Energy Audit, Green Audit & Environment Audit

Shri Guru Ram Rai University, Dehradun

October 2022

Conducted By

GTD POWER SYSTEM PVT. LTD.
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Acknowledgement

Energy audit, Green Audit and Environment Audit of the University is important tool to analyze wastage of energy and create healthy environment of any Institution. GTD Power Systems Pvt. Ltd Ghaziabad have been entrusted to carry out these audits by the management of Shri Guru Ram Rai University, Dehradun.

GTD Power Systems Pvt. Ltd is thankful to the Director and Management of the Shri Guru Ram Rai University, Dehradun for entrusting processes of Energy audit, Green Audit and Environment auditing with us. We thank faculty and non-teaching staff who took pain along with us to gather data through survey. We also thank the office staff who helped us during the document verification.

For GTD Power Systems Pvt. Ltd.

(S. K. MAHESHWARI) Director

Director

Executive Summary

A Nation's growth starts from its educational institutions, where the ecology is thought as a prime factor of development associated with environment. A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational institutions now a day are becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly. To preserve the environment within the campus, various viewpoints are applied by the several educational Universities to solve their environmental problems such as promotion of the energy savings, recycle of waste, water reduction, water harvesting etc. The activities pursued by University can also create a variety of adverse environmental impacts. To protect such situation Energy Audit, Green Audit and Environment Audit are required to be conducted in these institutions. Energy Audit pave the way to save energy consequently reducing Carbon Emissions. Environmental auditing is a process whereby an organization's environmental performance is tested against its environmental policies and objectives. Green audit is defined as an official examination of the effects a college has on the environment. It must also be under stood that Energy Audit, Green Audit and Environment Audit are inter related to each other. If you save Energy, it will save Environment. If you save trees or plant trees, it will save Environment and energy. If you clean Environment, it will save human life and save energy.

Thus, it is imperative that the University evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

In Shri Guru Ram Rai University, Dehradun, the audit process involved initial interviews with management to clarify policies, activities, records and the co- operation of staff and students in the implementation of mitigation measures. This was followed by staff and student interviews, collection of data through the questionnaire, review of records, observation of practices and observable

outcomes. In addition, the approach ensured that the management and staff are active participants in the green auditing process in the University. The summery of various Energy Conservation opportunities found in the University are as per Table-I.

S. No.	Name of Activity	Qty	Total Energy saving per year (KWh)	Total Cost of Energy saving @ Rs 5.90 (Rs)	Total Cost of Replacement (Rs)	Pay Back Period (Yrs)
1	2	3	4	5	6	7=6/5
1	Replacement of 36 W CFL with 18 W LED Lamp	88	3801.6	22429	15840	0.71
2	Replacement of 12 W CFL with 6 W LED Lamp	122	1756.8	10365	12200	1.18
3	Replacement of 40 W FTL with 20 W LED Tube Light	3050	146400	863760	915000	1.06
4	Replacement of Split AC 1.5 Ton capacity non star rating (more than eight year old) with Five Star Split AC year 2021	9	8724.87	51477	288000	5.59
5	Replacement of Window AC 1.5 Ton capacity non star rating more than eight year old with Five Star Window AC year 2022	21	25552.80	150762	840000	5.57
6	Replacement of Non star Ceiling Fans 75 W capacity with Five star Fan of 26 W capacity	1950	191100	1127490	5850000	5.19
	Total		**377336**	**2226283**	**7921040**	

Table-I: Summary of EC Strategy

Table-I summarize the Energy Conservation Strategy. Table-II summarize the various sources of energy and their usage in Shri Guru Ram Rai University, Dehradun during Year 2021-22.

Sl. No	Particulars	Unit	Quantity
1	Electricity (Grid)	KWH	1563939
2	Electricity (Solar)	KWH	509514.7
	Total Electrical Energy	KWH	2073453.7
3	Diesel	Litters	6050
4	LPG	Kgs	91200

Table-II: Total Energy Consumption from different Sources

Percentage Saving of Electrical Power has been shown in Table-III.

Annual Consumption			Savings Identified			Percentage Saving Identified (%)		
(KWH)	(TOE) (*)	Amount @ Rs 5.90/ unit (Rs)	KWH	TOE	Amount @ Rs 5.90/ unit (Rs)	KWH	TOE	Amount (Rs)
1563939	134.5	9227240	377336	32.45	2226283	24.13	24.13	24.13

Table-III: Percentage Saving in Electrical Power

***Note:** 1 KWH=860 Kcal and 1 TOE = 10^7 kcal

The baseline data prepared for the Shri Guru Ram Rai University, Dehradun will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development of the college. Existing data will allow the University to compare its programs and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. We expect that the management will be committed to implement the recommendations.

We are happy to submit the Energy audit, Green Audit and Environment Audit report to the Shri Guru Ram Rai University, Dehradun authorities.

24.1.2023

(S. K. MAHESHWARI)
Regn No: EA-2986
GTD POWER SYSTEMS PVT LTD
GHAZIABAD

Chapter 1

Introduction

1.0 Preamble

Energy Audit, Green Audit and Environment Audit are the useful tools for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. They can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. These can also create health consciousness and promote environmental awareness, values and ethics. They provide staff and students better understanding of green impact on campus. These auditing promote financial savings through reduction of resource use.

1.1 Introduction

Shri Guru Ram Rai University was established on April 5th 2017 as a Private University vide Government of Uttarakhand, notification no- 109/XXXVI (3)/2017/80(1)2016, issued on June 27th 2017, in recognition of the service to the nation by its parent body, the iconic Shri Guru Ram Rai Education Mission, Jhanda Sahib, Dehradun in the state of Uttarakhand. The University has been recognized by UGC u/s 2 (f) of the UGC act 1956 and is also recognized by other statutory bodies of the state as well as the country.

1.2 Location of Shri Guru Ram Rai University, Dehradun

The Shri Guru Ram Rai University, Dehradun is located just 3 Km away from the Dehradun Railway Station and is very well connected with roads and Jolly Grant, Dehradun airport is just 29 Km away from the campus.

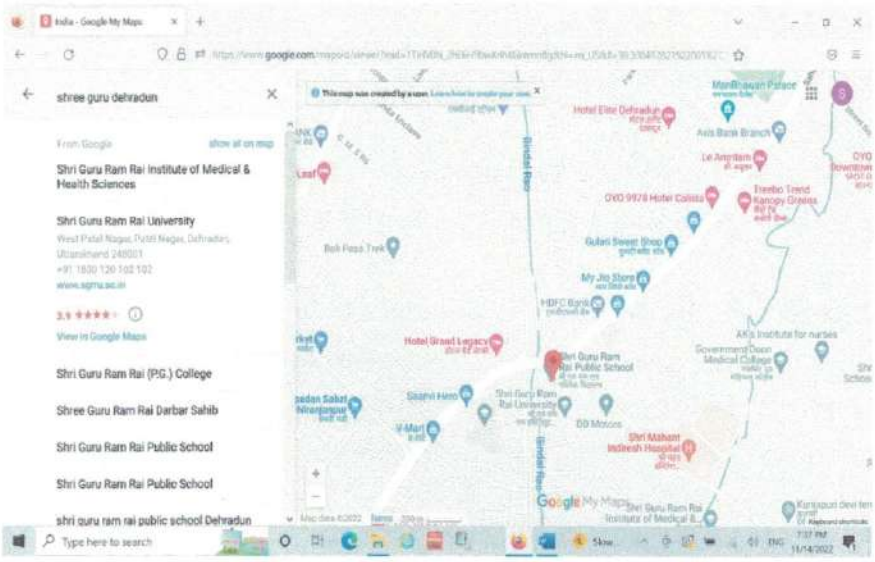


Fig-1.1: Location of SGRR University, Dehradun

1.3 Vision

"To establish Sri Guru Ram Rai University to be a Centre of Excellence in higher education, innovation, and social transformation by nurturing inquisitive and creative minds and by enabling the stakeholders to become committed professionals and educators of national and global relevance."

1.4 Mission

To provide a comprehensive and sustainable educational experience that fosters the spirit of inquiry, scientific thinking, and professional competence along with ethical and spiritual values

- To deliver a classic, well-rounded learning experience that is distinctive and impactful on the young generation preparing them for a successful career
- To engage, inspire and challenge the stakeholders to become leaders with ethics and positive contributors to their chosen field and humane citizens
- To attract, train and retrain qualified staff to work efficiently to bring forth the maximum resource potential
- To develop committed and responsible professionals who work for the welfare of society by providing innovative and efficient solutions and creating long-term relationships with the stakeholders

- To create a sustainable career, by collaborating with stakeholders and participating in community partnerships for life and livelihood in the local society in a responsive and dynamic way
- To make our students globally competent by introducing specialized training leading to professional capabilities and developing diverse skills in them for competitive advantage.
- To establish quality standards for generations by epitomizing professionalism and integrity while raising the achievements of students.
- To ceaselessly pursue excellence by strengthening a learning environment that makes the institution the most preferred destination in the country.

1.5 Campus

University's campus, spread over 332461 m^2 and built up area of 230886 $m.^2$ SGRR University, has vibrant green campus spread over 82.5 acres of land. Its state-of-art facilities give opportunities to develop leadership skills and to achieve professional excellence.

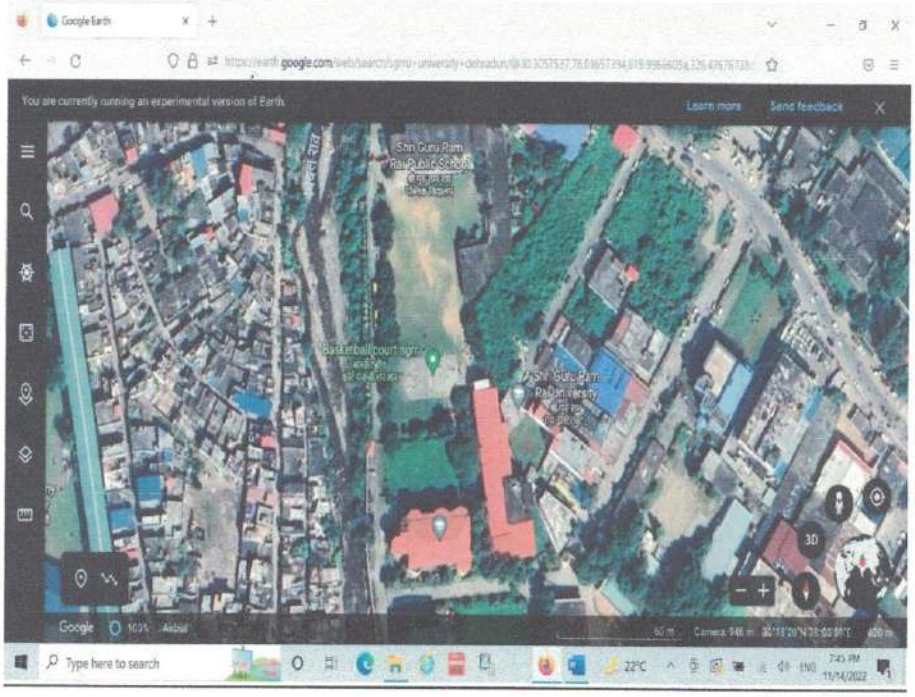


Figure-1.2: Campus View of Shri Guru Ram Rai University, Dehradun

1.7 Total Campus Area & University Building Spread Area

Campus area	332462.4 m^2
Built up area	230885.91 m^2
Green Area	222557 m^2

Table-1.1: Total Campus Area of University Building Spread Area

Shri Guru Ram Rai University, Dehradun has the best infrastructure facilities available for students including a serene external environment through thoughtful landscaping efforts. It has well-equipped library, high quality classroom interiors, well equipped seminar rooms and a state of art auditorium of 2000 persons capacity.

1.8 Strength of Staff, Students, other manpower and Visitors

(i) Staff:

Sr No	Particulars	Nos
1	Resident (On Roll)	70
2	Non-Resident (On Roll)	500
3	Casual Staff	75

Table-1.2: Staff Status

(ii) Students:

Sr No	Particulars	Nos
1	Hostellers	901
2	Day Scholar	7646

Table-1.3: Students Status

(iii) Average No of Daily Visitors: 52

(iv) Total population connected with the University: Based on above mentioned data, no of resident, nonresident person working/studying in the campus and daily casual visitors are as follows:

Sr. No	Particulars	Nos.
1	No of resident Staff/Students, living in the campus for 24 Hours	971
2	No of nonresident Staff/Students, coming in day time only	8146
3	No of Daily Visitors	52
Total Population		**9169**

Table-1.4: Total population connected with the University

1.10 Quality Policy

To continuously thrive to provide a congenial and wholesome academic environment and a healthy culture for faculty, staff and students which would motivate teachers' full participation with passion and develop an intense desire in the students to acquire comprehensive education and hence become a useful and confident human resource for the industry and academia. IQAC Members (2022-23) are as follows:

IQAC RE -CONSTITUTION OF SGRR UNIVERSITY, DEHRADUN

(January 2022)

1. Prof. (Dr) U.S.Rawat -Vice Chancellor of SGRR University Dehradun, Chairman-IQAC
2. **Few Senior Officers / Administrative Heads:**
   - i. Prof. (Dr) Deepak Sahni- Registrar, SGRR University
   - ii. Prof (Dr) Sanjay Sharma Pokhriyal -Controller of Examination, SGRR University
   - iii. Dr. Amit Verma, Professor & Head, Depratment of Medicine, SMHS.
   - iv. Dr. R.K Verma, Professor, School of Medical and Health Sciences.
   - v. Dr. Arun Kumar, Dean Research, SGRR University Dehradun.
   - vi. Prof. Malvika Kandpal, Academic Coordinator, SGRR University Dehradun.
   - vii. Prof. Kanchan Joshi Dean Student Welfare- SGRR University Dehradun.

viii. Prof. Saraswati Kala, Dean School of Humanities & Social Sciences.

ix. Prof Parul Goyal Dean, School of Computer Application & Information Technology

x. Mr. Manoj Jakhmola, Chief Finance Officer, School of Medical and Health Sciences.

xi. Mr. Jitendra Kumar Saxena Deputy HR, School of Medical and Health Sciences.

xii. Dr. Amita Saklani, Chief Librarian Patel Nagar Campus, SGRR University Dehradun.

xiii. Mr. Mohit Bhatt-IT Head, SGRR University Dehradun

3. Teachers to represent all level (three to eight):

i. Prof Alka N Chaudhary, Dean, School of Pharmaceutical Sciences.
ii. Dr. Pooja Jain, Professor, School of Management & Commerce Studies
iii. Dr. Soniya Gambhir, Associate Professor, School of Management & Commerce Studies
iv. Dr. Yogendra Bahuguna, Associate Professor, School of Pharmaceutical Sciences.
v. Mrs. Sheeba Phillip, Assistant Professor, School of Nursing.
vi. Dr. Deepak Som, Associate Professor, School of Agriculture Sciences.
vii. Dr. Sagarika Dash, Associate Professor, Department of Mass Communication School of Humanities and Social Sciences.
viii. Dr. Garima Singh, Assistant Professor, School of Humanities and Social Sciences.

4. Representative Alumni Association:

i. Dr. Manira Dhasmana, Dean Alumni SGRR University, Dehradun.

5. One Member from the Management (to be nominated by the Hon ble chancellor).

i. Mr. Mukesh Chandra Raturi, Editor Ratank, SGRR Education Mission.

