	FF	CLASS ROOM F-4 - SOCKET	10.89			
62	20-02-19	FF	CLASS ROOM F-4 - SOCKET	30.33			
63	20-02-19	FF	CLASS ROOM F-4 - SOCKET	31.61			
64	20-02-19	FF	CLASS ROOM F-4 - SOCKET	29.25			
65	20-02-19	FF	CLASS ROOM F-4 - SOCKET	35.23			
66	20-02-19	FF	SERVER ROOM - SOCKET	6.63			
67	20-02-19	FF	SERVER ROOM - SOCKET	6.23			
68	20-02-19	FF	CLASS ROOM F-2 - SOCKET	**62.53**			
69	20-02-19	FF	CLASS ROOM F-2 - SOCKET	**58.87**			
70	20-02-19	FF	CLASS ROOM F-2 - SOCKET	**45.19**			
71	20-02-19	FF	CLASS ROOM F-1 - SOCKET	7.01			
72	20-02-19	FF	CLASS ROOM F-1 - SOCKET	7.09			
73	20-02-19	FF	CLASS ROOM F-1 - SOCKET	7.04			
74	20-02-19	GF	OFFICE - SOCKET	**1293**			
75	20-02-19	GF	OFFICE - SOCKET	**1288**			
76	20-02-19	GF	OFFICE - SOCKET	**1277**			
77	20-02-19		ELECTRICAL ROOM - SOCKET	6.63			
C-BLOCK							
1	22-02-19	GF	PASSAGE	0.66	0.74		
2	22-02-19	GF	C-005	0.68			
3	22-02-19	GF	C-001,008	0.82			
4	22-02-19	GF	C-002,003,CP2	1.18			
5	22-02-19	GF	ADMIN OFFICE1	2.46	2.57		
6	22-02-19	GF	ADMIN OFFICE2	0.93			
B-BLOCK							
1	22-03-19	GF	AUDI	0.68	0.63		
2	22-03-19	GF	AUDI (STAGE LIGHTS)	0.7	0.85	0.9	0.95

Remarks: Checking of earthing connections are required at the location marked by **BOLD.**

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY

AC PANEL OF C BLOCK AT SUBSTATION



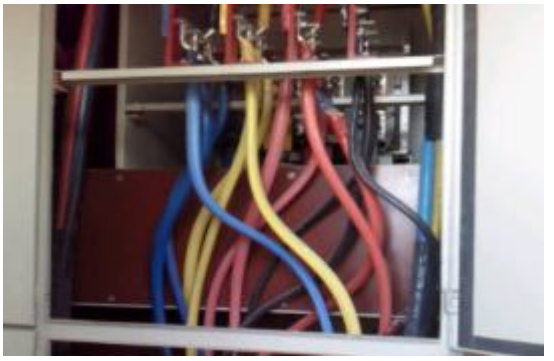


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	47.1 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	41.6 °C to 60.7 °C
Image Time	12-04-2019 PM 05:53:28

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	60.7 °C	60.7 °C	60.7 °C	0.80	32.0 °C	0.00
Cold	41.6 °C	41.6 °C	41.6 °C	0.80	32.0 °C	0.00
Centerpoint	50.8 °C	50.8 °C	50.8 °C	0.80	32.0 °C	0.00
Centerbox	57.0 °C	44.7 °C	48.6 °C	0.80	32.0 °C	2.55
P0	54.3 °C	54.3 °C	54.3 °C	0.80	32.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY

AC PANEL OF C BLOCK AT SUBSTATION 2

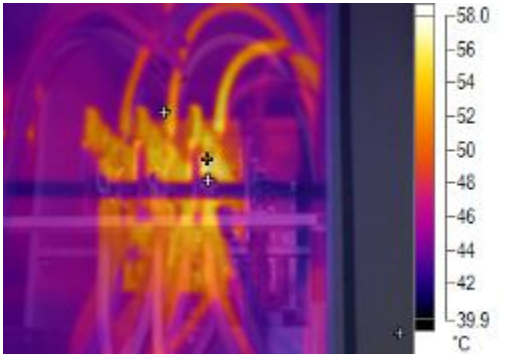


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	47.9 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	41.8 °C to 63.8 °C
Image Time	12-04-2019 PM 05:50:53

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	63.8 °C	63.8 °C	63.8 °C	0.80	32.0 °C	0.00
Cold	41.8 °C	41.8 °C	41.8 °C	0.80	32.0 °C	0.00
Centerpoint	46.9 °C	46.9 °C	46.9 °C	0.80	32.0 °C	0.00
Centerbox	63.8 °C	43.8 °C	51.2 °C	0.80	32.0 °C	4.47
P0	63.5 °C	63.5 °C	63.5 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY
MAIN INCOMER AT SUBSTATION