One nominee each from Local Society, Students and Alummi (to be nominated by the Hon ble chancellor).

(a) Society:

> Shri Naveen GHAI, Social Worker, 490Khurbura, Dehradun

(b) Students:

> Ms. Divya Verma, Research Scholar in Management.

6. **One nominee each from Employers/ Industrialists/ Stakeholders (to be Nominated by the Hon' ble Chancellor).**

(a) Industrialists:

> Mr. Sunil Uniyal, Industrialist, 223 Phase-2, Panditwari, Dehradun.

(b) Stakeholders:

> Prof. S.S.Rawat, Dean- School of Education, HNBGU, Srinagar,Garhwal.

> Dr. Sanjay Padaliya, NAAC Coordinator, SGRR PG College Dehradun.

7. **One of the senior teachers as Coordinator of the IQAC**

(a) Director/Coordinator- Dr. Kumud Saklani, Dean- School of Basic & Applied Sciences.

1.11 List of Auditors engaged in the Assignment

1. S. K. Maheshwari (EA-2986)
2. Vishwa Nath Nirmal (EA-8951)

Chapter 2

Pre-Audit Stage

2.1 A pre-audit meeting provides an opportunity to reinforce the scope and objectives of the audit and discussions were held on the practicalities associated with the audit. This meeting is an important prerequisite for the audit because it is the first opportunity to meet the audit team and deal with any concerns. The pre-audit meeting was held at Shri Guru Ram Rai University, Dehradun. The meeting was an opportunity to gather information that the audit team can study before arriving on the site. The audit protocol and audit plan were handed over at this meeting and discussed in advance of the audit itself. In Shri Guru Ram Rai University, pre-audit meeting was conducted successfully and necessary documents were collected directly from the University before the initiation of the audit processes. Actual planning of audit processes was discussed in the pre-audit meeting.

2.2 Management's Commitment

The Management of the University has shown the commitment towards the green auditing during the pre-audit meeting. They were ready to encourage all green activities. It was decided to promote all activities that are environment friendly such as awareness programs on the environment, campus farming, planting more trees on the campus etc., after the green auditing.

2.3 Report Formulation Planning

This report has been divided in following three parts:

1. Energy Audit,
2. Green Audit,
3. Environment Audit

The detailed discussions of these Audits will be done in subsequent chapters.

Chapter-3

Energy Audit

3.1 Sources of Energy being used in the University

The University is using both conventional and non-conventional sources of energy. The various sources of energy have been discussed in subsequence Paras.

3.2 Grid Energy

3.2.1 Electricity Distribution Network:

The electric supply of SGRR University, Dehradun is fed from 33/11 KV Substation, of Uttarakhand Power Corporation Ltd. All these connections have been released on LT through followings 11/0.4 KV LT Substation, situated inside the Campus.

Sr No	Name of Connection	Connection No	KW
1	Admin Block	SD0K000008197	100
2	Anatomy Block	SD0K000000778	120
3	J R Hostel	SD0K000025051	200
4	Paramedical College (Nursing Home)	SD0K000005317	75
5	College Of Nursing	SD0K000027977	75
6	S.G.R.R University, Pathribagh	SD0K000133866	75
7	I.T.S	SD0K000021976	255
	Total Capacity of Sub stations		**900**

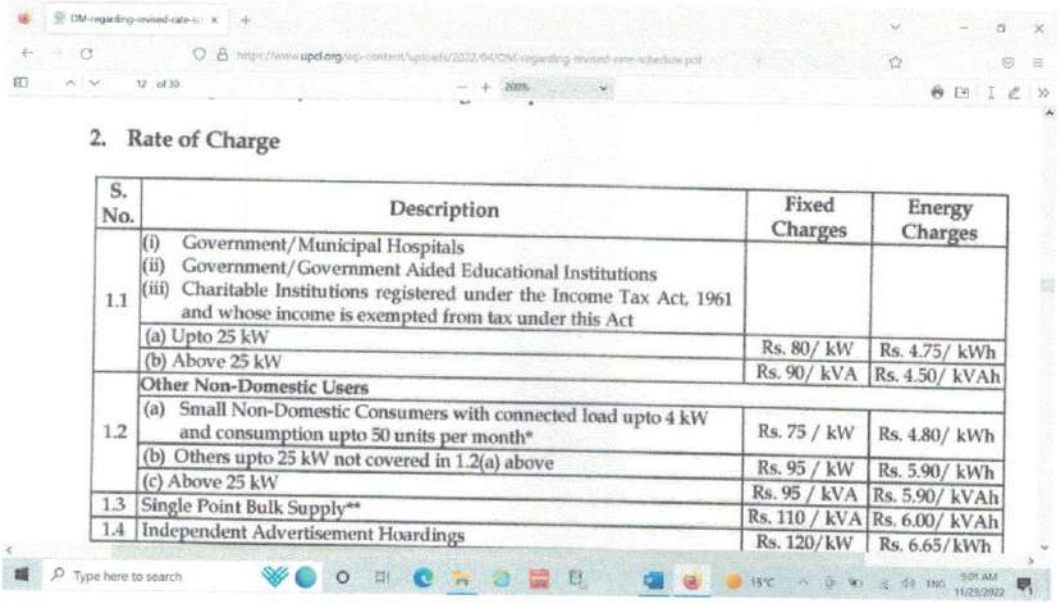
Table-3.1: Details of Electricity Connections in SGRR University

3.2.3 Tariff of Electricity Bill

The billing of all connections of SGRR University is done under RTS-2 category and rate of charge is as follows:

Fixed charges: Rs 95/KVA

Energy Charges: Rs 5.90/KVAh



2. Rate of Charge

S. No.	Description	Fixed Charges	Energy Charges
1.1	(i) Government/Municipal Hospitals (ii) Government/Government Aided Educational Institutions (iii) Charitable Institutions registered under the Income Tax Act, 1961 and whose income is exempted from tax under this Act		
	(a) Upto 25 kW	Rs. 80/ kW	Rs. 4.75/ kWh
	(b) Above 25 kW	Rs. 90/ kVA	Rs. 4.50/ kVAh
1.2	Other Non-Domestic Users		
	(a) Small Non-Domestic Consumers with connected load upto 4 kW and consumption upto 50 units per month*	Rs. 75 / kW	Rs. 4.80/ kWh
	(b) Others upto 25 kW not covered in 1.2(a) above	Rs. 95 / kW	Rs. 5.90/ kWh
	(c) Above 25 kW	Rs. 95 / kVA	Rs. 5.90/ kVAh
1.3	Single Point Bulk Supply**	Rs. 110 / kVA	Rs. 6.00/ kVAh
1.4	Independent Advertisement Hoardings	Rs. 120/kW	Rs. 6.65/kWh

Fig 3.1: Tariff applicable for University

3.2.4 Study of operational pattern and quality of Power Supply of Transformers

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel of Distribution Transformers and key parameters were recorded. Power Analyzer Configuration is shown in Table-3.2.

Electrical hook-up	3-Phase 4-Wire 3V
Probes	A193/MA193 AmpFLEX (6500 A)
Phase Harmonic Ratios	Fundamental Value as reference (%f)
Current ratio	1:1
Voltage ratio phase to neutral	1:1
Aggregation	1 min
Recorded measurements U	CF, rms, THDf
Recorded measurements V	CF, rms, THDf
Recorded measurements A	CF, rms, THDf
Recorded measurements other	F, PF, P (W)
Recorded harmonics V	0 - 50
Recorded harmonics A	0 - 50
Recorded harmonics S (VA)	0 - 50

Table-3.2: Power Analyzer Configuration

The measurements recorded for all Sub stations were as follows:

(I) **ITS Sub Station of 255 KW sanctioned Load**

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 13.50 PM 14.50 PM on dated 19.10.2022.

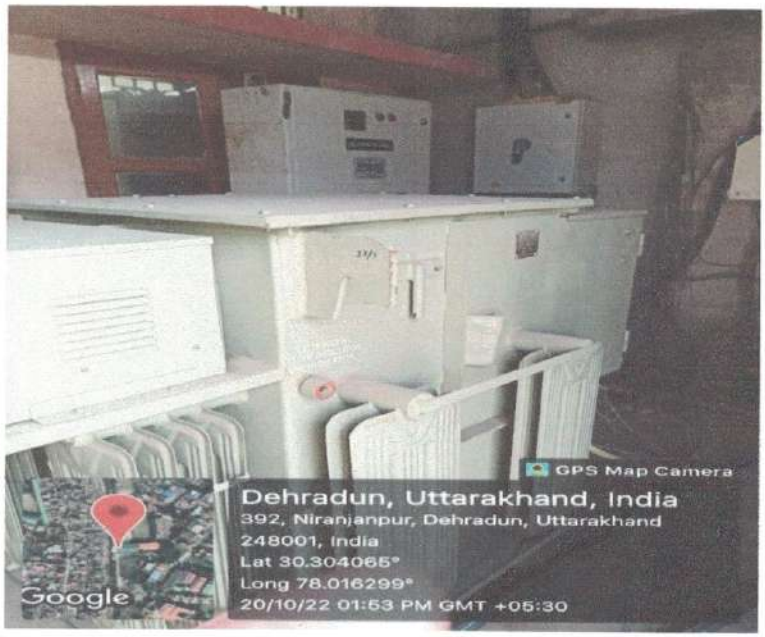


Figure-3.2: 11/0.4 KV Sub Station of ITS SGRR University

The key parameters were as follows:

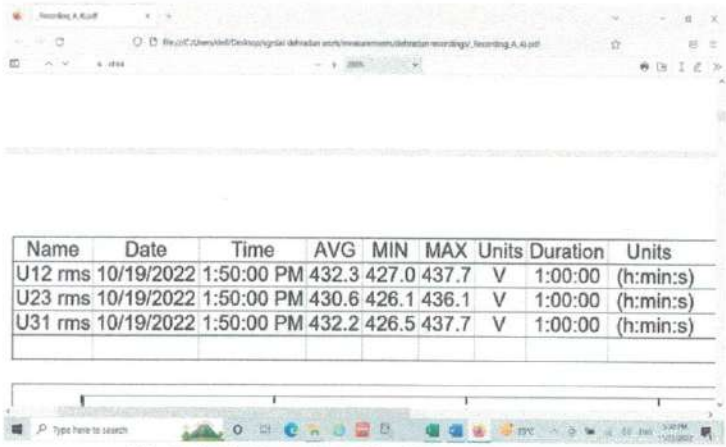
Recording Date: 19/10/2022

a. Current, Voltage and Power Factor

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/19/2022	1:50:00 PM	35.89	8.500	68.50	A	1:00:00	(h:min:s)
A2 rms	10/19/2022	1:50:00 PM	47.62	8.500	103.0	A	1:00:00	(h:min:s)
A3 rms	10/19/2022	1:50:00 PM	37.60	14.50	61.50	A	1:00:00	(h:min:s)
AN rms	10/19/2022	1:50:00 PM	31.17	21.50	48.70	A	1:00:00	(h:min:s)

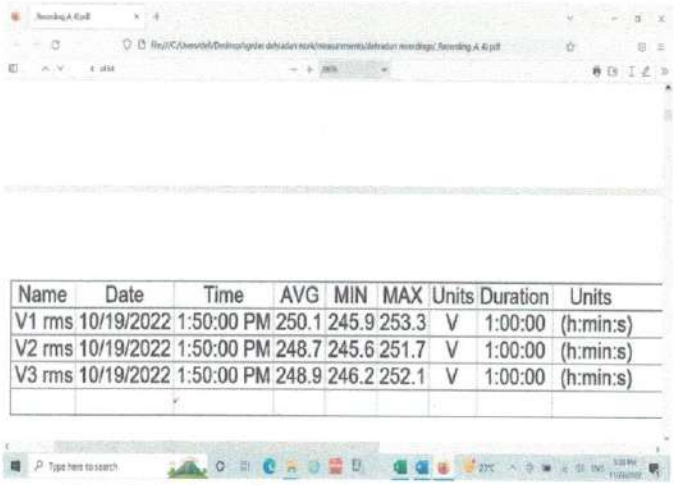
Table-3.3: Current Profile

The load was found slightly unbalanced. It needs balancing.



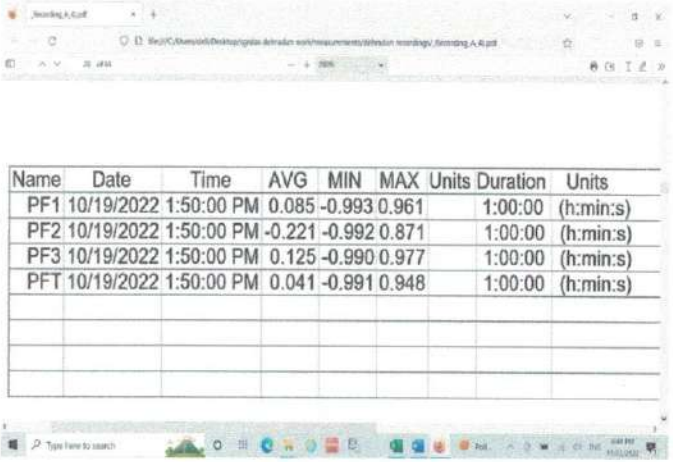
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/19/2022	1:50:00 PM	432.3	427.0	437.7	V	1:00:00	(h:min:s)
U23 rms	10/19/2022	1:50:00 PM	430.6	426.1	436.1	V	1:00:00	(h:min:s)
U31 rms	10/19/2022	1:50:00 PM	432.2	426.5	437.7	V	1:00:00	(h:min:s)

Fig-3.4: Voltage Profile (Phase to Phase)



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
V1 rms	10/19/2022	1:50:00 PM	250.1	245.9	253.3	V	1:00:00	(h:min:s)
V2 rms	10/19/2022	1:50:00 PM	248.7	245.6	251.7	V	1:00:00	(h:min:s)
V3 rms	10/19/2022	1:50:00 PM	248.9	246.2	252.1	V	1:00:00	(h:min:s)

Fig-3.5: Voltage Profile (Phase to Neutral)



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/19/2022	1:50:00 PM	0.085	-0.993	0.961		1:00:00	(h:min:s)
PF2	10/19/2022	1:50:00 PM	-0.221	-0.992	0.871		1:00:00	(h:min:s)
PF3	10/19/2022	1:50:00 PM	0.125	-0.990	0.977		1:00:00	(h:min:s)
PFT	10/19/2022	1:50:00 PM	0.041	-0.991	0.948		1:00:00	(h:min:s)

Fig-3.6: Power Factor during Measurement

The power factor shown is plus/minus due to Solar plant connected with the sub station.

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.7.

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/19/2022	1:50:00 PM	29.74	9.900	74.00	% f	1:00:00	(h:min:s)
A2 THDf	10/19/2022	1:50:00 PM	111.6	10.70	400.1	% f	1:00:00	(h:min:s)
A3 THDf	10/19/2022	1:50:00 PM	20.93	14.30	31.60	% f	1:00:00	(h:min:s)
U12 THDf	10/19/2022	1:50:00 PM	2.635	2.600	2.700	% f	1:00:00	(h:min:s)
U23 THDf	10/19/2022	1:50:00 PM	2.700	2.600	2.800	% f	1:00:00	(h:min:s)
U31 THDf	10/19/2022	1:50:00 PM	2.673	2.600	2.800	% f	1:00:00	(h:min:s)
V1 THDf	10/19/2022	1:50:00 PM	2.640	2.500	2.700	% f	1:00:00	(h:min:s)
V2 THDf	10/19/2022	1:50:00 PM	2.742	2.600	2.900	% f	1:00:00	(h:min:s)
V3 THDf	10/19/2022	1:50:00 PM	2.640	2.500	2.700	% f	1:00:00	(h:min:s)

Fig-3.7: THD Profile

Total Harmonic Distortion of current are more than 10% limit. It is recommended to install Harmonic Filters in consultation of any Harmonic Expert.

(II) SGRR University Sub Station of 75 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 10.05 PM to 11.05 PM on dated 20.10.2022.

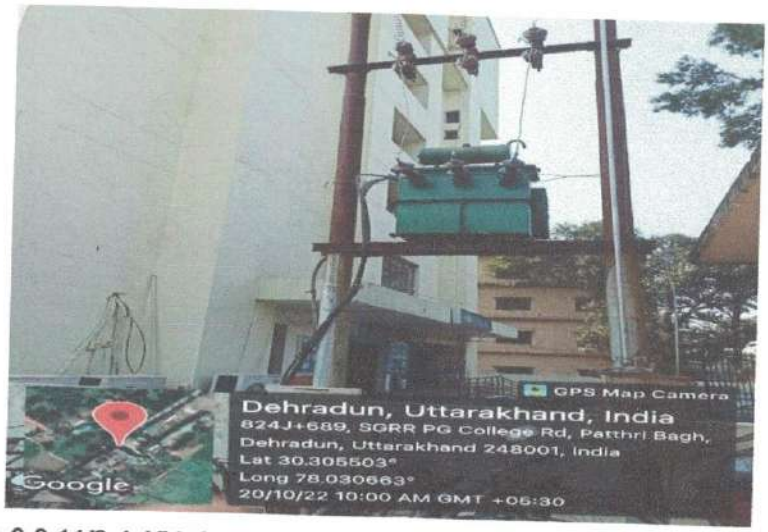


Fig-3.8:11/0.4 KV Sub station, S.G.R.R University, Pathribagh

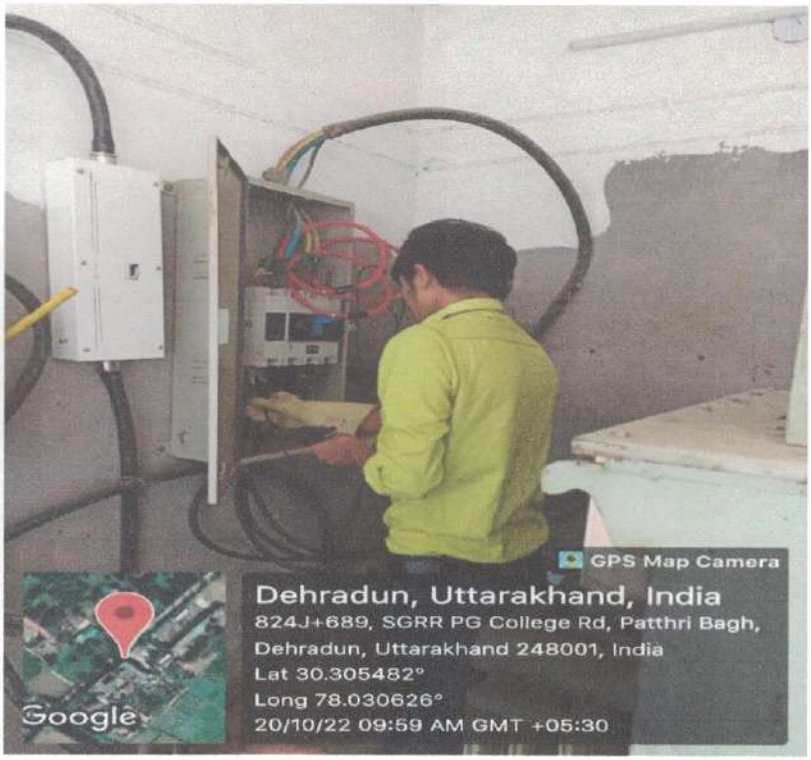
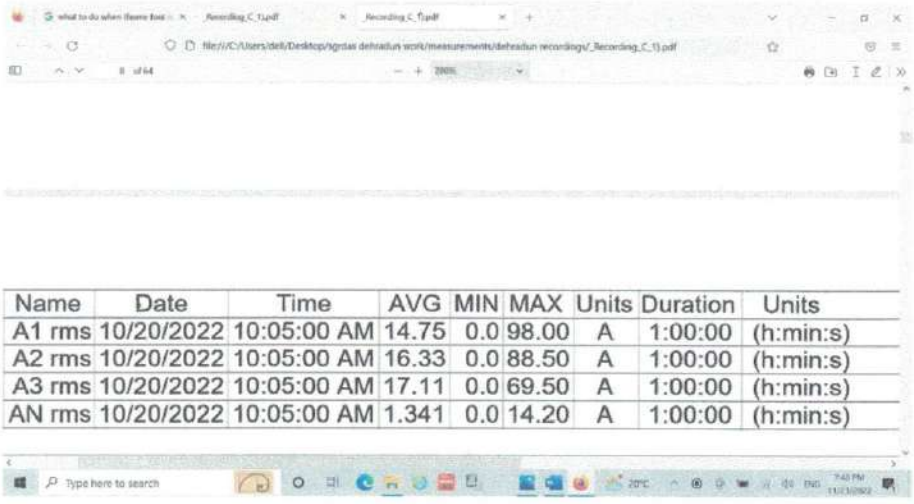


Fig-3.9: Electrical Parameters measurements of SGRRU Sub station Pathribagh

The key parameters were as follows:

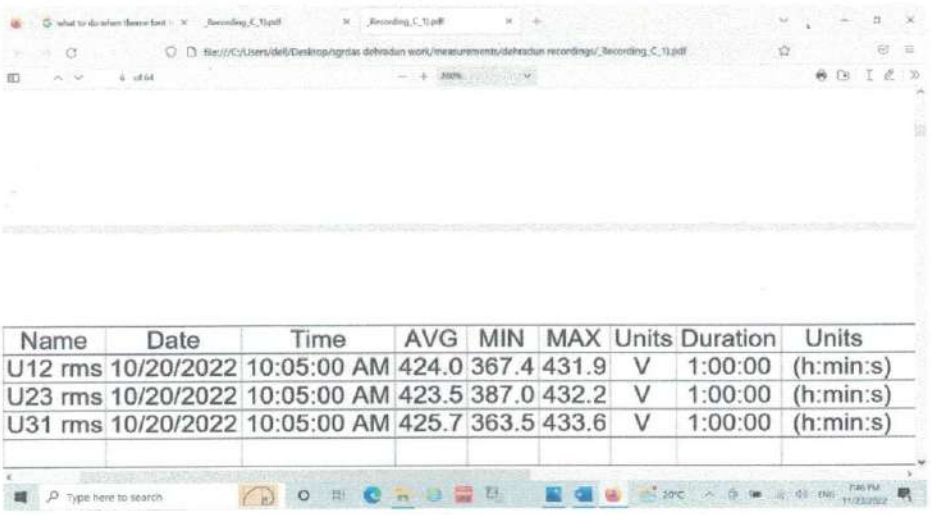
Recording Date: 20/10/2022.

a. Current, Voltage and Power Factor



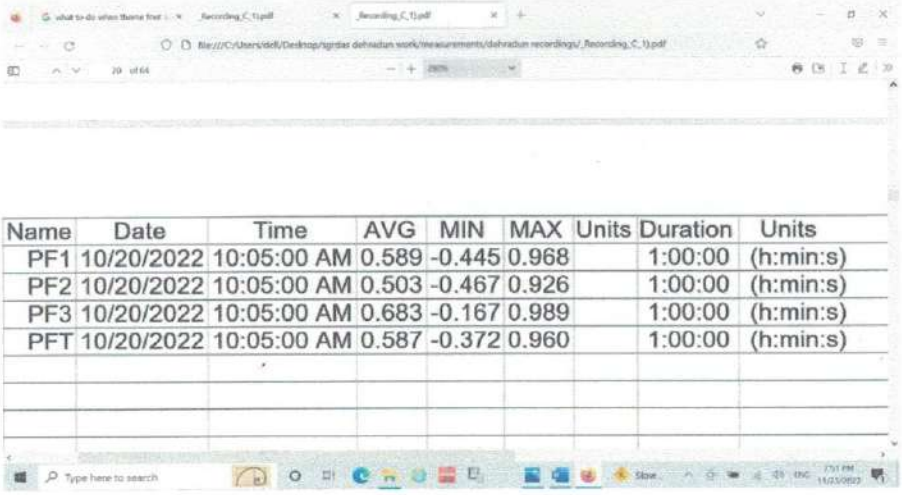
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	10:05:00 AM	14.75	0.0	98.00	A	1:00:00	(h:min:s)
A2 rms	10/20/2022	10:05:00 AM	16.33	0.0	88.50	A	1:00:00	(h:min:s)
A3 rms	10/20/2022	10:05:00 AM	17.11	0.0	69.50	A	1:00:00	(h:min:s)
AN rms	10/20/2022	10:05:00 AM	1.341	0.0	14.20	A	1:00:00	(h:min:s)

Fig-3.10: Current Profile



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	10:05:00 AM	424.0	367.4	431.9	V	1:00:00	(h:min:s)
U23 rms	10/20/2022	10:05:00 AM	423.5	387.0	432.2	V	1:00:00	(h:min:s)
U31 rms	10/20/2022	10:05:00 AM	425.7	363.5	433.6	V	1:00:00	(h:min:s)

Fig-3.11: Voltage Profile (Phase to Phase)



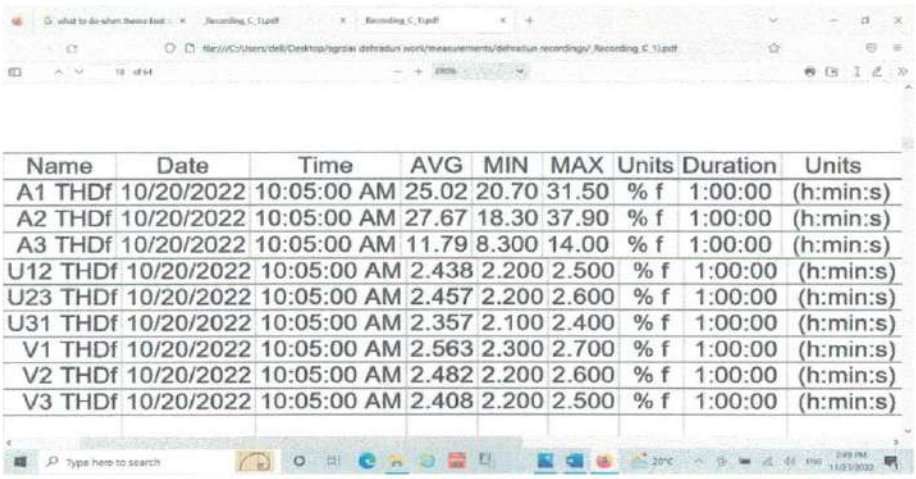
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	10:05:00 AM	0.589	-0.445	0.968		1:00:00	(h:min:s)
PF2	10/20/2022	10:05:00 AM	0.503	-0.467	0.926		1:00:00	(h:min:s)
PF3	10/20/2022	10:05:00 AM	0.683	-0.167	0.989		1:00:00	(h:min:s)
PFT	10/20/2022	10:05:00 AM	0.587	-0.372	0.960		1:00:00	(h:min:s)

Fig-3.12: Power Factor during Measurement

The power factor shown is plus/minus due to Solar plant connected with the sub station.

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.13.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	10:05:00 AM	25.02	20.70	31.50	% f	1:00:00	(h:min:s)
A2 THDf	10/20/2022	10:05:00 AM	27.67	18.30	37.90	% f	1:00:00	(h:min:s)
A3 THDf	10/20/2022	10:05:00 AM	11.79	8.300	14.00	% f	1:00:00	(h:min:s)
U12 THDf	10/20/2022	10:05:00 AM	2.438	2.200	2.500	% f	1:00:00	(h:min:s)
U23 THDf	10/20/2022	10:05:00 AM	2.457	2.200	2.600	% f	1:00:00	(h:min:s)
U31 THDf	10/20/2022	10:05:00 AM	2.357	2.100	2.400	% f	1:00:00	(h:min:s)
V1 THDf	10/20/2022	10:05:00 AM	2.563	2.300	2.700	% f	1:00:00	(h:min:s)
V2 THDf	10/20/2022	10:05:00 AM	2.482	2.200	2.600	% f	1:00:00	(h:min:s)
V3 THDf	10/20/2022	10:05:00 AM	2.408	2.200	2.500	% f	1:00:00	(h:min:s)

Fig-3.13: THD Profile

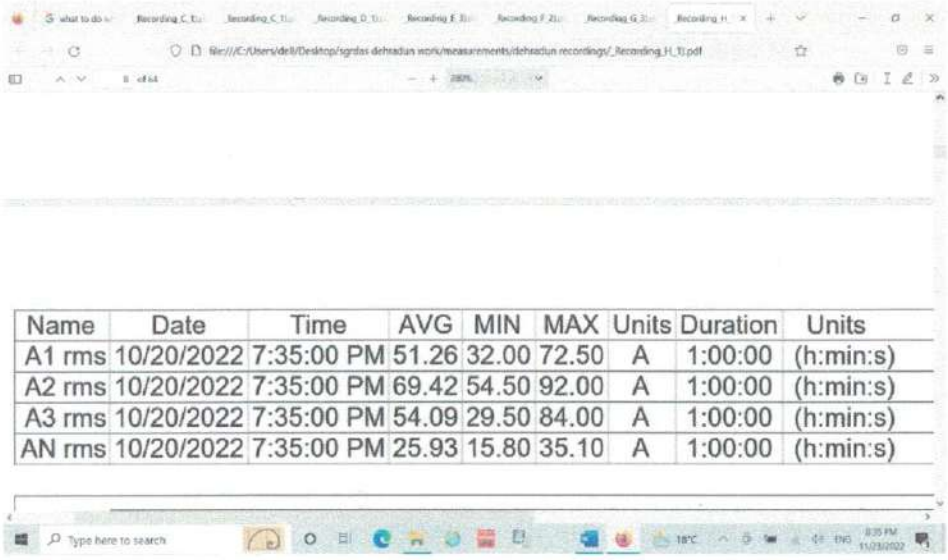
Total Harmonic Distortion of current are more than 10% limit. It is recommended to install Harmonic Filters in consultation of any Harmonic Expert.