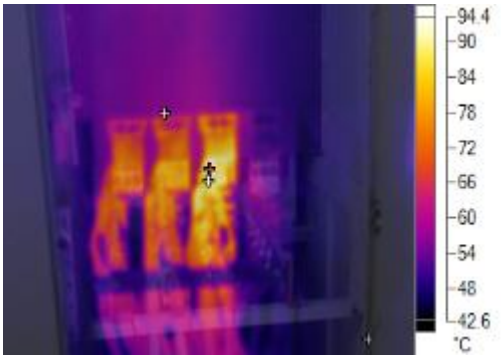


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	55.9 °C
Calibration Range	-20.0 °C to 350.0 °C
Image Range	45.0 °C to 106.4 °C
Image Time	12-04-2019 PM 04:11:23

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	106.4 °C	106.4 °C	106.4 °C	0.80	32.0 °C	0.00
Cold	45.0 °C	45.0 °C	45.0 °C	0.80	32.0 °C	0.00
Centerpoint	96.9 °C	96.9 °C	96.9 °C	0.80	32.0 °C	0.00
Centerbox	106.4 °C	48.0 °C	66.9 °C	0.80	32.0 °C	14.03
P0	75.5 °C	75.5 °C	75.5 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY

MAIN INCOMER BUSBAR AT SUBSTATION

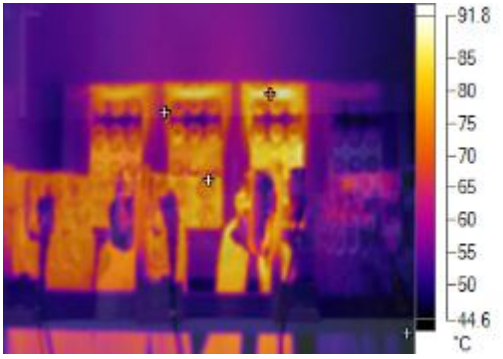


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	64.4 °C
Calibration Range	-20.0 °C to 350.0 °C
Image Range	47.5 °C to 103.4 °C
Image Time	12-04-2019 PM 04:08:53

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	103.4 °C	103.4 °C	103.4 °C	0.80	32.0 °C	0.00
Cold	47.5 °C	47.5 °C	47.5 °C	0.80	32.0 °C	0.00
Centerpoint	83.3 °C	83.3 °C	83.3 °C	0.80	32.0 °C	0.00
Centerbox	103.4 °C	52.0 °C	75.6 °C	0.80	32.0 °C	11.11
P0	85.0 °C	85.0 °C	85.0 °C	0.80	-274.0 °C	0.00

ANNEXURE -9

THERMOGRAPHY MEASUREMENT SURVEY

MAIN INCOMER BUSBAR AT SUBSTATION - HIGH TEMP

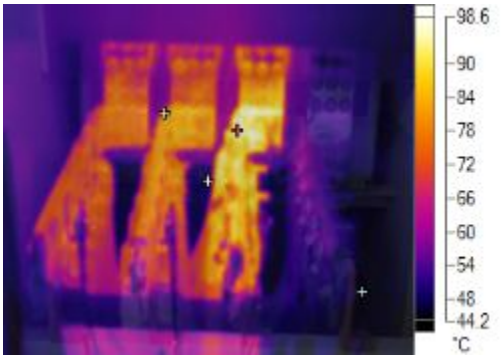


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	63.0 °C
Calibration Range	-20.0 °C to 350.0 °C
Image Range	47.0 °C to 111.1 °C
Image Time	12-04-2019 PM 04:08:26

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	111.1 °C	111.1 °C	111.1 °C	0.80	32.0 °C	0.00
Cold	47.0 °C	47.0 °C	47.0 °C	0.80	32.0 °C	0.00
Centerpoint	52.2 °C	52.2 °C	52.2 °C	0.80	32.0 °C	0.00
Centerbox	111.1 °C	48.6 °C	75.5 °C	0.80	32.0 °C	16.54
P0	99.1 °C	99.1 °C	99.1 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY
LV SIDE OF TRANSFORMER (SECONDARY SIDE)