(III) Admin Sub Station of 100 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 19.35 PM to 20.35 PM on dated 20.10.2022. The key parameters were as follows:

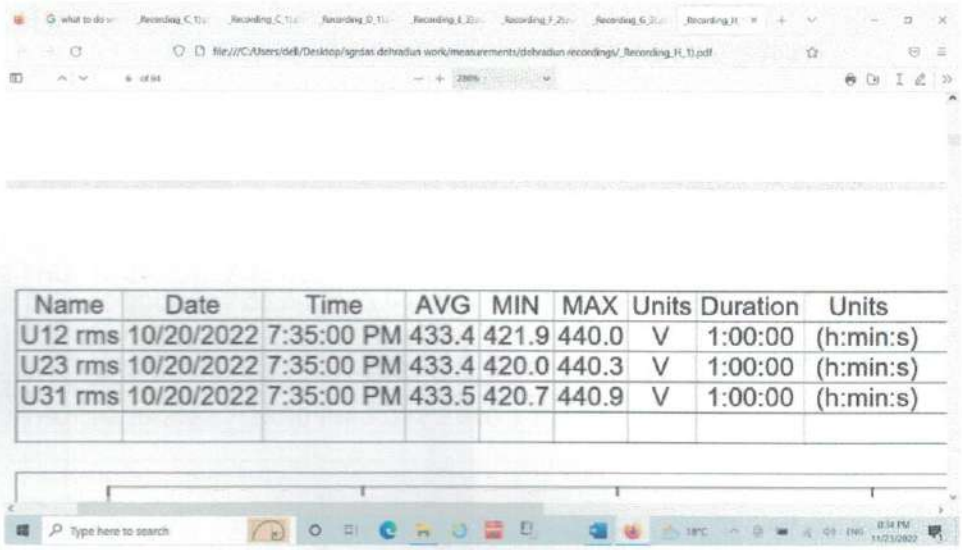
Recording Date: 20/10/2022

a. Current, Voltage and Power Factor



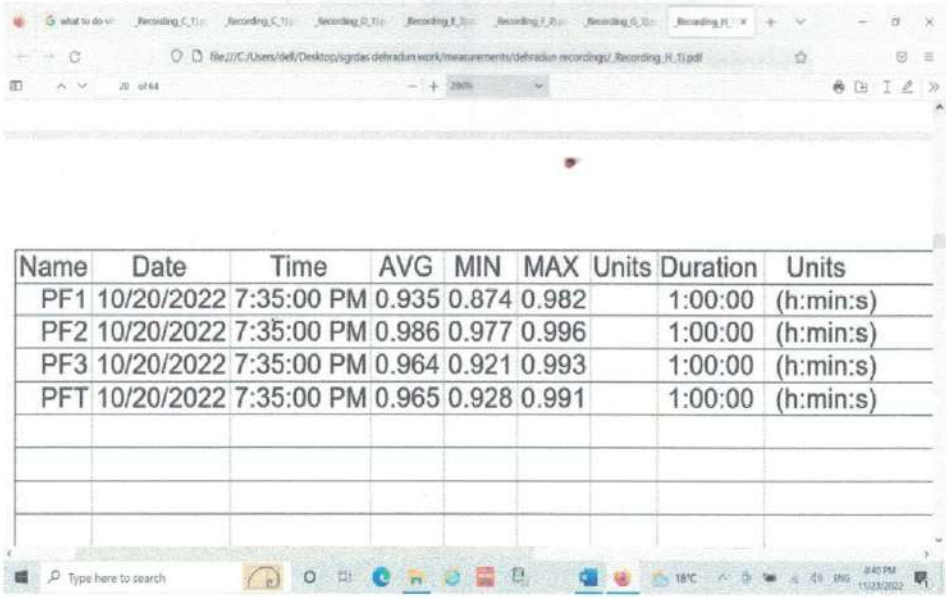
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	7:35:00 PM	51.26	32.00	72.50	A	1:00:00	(h:min:s)
A2 rms	10/20/2022	7:35:00 PM	69.42	54.50	92.00	A	1:00:00	(h:min:s)
A3 rms	10/20/2022	7:35:00 PM	54.09	29.50	84.00	A	1:00:00	(h:min:s)
AN rms	10/20/2022	7:35:00 PM	25.93	15.80	35.10	A	1:00:00	(h:min:s)

Fig-3.14: Current Profile



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	7:35:00 PM	433.4	421.9	440.0	V	1:00:00	(h:min:s)
U23 rms	10/20/2022	7:35:00 PM	433.4	420.0	440.3	V	1:00:00	(h:min:s)
U31 rms	10/20/2022	7:35:00 PM	433.5	420.7	440.9	V	1:00:00	(h:min:s)

Fig-3.15: Voltage Profile (Phase to Phase)

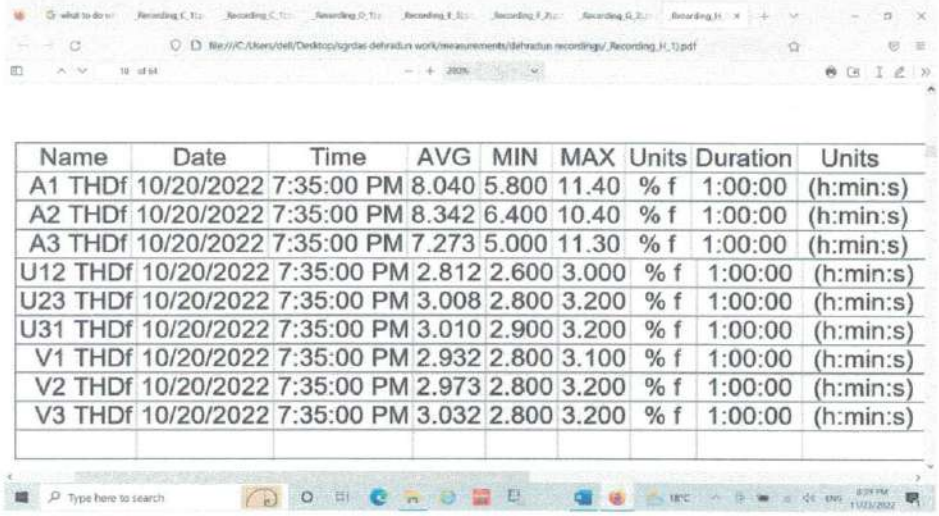


Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	7:35:00 PM	0.935	0.874	0.982		1:00:00	(h:min:s)
PF2	10/20/2022	7:35:00 PM	0.986	0.977	0.996		1:00:00	(h:min:s)
PF3	10/20/2022	7:35:00 PM	0.964	0.921	0.993		1:00:00	(h:min:s)
PFT	10/20/2022	7:35:00 PM	0.965	0.928	0.991		1:00:00	(h:min:s)

Fig-3.16: Power Factor during Measurement

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.17.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	7:35:00 PM	8.040	5.800	11.40	% f	1:00:00	(h:min:s)
A2 THDf	10/20/2022	7:35:00 PM	8.342	6.400	10.40	% f	1:00:00	(h:min:s)
A3 THDf	10/20/2022	7:35:00 PM	7.273	5.000	11.30	% f	1:00:00	(h:min:s)
U12 THDf	10/20/2022	7:35:00 PM	2.812	2.600	3.000	% f	1:00:00	(h:min:s)
U23 THDf	10/20/2022	7:35:00 PM	3.008	2.800	3.200	% f	1:00:00	(h:min:s)
U31 THDf	10/20/2022	7:35:00 PM	3.010	2.900	3.200	% f	1:00:00	(h:min:s)
V1 THDf	10/20/2022	7:35:00 PM	2.932	2.800	3.100	% f	1:00:00	(h:min:s)
V2 THDf	10/20/2022	7:35:00 PM	2.973	2.800	3.200	% f	1:00:00	(h:min:s)
V3 THDf	10/20/2022	7:35:00 PM	3.032	2.800	3.200	% f	1:00:00	(h:min:s)

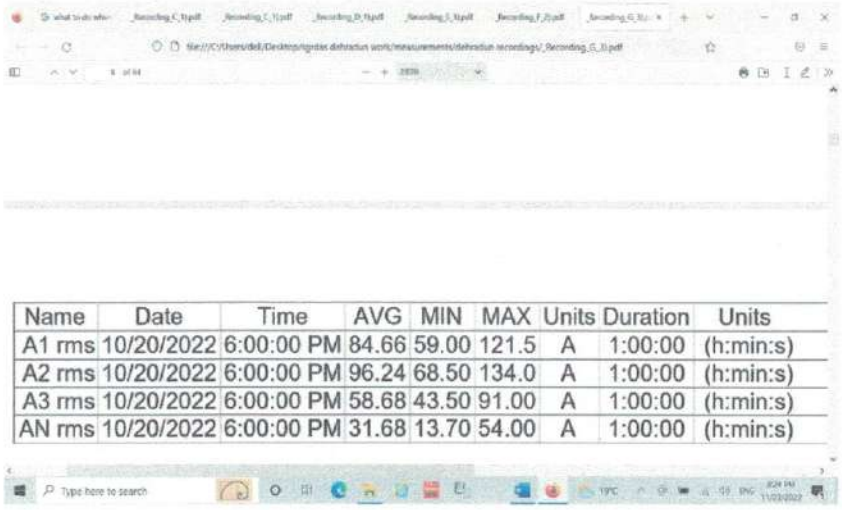
Fig-3.17: THD Profile

(IV) Anatomy Block Sub Station of 120 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 13.50 PM to 14.50 PM on dated 19.10.2022. The key parameters were as follows:

Recording Date: 19/10/2022

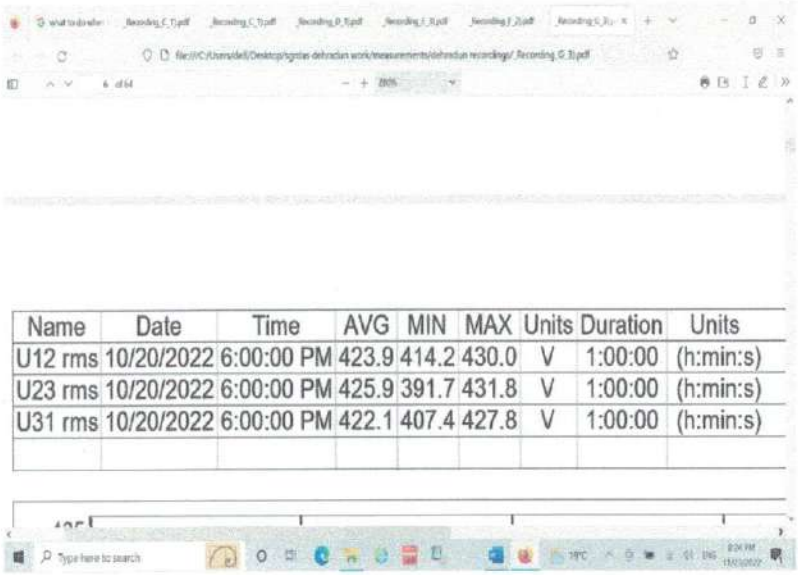
a. Current, Voltage and Power Factor



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	6:00:00 PM	84.66	59.00	121.5	A	1:00:00	(h:min:s)
A2 rms	10/20/2022	6:00:00 PM	96.24	68.50	134.0	A	1:00:00	(h:min:s)
A3 rms	10/20/2022	6:00:00 PM	58.68	43.50	91.00	A	1:00:00	(h:min:s)
AN rms	10/20/2022	6:00:00 PM	31.68	13.70	54.00	A	1:00:00	(h:min:s)

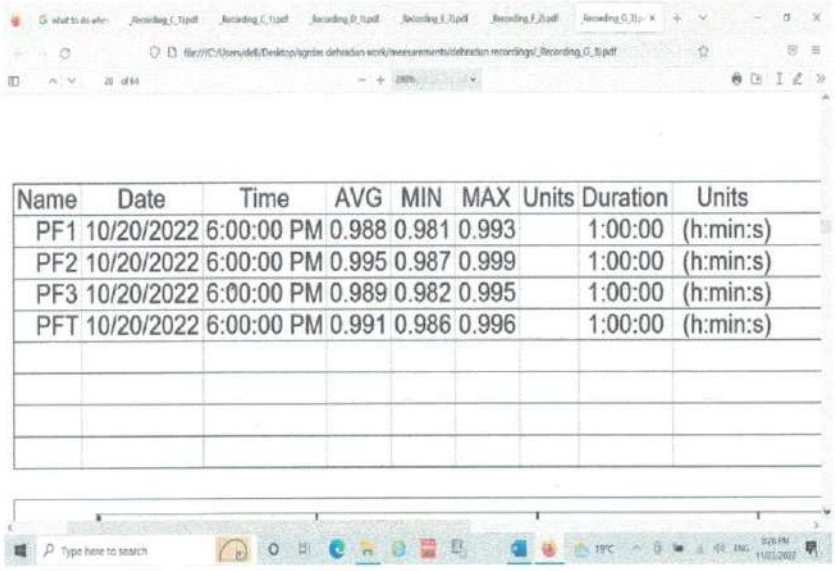
Fig-3.18: Current Profile

The Load on the all the three phases Transformer was found unbalanced and need balancing.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	6:00:00 PM	423.9	414.2	430.0	V	1:00:00	(h:min:s)
U23 rms	10/20/2022	6:00:00 PM	425.9	391.7	431.8	V	1:00:00	(h:min:s)
U31 rms	10/20/2022	6:00:00 PM	422.1	407.4	427.8	V	1:00:00	(h:min:s)

Fig-3.19: Voltage Profile (Phase to Phase)

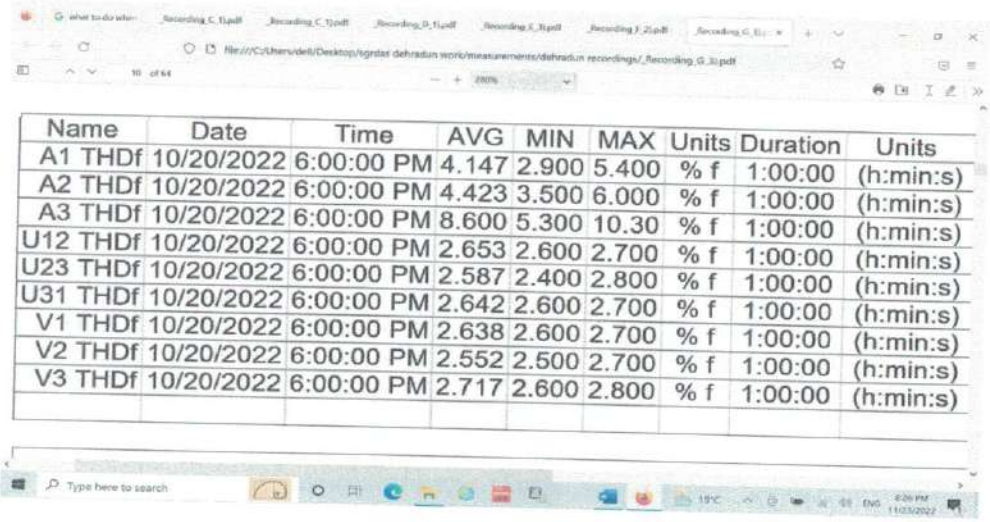


Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	6:00:00 PM	0.988	0.981	0.993		1:00:00	(h:min:s)
PF2	10/20/2022	6:00:00 PM	0.995	0.987	0.999		1:00:00	(h:min:s)
PF3	10/20/2022	6:00:00 PM	0.989	0.982	0.995		1:00:00	(h:min:s)
PFT	10/20/2022	6:00:00 PM	0.991	0.986	0.996		1:00:00	(h:min:s)

Fig-3.20: Power Factor during Measurement

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.21.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	6:00:00 PM	4.147	2.900	5.400	% f	1:00:00	(h:min:s)
A2 THDf	10/20/2022	6:00:00 PM	4.423	3.500	6.000	% f	1:00:00	(h:min:s)
A3 THDf	10/20/2022	6:00:00 PM	8.600	5.300	10.30	% f	1:00:00	(h:min:s)
U12 THDf	10/20/2022	6:00:00 PM	2.653	2.600	2.700	% f	1:00:00	(h:min:s)
U23 THDf	10/20/2022	6:00:00 PM	2.587	2.400	2.800	% f	1:00:00	(h:min:s)
U31 THDf	10/20/2022	6:00:00 PM	2.642	2.600	2.700	% f	1:00:00	(h:min:s)
V1 THDf	10/20/2022	6:00:00 PM	2.638	2.600	2.700	% f	1:00:00	(h:min:s)
V2 THDf	10/20/2022	6:00:00 PM	2.552	2.500	2.700	% f	1:00:00	(h:min:s)
V3 THDf	10/20/2022	6:00:00 PM	2.717	2.600	2.800	% f	1:00:00	(h:min:s)

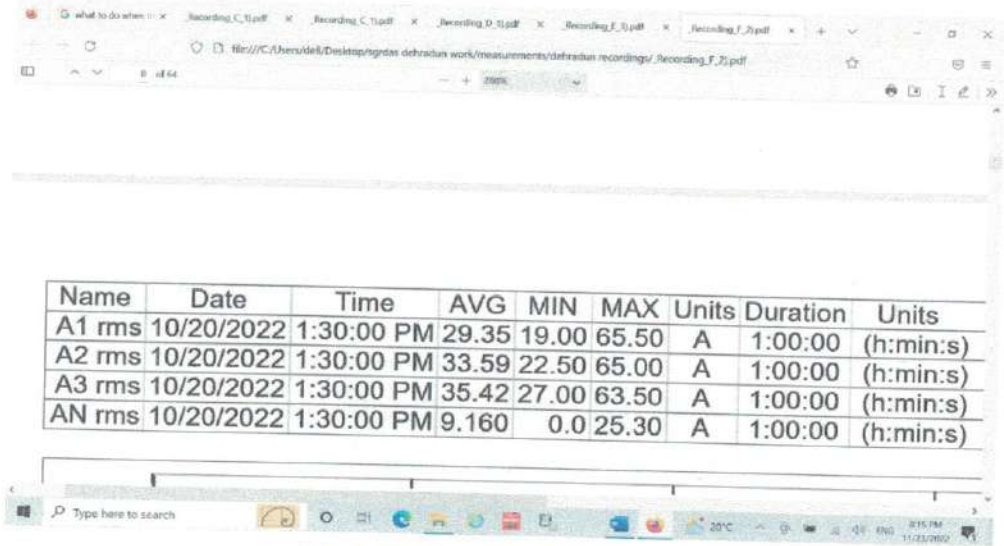
Fig-3.21: THD Profile

(V) JR Hostel Sub Station of 200 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 13.30 PM to 14.30 PM on dated 20.10.2022. The key parameters were as follows:

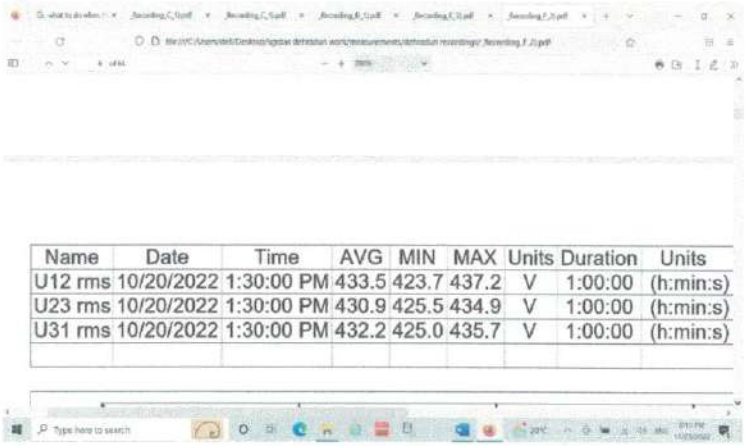
Recording Date: 20/10/2022

a. Current, Voltage and Power Factor



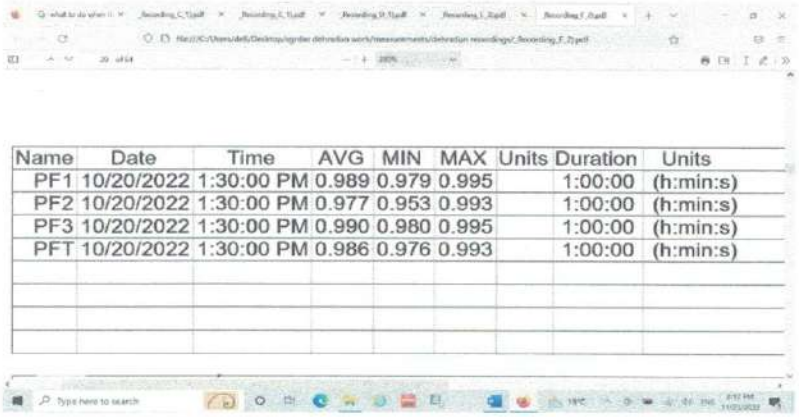
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	1:30:00 PM	29.35	19.00	65.50	A	1:00:00	(h:min:s)
A2 rms	10/20/2022	1:30:00 PM	33.59	22.50	65.00	A	1:00:00	(h:min:s)
A3 rms	10/20/2022	1:30:00 PM	35.42	27.00	63.50	A	1:00:00	(h:min:s)
AN rms	10/20/2022	1:30:00 PM	9.160	0.0	25.30	A	1:00:00	(h:min:s)

Fig-3.22: Current Profile



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	1:30:00 PM	433.5	423.7	437.2	V	1:00:00	(h:min:s)
U23 rms	10/20/2022	1:30:00 PM	430.9	425.5	434.9	V	1:00:00	(h:min:s)
U31 rms	10/20/2022	1:30:00 PM	432.2	425.0	435.7	V	1:00:00	(h:min:s)

Fig-3.23: Voltage Profile (Phase to Phase)

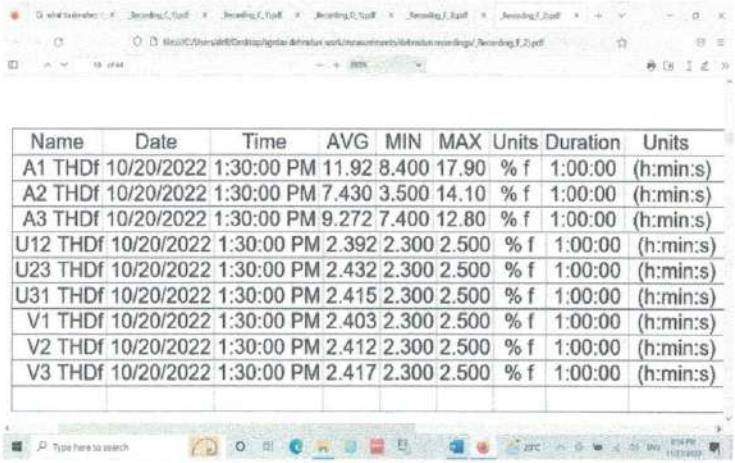


Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	1:30:00 PM	0.989	0.979	0.995		1:00:00	(h:min:s)
PF2	10/20/2022	1:30:00 PM	0.977	0.953	0.993		1:00:00	(h:min:s)
PF3	10/20/2022	1:30:00 PM	0.990	0.980	0.995		1:00:00	(h:min:s)
PFT	10/20/2022	1:30:00 PM	0.986	0.976	0.993		1:00:00	(h:min:s)

Fig-3.24: Power Factor during Measurement

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.25.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	1:30:00 PM	11.92	8.400	17.90	% f	1:00:00	(h:min:s)
A2 THDf	10/20/2022	1:30:00 PM	7.430	3.500	14.10	% f	1:00:00	(h:min:s)
A3 THDf	10/20/2022	1:30:00 PM	9.272	7.400	12.80	% f	1:00:00	(h:min:s)
U12 THDf	10/20/2022	1:30:00 PM	2.392	2.300	2.500	% f	1:00:00	(h:min:s)
U23 THDf	10/20/2022	1:30:00 PM	2.432	2.300	2.500	% f	1:00:00	(h:min:s)
U31 THDf	10/20/2022	1:30:00 PM	2.415	2.300	2.500	% f	1:00:00	(h:min:s)
V1 THDf	10/20/2022	1:30:00 PM	2.403	2.300	2.500	% f	1:00:00	(h:min:s)
V2 THDf	10/20/2022	1:30:00 PM	2.412	2.300	2.500	% f	1:00:00	(h:min:s)
V3 THDf	10/20/2022	1:30:00 PM	2.417	2.300	2.500	% f	1:00:00	(h:min:s)

Fig-3.25: THD Profile

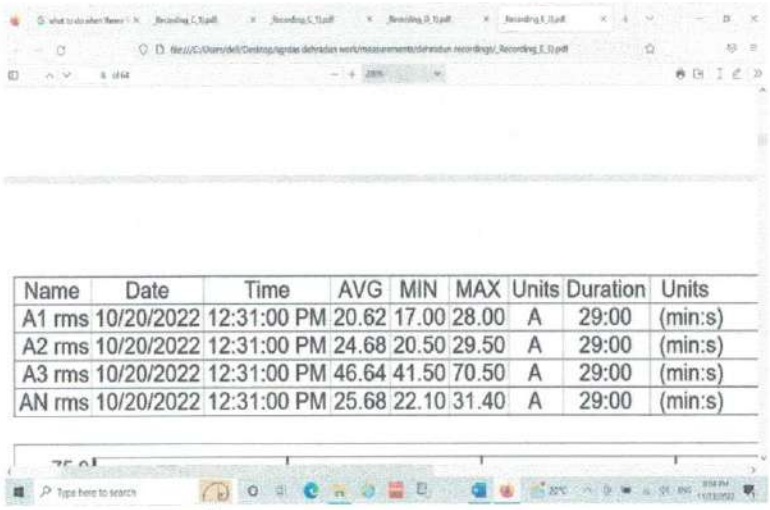
Total Harmonic Distortion of current are slightly more than 10% limit.

(VI) Para Medical College Sub Station of 75 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 13.30 PM to 14.00 PM on dated 20.10.2022. The key parameters were as follows:

Recording Date: 20/10/2022

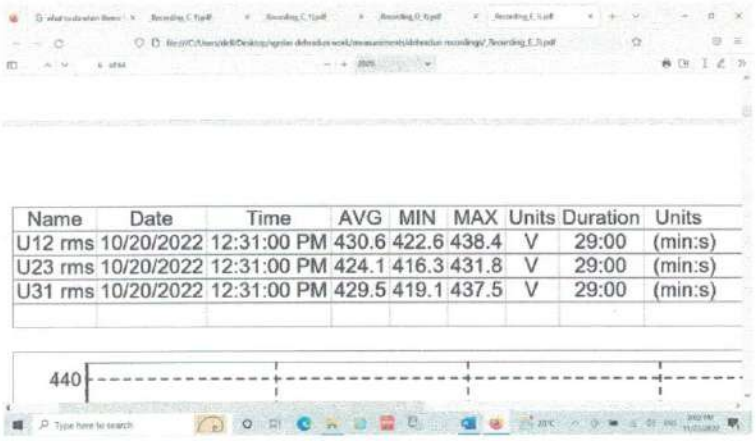
a. Current, Voltage and Power Factor



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	12:31:00 PM	20.62	17.00	28.00	A	29:00	(min:s)
A2 rms	10/20/2022	12:31:00 PM	24.68	20.50	29.50	A	29:00	(min:s)
A3 rms	10/20/2022	12:31:00 PM	46.64	41.50	70.50	A	29:00	(min:s)
AN rms	10/20/2022	12:31:00 PM	25.68	22.10	31.40	A	29:00	(min:s)

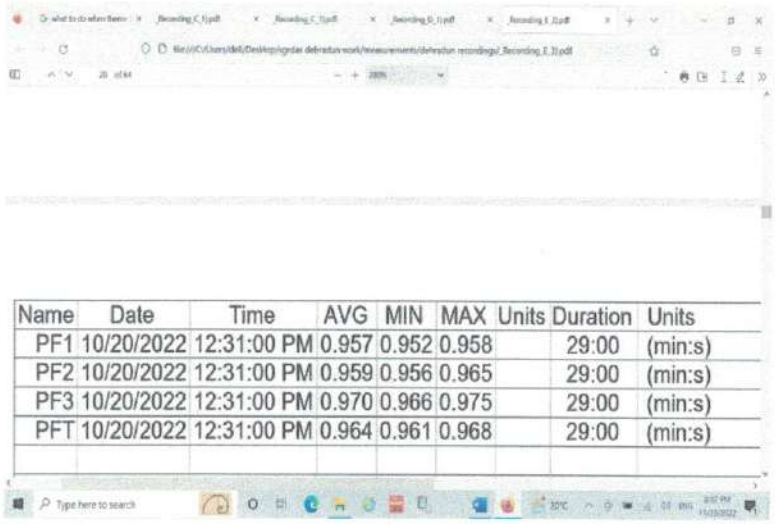
Fig-3.26: Current Profile

The load on all the three phases was found highly unbalanced and need balancing.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	12:31:00 PM	430.6	422.6	438.4	V	29:00	(min:s)
U23 rms	10/20/2022	12:31:00 PM	424.1	416.3	431.8	V	29:00	(min:s)
U31 rms	10/20/2022	12:31:00 PM	429.5	419.1	437.5	V	29:00	(min:s)

Fig-3.27: Voltage Profile (Phase to Phase)

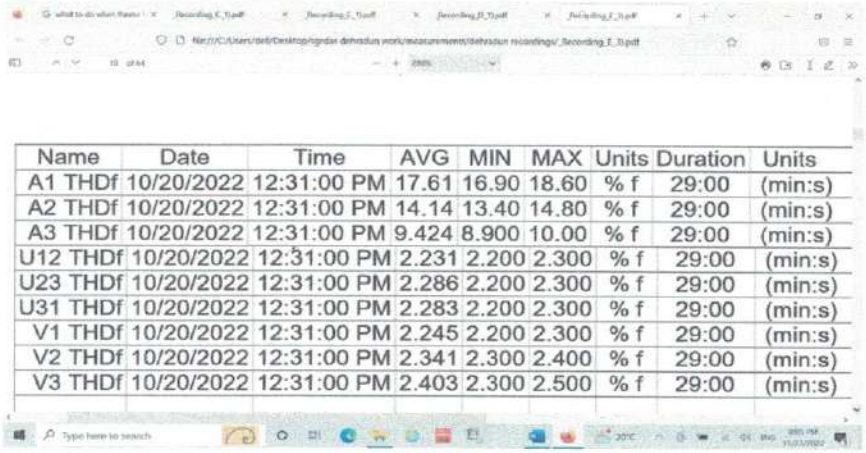


Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	12:31:00 PM	0.957	0.952	0.958		29:00	(min:s)
PF2	10/20/2022	12:31:00 PM	0.959	0.956	0.965		29:00	(min:s)
PF3	10/20/2022	12:31:00 PM	0.970	0.966	0.975		29:00	(min:s)
PFT	10/20/2022	12:31:00 PM	0.964	0.961	0.968		29:00	(min:s)

Fig-3.28: Power Factor during Measurement

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.29.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	12:31:00 PM	17.61	16.90	18.60	% f	29:00	(min:s)
A2 THDf	10/20/2022	12:31:00 PM	14.14	13.40	14.80	% f	29:00	(min:s)
A3 THDf	10/20/2022	12:31:00 PM	9.424	8.900	10.00	% f	29:00	(min:s)
U12 THDf	10/20/2022	12:31:00 PM	2.231	2.200	2.300	% f	29:00	(min:s)
U23 THDf	10/20/2022	12:31:00 PM	2.286	2.200	2.300	% f	29:00	(min:s)
U31 THDf	10/20/2022	12:31:00 PM	2.283	2.200	2.300	% f	29:00	(min:s)
V1 THDf	10/20/2022	12:31:00 PM	2.245	2.200	2.300	% f	29:00	(min:s)
V2 THDf	10/20/2022	12:31:00 PM	2.341	2.300	2.400	% f	29:00	(min:s)
V3 THDf	10/20/2022	12:31:00 PM	2.403	2.300	2.500	% f	29:00	(min:s)

Fig-3.29: THD Profile

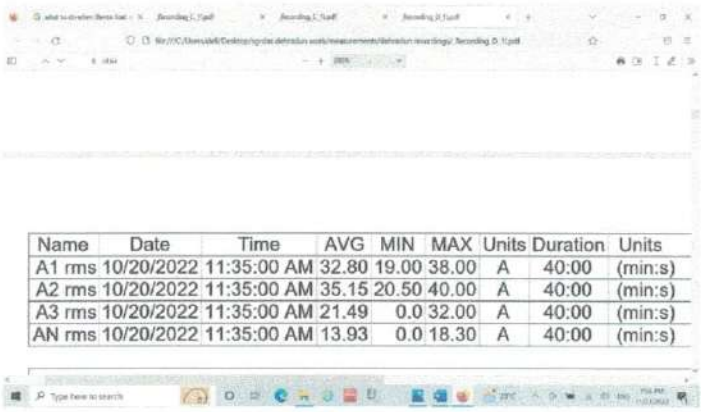
Total Harmonic Distortion of current are more than 10% limit. It is recommended to install Harmonic Filters in consultation of any Harmonic Expert.