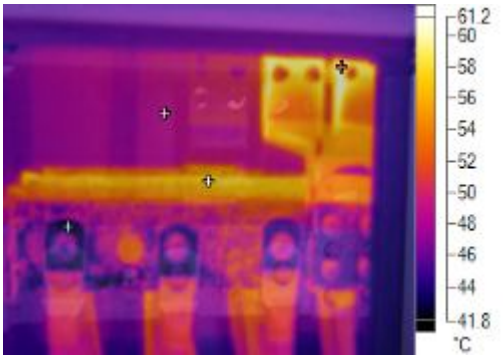


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	52.2 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	44.2 °C to 67.6 °C
Image Time	12-04-2019 PM 04:07:52

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	67.6 °C	67.6 °C	67.6 °C	0.80	32.0 °C	0.00
Cold	44.2 °C	44.2 °C	44.2 °C	0.80	32.0 °C	0.00
Centerpoint	62.8 °C	62.8 °C	62.8 °C	0.80	32.0 °C	0.00
Centerbox	65.0 °C	45.3 °C	54.5 °C	0.80	32.0 °C	4.01
P0	66.2 °C	66.2 °C	66.2 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY

LV SIDE OF TRANSFORMER (SECONDARY SIDE)

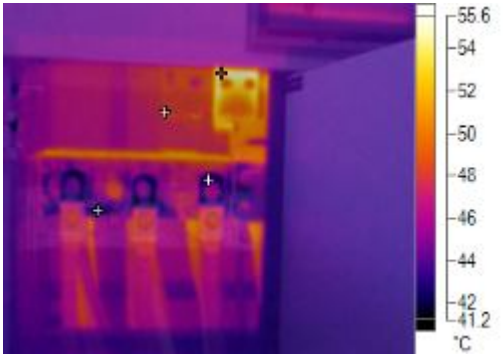


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	48.0 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	43.4 °C to 60.9 °C
Image Time	12-04-2019 PM 12:52:27

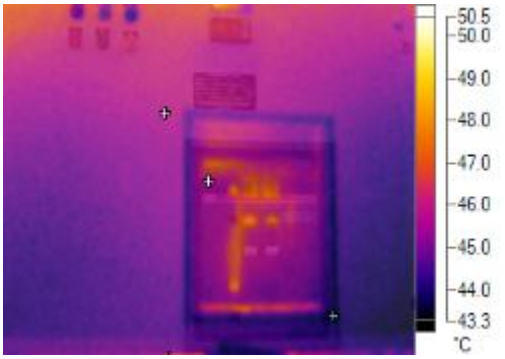
Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	60.9 °C	60.9 °C	60.9 °C	0.80	32.0 °C	0.00
Cold	43.4 °C	43.4 °C	43.4 °C	0.80	32.0 °C	0.00
Centerpoint	45.3 °C	45.3 °C	45.3 °C	0.80	32.0 °C	0.00
Centerbox	59.3 °C	43.9 °C	49.5 °C	0.80	32.0 °C	2.89
P0	65.7 °C	65.7 °C	65.7 °C	0.80	-274.0 °C	0.00

ANNEXURE -9

THERMOGRAPHY MEASUREMENT SURVEY

LV SIDE ACB OF TRANSFORMER (SECONDARY SIDE)



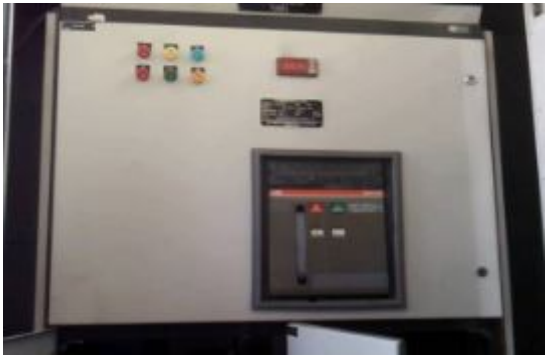


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	48.2 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	45.9 °C to 54.7 °C
Image Time	12-04-2019 PM 12:52:07

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	54.7 °C	54.7 °C	54.7 °C	0.80	32.0 °C	0.00
Cold	45.9 °C	45.9 °C	45.9 °C	0.80	32.0 °C	0.00
Centerpoint	49.0 °C	49.0 °C	49.0 °C	0.80	32.0 °C	0.00
Centerbox	51.5 °C	46.9 °C	48.7 °C	0.80	32.0 °C	0.73
P0	63.0 °C	63.0 °C	63.0 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY
JP_00794.IS2