(VI) College of Nursing Sub Station of 120 KW sanctioned Load

Power Analyzer was installed on Main Bus bar of incoming Distribution Panel from 11.35 PM to 12.15 PM on dated 20.10.2022. The key parameters were as follows:

Recording Date: 20/10/2022

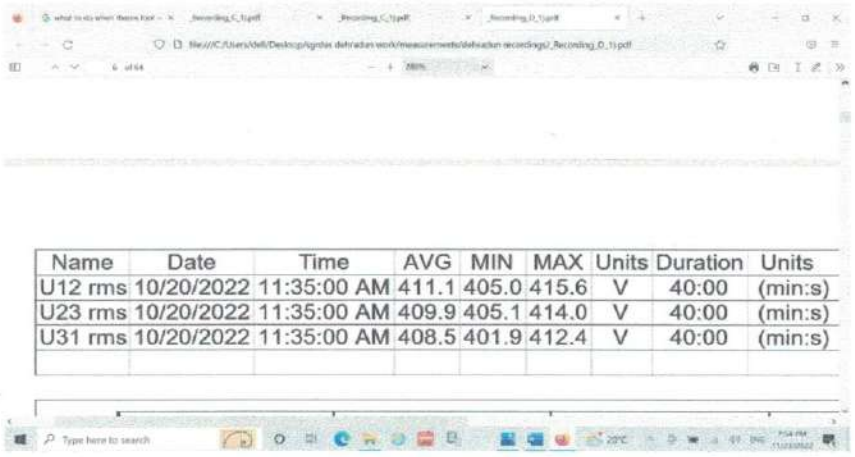
a. Current, Voltage and Power Factor



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	10/20/2022	11:35:00 AM	32.80	19.00	38.00	A	40:00	(min:s)
A2 rms	10/20/2022	11:35:00 AM	35.15	20.50	40.00	A	40:00	(min:s)
A3 rms	10/20/2022	11:35:00 AM	21.49	0.0	32.00	A	40:00	(min:s)
AN rms	10/20/2022	11:35:00 AM	13.93	0.0	18.30	A	40:00	(min:s)

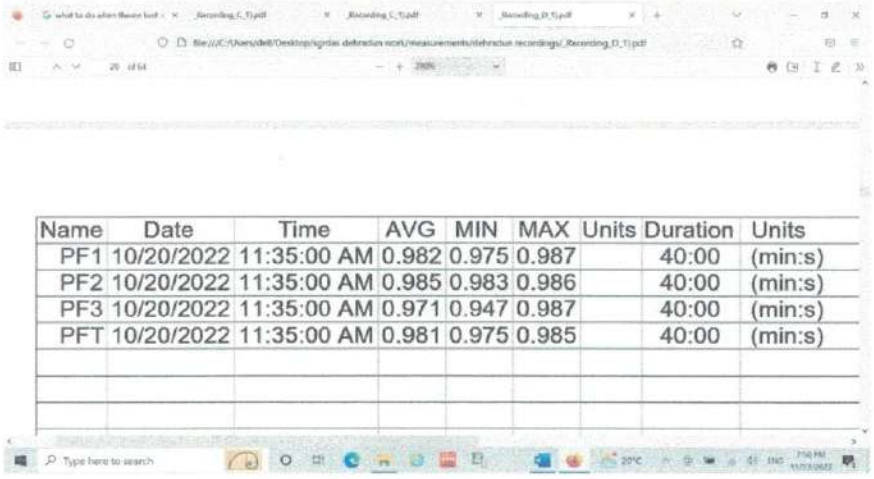
Fig-3.30: Current Profile

The load on all the three phases was found highly unbalanced and need balancing.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
U12 rms	10/20/2022	11:35:00 AM	411.1	405.0	415.6	V	40:00	(min:s)
U23 rms	10/20/2022	11:35:00 AM	409.9	405.1	414.0	V	40:00	(min:s)
U31 rms	10/20/2022	11:35:00 AM	408.5	401.9	412.4	V	40:00	(min:s)

Fig-3.31: Voltage Profile (Phase to Phase)

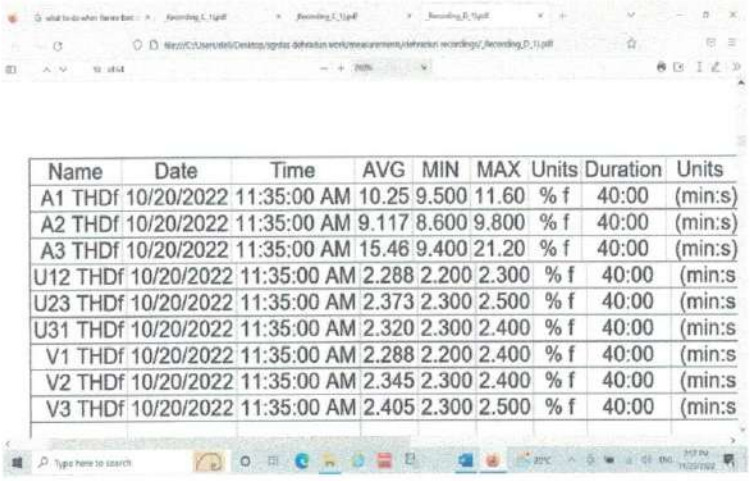


Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
PF1	10/20/2022	11:35:00 AM	0.982	0.975	0.987		40:00	(min:s)
PF2	10/20/2022	11:35:00 AM	0.985	0.983	0.986		40:00	(min:s)
PF3	10/20/2022	11:35:00 AM	0.971	0.947	0.987		40:00	(min:s)
PFT	10/20/2022	11:35:00 AM	0.981	0.975	0.985		40:00	(min:s)

Fig-3.32: Power Factor during Measurement

b. Harmonic Distortion and Total Harmonic Distortion (THD)

The abstract of Current and Voltage THD have been shown in Fig-3.6.



Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 THDf	10/20/2022	11:35:00 AM	10.25	9.500	11.60	% f	40:00	(min:s)
A2 THDf	10/20/2022	11:35:00 AM	9.117	8.600	9.800	% f	40:00	(min:s)
A3 THDf	10/20/2022	11:35:00 AM	15.46	9.400	21.20	% f	40:00	(min:s)
U12 THDf	10/20/2022	11:35:00 AM	2.288	2.200	2.300	% f	40:00	(min:s
U23 THDf	10/20/2022	11:35:00 AM	2.373	2.300	2.500	% f	40:00	(min:s
U31 THDf	10/20/2022	11:35:00 AM	2.320	2.300	2.400	% f	40:00	(min:s
V1 THDf	10/20/2022	11:35:00 AM	2.288	2.200	2.400	% f	40:00	(min:s
V2 THDf	10/20/2022	11:35:00 AM	2.345	2.300	2.400	% f	40:00	(min:s
V3 THDf	10/20/2022	11:35:00 AM	2.405	2.300	2.500	% f	40:00	(min:s

Fig-3.33: THD Profile

Total Harmonic Distortion of current are more than 10% limit. It is recommended to install Harmonic Filters in consultation of any Harmonic Expert.

3.2.4 Capacitor Banks

No Capacitors were found installed in any Electrical connection of University

3.2.5 Review of Electricity Bills, Contract Demand

Due to Corona during Year 2020 and first half of Year 2021, calendar year wise study will not solve any purpose. As such the study of all parameters has been done for the period from October 2021 to September 2022. The power consumption, maximum Demand and Power Factor of all the connections from have been tabulated in Table-3.3 to Table-3.9.

Admin Block Connection No SD0K000008197 (100 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	23360	25040	920	78	0.93
2	Nov-21	13960	15880	1560	59.6	0.88
3	Dec-21	30280	31920	120	100	0.95
4	Jan-22	29440	30680	360	102.4	0.96
5	Feb-22	20920	22200	800	77.6	0.94

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
6	Mar-22	17280	18600	2840	64.8	0.93
7	Apr-22	26640	28680	560	84.8	0.93
8	May-22	33520	35600	320	96.4	0.94
9	Jun-22	39240	41080	120	106.4	0.96
10	Jul-22	39760	41520	200	104.8	0.96
11	Aug-22	28160	29640	1240	100.8	0.95
12	Sep-22	31560	33160	160	106.8	0.95
	Total	**334120**	**354000**	**9200**	**1082.4**	**0.94**

Table-3.3: Power consumption, maximum Demand and Power Factor of Admin Block Connection

From Table-3.3, it is observed that maximum demand of the year is higher than sanctioned load. Average Power Factor: 0.94. Maximum demand can be decreased by improving power factor to 0.99 by installing capacitor bank. Also some load may be transferred on nearby connection, if possible. Otherwise, the sanctioned load is required to be increased.

Anatony Block Connection No SD0K00000778 (120 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	4200	5880	60	19.8	0.71
2	Nov-21	3960	4980	180	24	0.80
3	Dec-21	9540	10920	60	46.8	0.87
4	Jan-22	9180	10560	120	44.4	0.87
5	Feb-22	4020	5580	360	28.2	0.72
6	Mar-22	2880	4680	300	26.4	0.62
7	Apr-22	7740	8880	0	30	0.87
8	May-22	8460	9720	60	31.2	0.87
9	Jun-22	6360	8400	120	36.6	0.76
10	Jul-22	6540	8100	60	27	0.81
11	Aug-22	4020	5400	180	22.8	0.74
12	Sep-22	2940	4200	300	18	0.7
	Total	**69840**	**87300**	**1800**	**355.2**	**0.78**

Table-3.4: Power consumption, maximum Demand and Power Factor of Anatony Block Connection

Average Power Factor: 0.78. It is being observed that Power Factor of the Anatony Block connection is very poor. Power factor need to be increased by

installing Capacitor Bank.

J R Hostel Connection No SD0K000025051 (200 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	55572	57504		129.48	0.97
2	Nov-21	35757	37341		109.92	0.96
3	Dec-21	64569	65238		164.52	0.99
4	Jan-22	85947	86553	0	199.86	0.99
5	Feb-22	58995	59715	0	177.3	0.99
6	Mar-22	43368	44454	0	124.71	0.98
7	Apr-22	64845	66099	0	157.41	0.98
8	May-22	76770	77865	0	167.37	0.99
9	Jun-22	81201	82437	0	200.76	0.99
10	Jul-22	55434	56574	0	121.02	0.98
11	Aug-22	57375	58581	0	119.28	0.98
12	Sep-22	53826	55314	0	119.04	0.97
	Total	**733659**	**747675**	**0**	**1790.67**	**0.98**

Table-3.5: Power consumption, maximum Demand and Power Factor of J R Hostel Connection

It is being observed that Power Factor of the J R Hostel Connection is 0.98, which is very good.

Paramedical College Connection No SD0K000005317 (75 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	16600	17060		45.80	0.97
2	Nov-21	13700	14200		39.60	0.96
3	Dec-21	16080	16400		43.80	0.98
4	Jan-22	15820	16040	0	47	0.99
5	Feb-22	12940	13180	0	41.2	0.98
6	Mar-22	18440	18780	0	47.6	0.98
7	Apr-22	22500	22760	0	48.8	0.99
8	May-22	23540	23760	0	46.6	0.99
9	Jun-22	19580	19800	0	48.2	0.99
10	Jul-22	23140	23380	0	51	0.99
11	Aug-22	22020	22240	0	53.4	0.99
12	Sep-22	22700	22920		57.8	0.99
	Total	**227060**	**230520**	**0**	**570.8**	**0.98**

Table-3.6: Power consumption, maximum Demand and Power Factor of Paramedical College Connection

It is being observed that Power Factor of the Paramedical College connection

is 0.98, which is very good.

College of Nursing Connection No SD0K000027977 (75 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	1360	1600	1600	34.40	0.85
2	Nov-21	320	360	360	3.60	0.89
3	Dec-21	2840	2840	2840	14.00	1.00
4	Jan-22	1920	2000	2000	18	0.96
5	Feb-22	3600	4320	4320	34.8	0.83
6	Mar-22	6360	6360	6360	46.8	0.93
7	Apr-22	6360	6840	6840	43.2	0.93
8	May-22	8400	9240	9240	108	0.91
9	Jun-22	6360	6480	6480	81.6	0.98
10	Jul-22	11400	12600	9360	128.4	0.9
11	Aug-22	8520	9360	9360	87.6	0.91
12	Sep-22	9480	10320	8160	72	0.92
	Total	**66920**	**72320**	**66920**	**672.4**	**0.92**

Table-3.7: Consumption, Maximum Demand and PF of College of Nursing

From Table-3.7, it is observed that maximum demand of the year is higher than sanctioned load. Average Power Factor is 0.92. Maximum demand can be decreased by improving power factor to 0.99 by installing capacitor bank. The sanctioned load is also required to be increased.

S G R R University Connection No SD0K000123866 (75 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	4320	4560		28.8	0.95
2	Nov-21	3360	3840		20.4	0.88
3	Dec-21	3600	3960		20.4	0.91
4	Jan-22	3120	3480	0	20.4	0.9
5	Feb-22	2760	2760	0	18	1
6	Mar-22	4320	4920	0	27.6	0.88
7	Apr-22	6360	6480	0	32.4	0.98
8	May-22	8880	9240	0	33.6	0.96
9	Jun-22	6120	6360	0	21.6	0.96
10	Jul-22					
11	Aug-22	6760	7880	2200	21.6	0.86
12	Sep-22	5040	5680	1240	39.2	0.89
	Total	**54640**	**59160**	**3440**	**284**	**0.92**

Table-3.8:Consumption, maximum Demand and PF of S G R R University

Average Power Factor: 0.92. It is being observed that Power Factor of the S G R R University connection is poor. Capacitor Bank needs to be installed.

ITS Connection No SD0K000021976 (255 KW)

Sr. No	Month/Year	Power Consumption		Solar (KWH)	Maximum Demand (KVA)	Power Factor
		KWH	KVAH			
1	Oct-21	4518	6780	3666	53.04	0.67
2	Nov-21	2424	3552	3552	43.2	0.68
3	Dec-21	3168	4302	2700	23.52	0.74
4	Jan-22	3498	4602	3258	0	0.76
5	Feb-22	2688	3534	3534	0	0.76
6	Mar-22	2616	3516	3516	0	0.74
7	Apr-22	3594	5208	4572	0	0.69
8	May-22	9384	13164	3270	0	0.71
9	Jun-22	11394	16710	2472	0	0.68
10	Jul-22	9180	12540	2688	0	0.73
11	Aug-22	10326	13536	4152	0	0.76
12	Sep-22	14910	19098	2070		0.78
	Total	**77700**	**106542**	**39450**	**119.76**	**0.73**

Table-3.9: Power consumption, maximum Demand and PF of ITS Connection

Average Power Factor: 0.73. It is being observed that Power Factor of the ITS is very poor. Capacitor Bank need to be installed.

Total Power Consumption of all Connections

Sr No	Location	KW	Energy Consumption during Year 2021-2022 (KWH)	Maximum Demand during the year (KVA)	Av Power Factor
1	Admin Block	100	334120	106.8	0.94
2	Anatomy Block	120	69840	46.8	0.78
3	J R Hostel	200	733659	200.76	0.98
4	Paramedical College (Nursing Home)	75	227060	57.8	0.98
5	College Of Nursing	75	66920	128.4	0.92
6	S.G.R.R University	75	54640	39.2	0.92
7	I.T.S	255	77700	53.04	0.73
	Total	**900**	**1563939**		

Table-3.10: Total Power Consumption of all Connections

It is recommended that capacitor banks may be installed in those Electrical connections, where power factor is less than 0.98. It will save billing units (KVAH) and reduce demand.

3.3 Non-Conventional Electrical Energy Source

There are Solar Plants in the University as per details given in Table-3.11.

Sr No	Place	Buildings	Capacity (KW)
1	Nursing College	Nursing	63.04
2	Admin Block	Admin	99.84
3	ITS Block	Library	48.64
		Microbiology	51.2
		Pharmacy	49.92
4	Anatomy Block	Anatomy	23.04
		Eaxmination	65.6
		Faculty	24.32
5	University	University	57.6
	Total Capacity		**483.2**

Table-3.11: Solar Plants capacity installed in SGRR University (KW)

Solar generation from Sept-21 to August-22 was as per Table-3.12.

Sr No	Month	Nursing Block (KWH)	Other Block (KWH)	Total (KWH)
1	Sep-21	5909	33184	39093
2	Oct-21	6527	35447	41974
3	Nov-21	6045	29882	35927
4	Dec-21	NA	NA	NA
5	Jan-22	4866	24877	29743
6	Feb-22	6266	32504	38770
7	Mar-22	8742	47939	56681
8	Apr-22	9294	51012.7	60306.7
9	May-22	8908	50269	59177
10	Jun-22	8508	47982	56490
11	Jul-22	7027	39257	46284
12	Aug-22	6737	38332	45069
	Total	**78829**	**430685.7**	**509514.7**

Table-3.12: Solar generation from Sept-21 to August-22

Total Solar Genaration for 11 months was 509514.7 KWH

Yearly solar generation on average basis: 555834 KWH

3.4 Diesel Generator Set

There are six no DG sets of capacity as shown in Table-3.12

Sr No	DG Set Location	Capacity (KVA)	Nos
1	Medical Collage	125	2
2	Pathri Bagh	82.5	1
3	ITS	125	1
4	Nursing Collage	82.5	1
5	Paramedical Collage	62.5	1
	Total	**602.5**	**6**

Table-3.12: Capacities of DG sets installed in SGRR University

Fig-34: 82.5 KVA DG Set installed in SGRR University, Patthribagh

3.4.1 Diesel Consumption of D G Sets

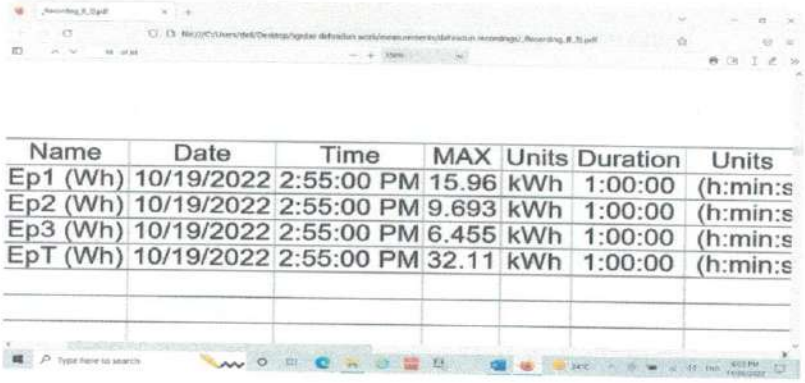
The Diesel consumption of past one year has been shown in Table-3.13

Sr No	DG Set Location	Capacity (KVA)	No	Liters	Running Hrs
1	Medical Collage	125	2	3400	96
2	Pathri Bagh	82.5	1	1200	56
3	ITS	125	1	800	35
4	Nursing Collage	82.5	1	400	35
5	Paramedical Collage	62.5	1	250	35
	Total			**6050**	**257**

Table-3.13: Statement of Diesel Consumption

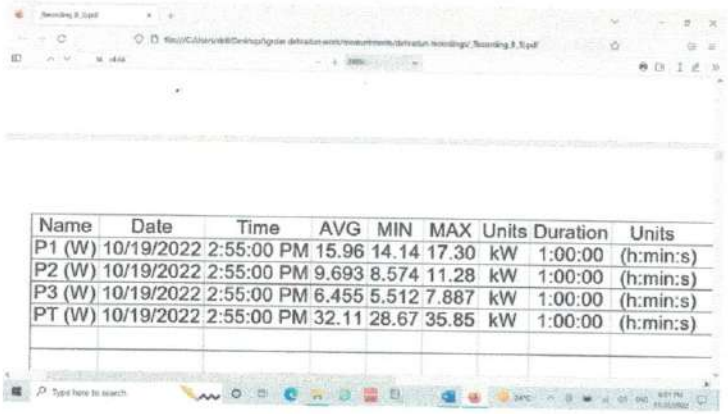
3.4.2 Performance Test of DG Set

As the running Hours per day of all DG sets are 257/365 i.e., 42.25 minutes (very less), performance evaluation of DG Set is not necessary. However, DG Set of 125 KVA capacity installed in ITS was chosen for Performance Test and was run for one hour from 14.55 PM to 15.54 PM on dated 19.10.2022 and Diesel consumption was noted. Units produced along with load were recorded, which have been shown in Fig-3.35 & 3.36.



Name	Date	Time	MAX	Units	Duration	Units
Ep1 (Wh)	10/19/2022	2:55:00 PM	15.96	kWh	1:00:00	(h:min:s
Ep2 (Wh)	10/19/2022	2:55:00 PM	9.693	kWh	1:00:00	(h:min:s
Ep3 (Wh)	10/19/2022	2:55:00 PM	6.455	kWh	1:00:00	(h:min:s
EpT (Wh)	10/19/2022	2:55:00 PM	32.11	kWh	1:00:00	(h:min:s

Fig-3.35: Total Units generated by Dg Set 450 KVA



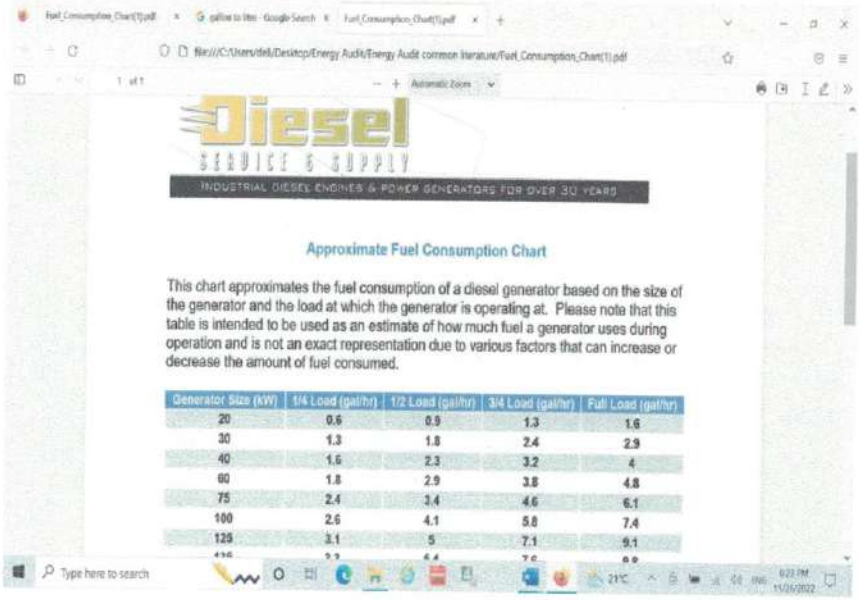
Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
P1 (W)	10/19/2022	2:55:00 PM	15.96	14.14	17.30	kW	1:00:00	(h:min:s)
P2 (W)	10/19/2022	2:55:00 PM	9.693	8.574	11.28	kW	1:00:00	(h:min:s)
P3 (W)	10/19/2022	2:55:00 PM	6.455	5.512	7.887	kW	1:00:00	(h:min:s)
PT (W)	10/19/2022	2:55:00 PM	32.11	28.67	35.85	kW	1:00:00	(h:min:s)

Fig-3.36: Average Load recorded by Power Analyzer

From Units recorded by Power Analyzer (Fig-3.35), it has been observed that total units generated in one hour was 32.11 KWH. The Diesel consumption was 23 Liters. From load recorded by Power Analyzer (Fig-3.36), it has been observed that the average load during one hour was 32.11 KW (i.e. 37.77 KVA based on 0.85 PF). Percent Loading of DG Set=37.77/125*100=30.22%.

Specific Fuel Consumption= 23/32.11=0.717 Liters/KWH

The Fuel Consumption of 23 Liters per hour of DG set is higher than 3.1 gallon i.e 11.74 liters per hour at 25% loading as per chart shown in Fig-3.37. On 30% loading it should be not more than 14.1 Litres per Hour.


Diesel
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Approximate Fuel Consumption Chart

This chart approximates the fuel consumption of a diesel generator based on the size of the generator and the load at which the generator is operating at. Please note that this table is intended to be used as an estimate of how much fuel a generator uses during operation and is not an exact representation due to various factors that can increase or decrease the amount of fuel consumed.

Generator Size (kW)	1/4 Load (gal/hr)	1/2 Load (gal/hr)	3/4 Load (gal/hr)	Full Load (gal/hr)
20	0.6	0.9	1.3	1.6
30	1.3	1.8	2.4	2.9
40	1.6	2.3	3.2	4
60	1.8	2.9	3.8	4.8
75	2.4	3.4	4.6	6.1
100	2.6	4.1	5.8	7.4
125	3.1	5	7.1	9.1

Fig-3.37: Standard Fuel Consumption of DG set

No replacement of DG set is recommended in view of less running hours.

3.5 Other Sources of Energy

The other sources of energy used in Shri Guru Ram Rai University is LPG. The consumption of LPG in Mess and Canteen was found 4800 cylinders (19 Kg) i.e. 91200 Kgs

3.6 Total Energy Consumption of Shri Guru Ram Rai University

Table-3.14, summarize the Energy consumption from various sources of energy in Shri Guru Ram Rai University during Year 2021-22.

Sl. No	Particulars	Unit	Quantity
1	Electricity (Grid)	KWH	1563939
2	Electricity (Solar)	KWH	509514.7
	Total Electrical Energy	KWH	2073453.7
3	Diesel	Litters	6050
4	LPG	Kgs	91200

Table-3.14: Energy Consumption from different Sources

3.7 Connected Load of Electrical Appliances

Sr No	Name of Item/Equipment	Capacity (W)	Total Nos	Total capacity (KW)
1	CFL	36	88	3.168
		12	122	1.464
2	LED Lamps	15	855	12.825
		9	310	2.79
		7	445	3.115
		36	375	13.5
3	Tubelight	40	3050	122
		28	2150	60.2
4	LED Tubelite	20/18	2315	44.79
5	LED Pole Lights	72	91	6.552
		25	55	1.375
6	Fans	55	3580	196.9
		75	1950	146.25
7	Blower Heater	2000	85	170
8	Room Heaters	800	25	20
9	Refrigerator	500	5	2.5
10	Exaust Fan			
	18 inch	410	28	11.48
	12 inch	50	955	47.75
	9 inch	40	980	39.2
11	Air Conditioners			
	1.5 T split	1600	21	33.6
	1.5 ton window	1800	9	16.2
	2.0 T split	3200	39	124.8
	3.0 T Split	4800	24	115.2
	2.0 T Cusset	3200	1	3.2
	3.0 T Cusset	4800	1	4.8
12	Packaged Air Conditioners			
	5.5 T	6050	11	66.55
	8.5 T	9350	28	261.8
	11 T	12100	17	205.7
13	Computer system	150	905	135.75
14	Printers	300	99	29.7
15	Photocopier	500	8	4
16	Projectors	800	98	78.4
17	Pumps			
18	Tube wells 17.5 HP	13055	4	52.22
19	Fire Pump Motors 15 HP	11190	2	22.38
20	Fire Pump Motors 7.5 HP	5595	3	16.785
	SubTotal			**2076.944**

Table-3.15: Connected Load of Electrical Appliances

3.8 Lighting & Illumination

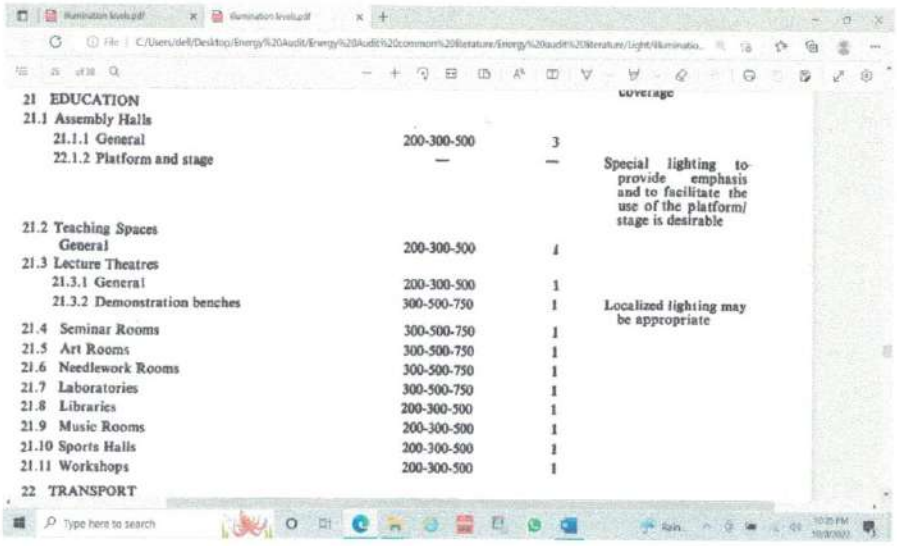
Illumination Level of various Buildings of Shri Guru Ram Rai University are as per Table-3.16.