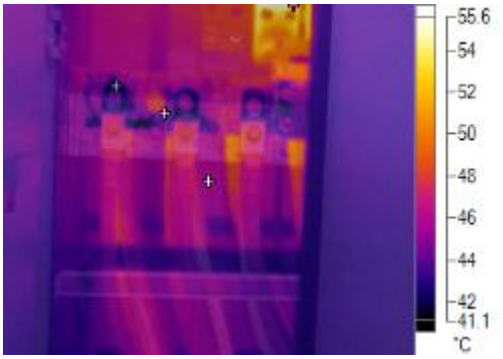


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	47.5 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	43.3 °C to 60.9 °C
Image Time	12-04-2019 PM 12:50:27

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	60.9 °C	60.9 °C	60.9 °C	0.80	32.0 °C	0.00
Cold	43.3 °C	43.3 °C	43.3 °C	0.80	32.0 °C	0.00
Centerpoint	49.1 °C	49.1 °C	49.1 °C	0.80	32.0 °C	0.00
Centerbox	54.9 °C	43.3 °C	48.3 °C	0.80	32.0 °C	1.98
P0	62.2 °C	62.2 °C	62.2 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY
JP_00793.IS2

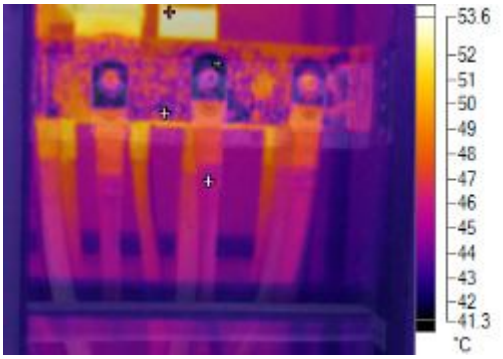


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	47.8 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	43.5 °C to 58.4 °C
Image Time	12-04-2019 PM 12:50:05

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	58.4 °C	58.4 °C	58.4 °C	0.80	32.0 °C	0.00
Cold	43.5 °C	43.5 °C	43.5 °C	0.80	32.0 °C	0.00
Centerpoint	48.0 °C	48.0 °C	48.0 °C	0.80	32.0 °C	0.00
Centerbox	54.7 °C	43.9 °C	48.8 °C	0.80	32.0 °C	1.75
P0	61.8 °C	61.8 °C	61.8 °C	0.80	-274.0 °C	0.00

ANNEXURE -9
THERMOGRAPHY MEASUREMENT SURVEY
LEFT SIDE LV SIDE OF TRANSFORMER (SECONDARY SIDE)

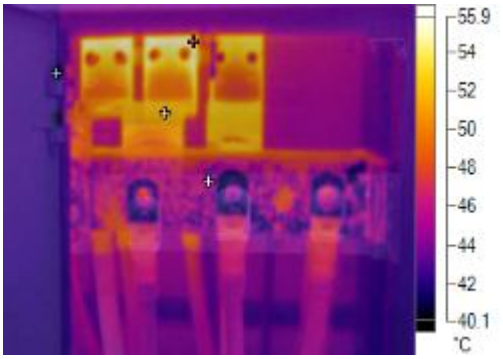


Image Info

Background Temperature	32.0 °C
Emissivity	0.80
Average Temperature	48.1 °C
Calibration Range	-20.0 °C to 80.0 °C
Image Range	42.1 °C to 61.2 °C
Image Time	12-04-2019 PM 12:49:02

Marker Info

Marker Name	Maximum	Minimum	Average	Emissivity	BG Temp	Std.Dev
Hot	61.2 °C	61.2 °C	61.2 °C	0.80	32.0 °C	0.00
Cold	42.1 °C	42.1 °C	42.1 °C	0.80	32.0 °C	0.00
Centerpoint	46.8 °C	46.8 °C	46.8 °C	0.80	32.0 °C	0.00
Centerbox	57.6 °C	42.5 °C	50.0 °C	0.80	32.0 °C	3.38
P0	56.5 °C	56.5 °C	56.5 °C	0.80	32.0 °C	0.00

ANNEXURE-10		
LIST OF ACTION REQUIRED		
Sr No	**Suggestion**	**Implementation Schedule**
1	Contract Demand Increase for UG Hostel Service	Immediate
2	Contract Demand Increase for High rise Hostel Service	Immediate
3	Capacitor installation for PF improvement	From Jul-19 Onwards
4	LED light retrofitting (replacement of existing light with new LED lights at the time of failure of existing lights)	In steps
5	Occupancy Sensor in Class Room with one class room as sample	From Jul-19 Onwards
6	EMS (Energy Monitoring System)	From Jul-19 Onwards

Note:

1. Above schedule is prepared based on the meeting on 25th Jun 2019.