Sr No	Particulars	Lux Level	Sr No	Particulars	Lux Level
	MBBS Girls Hostal Old			**Paramedical Collage**	
1	Room No 25	44	45	Wardens Office	121
2	Room No 2	52	46	Room No 16	113
3	Room No 5	58	47	Room No 156	85
4	Room No 52	108	48	Room No 170	79
5	Room No 46	98	49	Room No 173	126
6	Room No 88	55	50	Room No 192	135
7	Room No 92	74	51	Room No 176	128
8	Room No 95	26	52	Room No 174	111
9	Room No 118	57	53	Room No 30	110
10	Room No 116	64		**J R Hostal**	
	MBBS Girls Hostal new		51	Room no 48	77
11	Room No G2	70	52	Room no 46	133
12	Room No G9	62	53	Room no 24	137
13	Room No 3	121	54	Room no 26	55
14	Room No F20	95		**Admin Block**	
15	Room No 9	44	55	Centrol Of Examination	147
16	Room No 28	102	56	Principal Office	230
17	Room No 41	149	57	Principal Office	205
18	Room No 36	117	58	Vice Principal Office	145
	MBBS Boy Hostal	0	59	Cmmittee Room	206
19	Room No G 23	36	60	Library	85
20	Room No G 26	39		**Lecture Theatre Hall**	
21	Room No G 30	57	61	LT 01	98
22	Room No G 41	87	62	LT 02	192
23	Room No 11 1st Floor	62	63	Experimental Lab	132
24	Room No 8 1st Floor	44	64	Hematology Lab	79
25	Room No 16 1st Floor	67	65	Clinical Laboratory	100
26	Room No 23 1st Floor	65		**ITS**	
27	Room No 26 2nd Floor	59	66	Room No 102	90
28	Room No 28 2nd Floor	54	67	Room No 110	209
29	Room No 49 2nd Floor	97	68	Room No 101	191
30	Room No 31 2nd Floor	69	69	Room No 103	140
31	Dining Hall 2nd Floor	50	70	Register Office	342

Sr No	Particulars	Lux Level	Sr No	Particulars	Lux Level
	Pathri Baag			**Street Light (During Night)**	
32	Library	112	71	I TS Main Gate	40
33	Girls Hostal Room No 111	92	72	Register Office	74
34	Room No 216	137	73	Computer Center	47
35	Admin Call	121	74	Medical Collage Main Gate	49
36	Room No 102	104	75	Anatony	48
37	Room No 105 Lecture Hall	89	76	F M T	58
38	Room No 203	113	77	Girls Hostal	89
	Nursing Home		78	Boy Hostal	39
39	BSc Nursing Home 1st Year Rom No 11	168	79	**Paramedical Collage Main Gate**	50
40	G N M 1st Year	71	80	Main Room	13
41	Examination Hall	94	81	College	24
42	Administer Office	265	82	Hostal	27
43	Reception	105	83	Admin Block	46
44	Penal Room	136	84	Admin Block Parking	38

Table-3.16: Illumination Level of various Buildings

Illumination Level of some Buildings of the University are lower side and should be maintained as per IS 3646 (Part-1)1992 shown in Fig-3.13. Use of natural light should be done by opening curtains in day time.



21 EDUCATION			Coverage
21.1 Assembly Halls			
21.1.1 General	200-300-500	3	
22.1.2 Platform and stage	—	—	Special lighting to provide emphasis and to facilitate the use of the platform/ stage is desirable
21.2 Teaching Spaces			
General	200-300-500	1	
21.3 Lecture Theatres			
21.3.1 General	200-300-500	1	
21.3.2 Demonstration benches	300-500-750	1	Localized lighting may be appropriate
21.4 Seminar Rooms	300-500-750	1	
21.5 Art Rooms	300-500-750	1	
21.6 Needlework Rooms	300-500-750	1	
21.7 Laboratories	300-500-750	1	
21.8 Libraries	200-300-500	1	
21.9 Music Rooms	200-300-500	1	
21.10 Sports Halls	200-300-500	1	
21.11 Workshops	200-300-500	1	
22 TRANSPORT			

Fig-3.38: Lux levels as per IS 3646 (Part-1)1992

3.9 Air-Conditioning System

3.9.1 Details of Air Conditioners

Sr. No	Location	Item Discription					
		Split AC 1.5 T	Split AC 2 T	Split AC 3 T	Window AC 1.5 T	Cusset AC 2 T	Cusset AC 3 T
1	Principal Office	3	1				
2	Guest House	11	3				
3	Pathology Lab Room no 23 & 24		2				
4	Auditorium Waiting Room		1				
5	MIcrobiology Room no 3&4						
6	MIcrobiology Room no 6		2				
7	MIcrobiology Room no 8						
8	MIcrobiology Room no 9		1				
9	MIcrobiology Room no 12						
10	MIcrobiology Room no 13		1				
11	MIcrobiology Room no 16	1					
12	Pharmocology Room no 2						
13	HOD Pharmocology						
14	Animal House		1		4		
15	Physilogy Room no 16						
16	Physilogy Room no 6		1				
17	Physilogy Seminar Room no 8		1				
18	Physilogy Demo Room			3			
19	Biochemistry Deptt.						
20	Molucular Lab	4					
21	Biochemistry Seminar Hall		2				
22	Biochemistry PG Lab		1				
23	Community Medicine Room no 1		1				
24	Anatomy DH Room						
25	Anatomy HOD Room				1		
26	Anatomy Histology Lab		1				
27	FMT Department						
28	ITS Animal House	1			3		
29	ITS VC Room		1				
30	PRO VC Room	1					
31	Meeitng Hall MBA		2				
32	Coferance Hall Staff		2				
33	ITS Life Science		2				
34	ITS Pharmacy		4				
35	ITS Pharmacy Computer Lab		6		1		
36	Computer Lab		2	20			
37	Nursing College Office		1				
38	VC Office			1			
39	Studio					1	
40	Studio						1
	Total	**21**	**39**		**9**	**0**	**0**

Table 3.17- Details of Air Conditioners

3.9.2 Details of Package Units

Sr No	Location (Medical College)	Type	5.5 TR	8.5 TR	11 TR
1	Library	Package Unit		6	
2	Computer Lab	Ductable Unit	2		
3	Library General Section	Ductable Unit			1
4	Library Reading Hall 1st Floor	Ductable Unit			3
5	Library Reading Hall 2nd Floor	Package Unit		6	
6	Auditorium Hall ((Ductable)	Package Unit		2	6
7	Pharmacology Computer Lab	Ductable Unit			2
8	LT 1 Unit	Ductable Unit	1	2	
9	LT 2 Unit	Ductable Unit	1	2	
10	Examination Hall 1st Floor	Ductable Unit	3	3	
11	Examination Hall 2nd Floor	Ductable Unit		7	
12	Molecular Lab	AHU Unit			1
13	Anatony	Cold Room (25 Rack)			
14	Canteen ITS	Ductable Unit	4		
15	ITS Conference Hall	Ductable Unit			4
	Total Nos		**11**	**28**	**17**

Table 3.18- Details of Package Air Conditioners

3.10 Energy Efficiency Measures

Two technologies which have been identified in the Demand Side Management are as follows:

i. Replacement of conventional ceiling fans with Efficient ceiling fans
ii. Replacement of conventional air-conditioners with EE star rated ACs
iii. Replacement of CFL and conventional FTL with LED Lamp/LED Tube Light

3.10.1 Replacement of conventional ceiling fans with Efficient ceiling fans

Replacing conventional fans with star rated fans can save substantial amount of electrical energy and money. We recommend replacement of 1950 existing fans (75 W) with new Energy Efficient fans (26 W). Energy saving and Payback period has been shown in Table-3.19. Price of new Fan has been considered after adjusting scrap vale @ Rs 300 per Fan.

Sr No	Particulars	Quantity	Unit
1	Total nos of non star Fans of 75 W capacity	1950	Nos.
2	Cost of replacement @ Rs 3000 per Fan by 26 W Five star rated Fan	5850000	Rs
	Energy saved per unit @ 49 watts on 10 hours/day and 200 days per year basis	98	W
3	Total Energy saved @ 49 watts on 10 hours/day and 200 days per year basis	191100	KWH
4	Cost of electricity savings per year @ Rs 5.90 per unit	1127490	Rs
5	**Payback period (Year)**	**5.19**	**Years**

Table-3.19: Replacement of conventional ceiling fans with Efficient Ceiling fans

3.10.2 Replacement of conventional air-conditioners with EE star rated ACs

It is proposed to replace 133 nos. non star 1.5 Tons window Air Conditioners (EER 2.2) into 5 Star 1.5 Tons window Air Conditioners (EER 3.5). EER of none of the Air conditioner was available with the University. For EE measures, it was taken from various notifications issued by BEE, based on year of purchase as per Figure-3.14 & Figure-3.15.

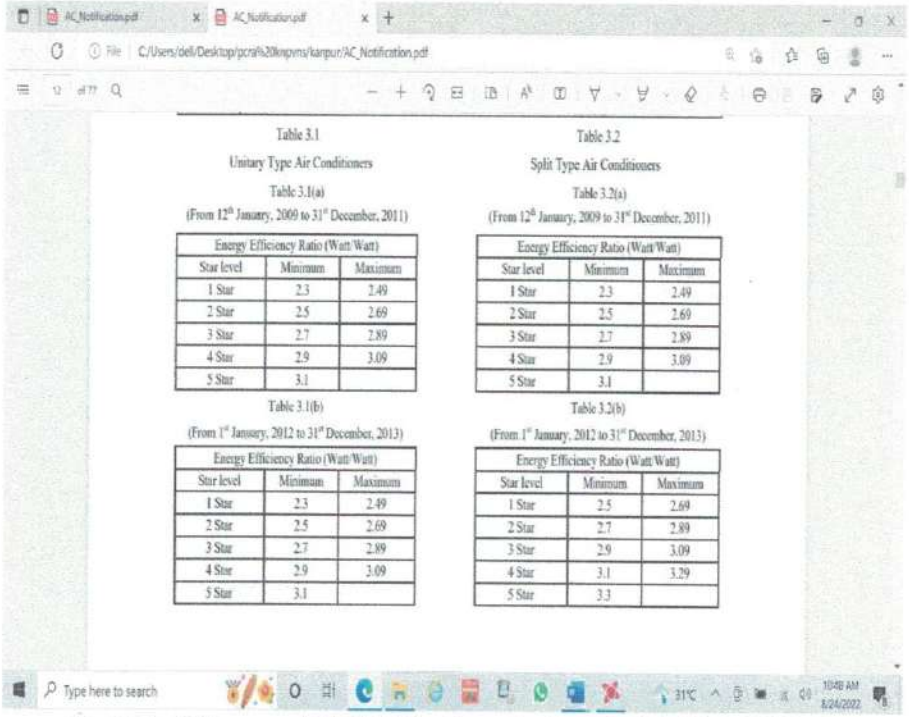


Table 3.1

Unitary Type Air Conditioners

Table 3.1(a)

(From 12th January, 2009 to 31st December, 2011)

Energy Efficiency Ratio (Watt/Watt)		
Star level	Minimum	Maximum
1 Star	2.3	2.49
2 Star	2.5	2.69
3 Star	2.7	2.89
4 Star	2.9	3.09
5 Star	3.1	

Table 3.1(b)

(From 1st January, 2012 to 31st December, 2013)

Energy Efficiency Ratio (Watt/Watt)		
Star level	Minimum	Maximum
1 Star	2.3	2.49
2 Star	2.5	2.69
3 Star	2.7	2.89
4 Star	2.9	3.09
5 Star	3.1	

Table 3.2

Split Type Air Conditioners

Table 3.2(a)

(From 12th January, 2009 to 31st December, 2011)

Energy Efficiency Ratio (Watt/Watt)		
Star level	Minimum	Maximum
1 Star	2.3	2.49
2 Star	2.5	2.69
3 Star	2.7	2.89
4 Star	2.9	3.09
5 Star	3.1	

Table 3.2(b)

(From 1st January, 2012 to 31st December, 2013)

Energy Efficiency Ratio (Watt/Watt)		
Star level	Minimum	Maximum
1 Star	2.5	2.69
2 Star	2.7	2.89
3 Star	2.9	3.09
4 Star	3.1	3.29
5 Star	3.3	

Fig-3.39: EER as per BEE Notifications for Year 2009-11 & 2012-13

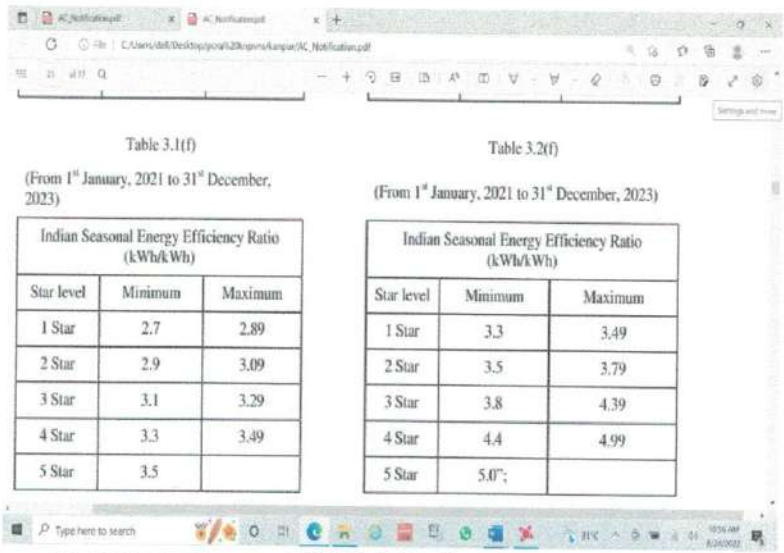


Table 3.1(f)

(From 1st January, 2021 to 31st December, 2023)

Indian Seasonal Energy Efficiency Ratio (kWh/kWh)		
Star level	Minimum	Maximum
1 Star	2.7	2.89
2 Star	2.9	3.09
3 Star	3.1	3.29
4 Star	3.3	3.49
5 Star	3.5	

Table 3.2(f)

(From 1st January, 2021 to 31st December, 2023)

Indian Seasonal Energy Efficiency Ratio (kWh/kWh)		
Star level	Minimum	Maximum
1 Star	3.3	3.49
2 Star	3.5	3.79
3 Star	3.8	4.39
4 Star	4.4	4.99
5 Star	5.0";	

Fig-3.40: EER as per BEE Notifications for Year 2021-2023

3.10.3 Pay Back Period per Unit of Air Conditioner

Pay Back Period per Unit of Air Conditioner proposed for replacement has been shown in Table-3.20.

Existing Air Conditioner (Each unit)				Proposed Air Conditioner (Each unit))						
S. No.	Details	Rated Watt	EER	Details	EER of new AC	Effective Power drawn (W)	Energy Saving per year (KWh)	Cost of Energy saving @ Rs 5.90	Cost of new Five star AC/ Unit (Rs)	Pay Back Period (Yrs)
1	2	3	4	5	6	7=3*4/6	8=(3-7)*10Hr*180 Days/ 1000	9=8*5.90	10	11=10/9
1	Window AC 1.5 Ton capacity non star rating more than eight year old	1450	2.2	Window AC 1.5 Ton capacity five star rating year 2021	3.5	911.43	969.43	5719.63	32000	5.59
2	Split AC non Star 1.5 Ton non star more than 8 years old	1300	2.4	Split AC Five Star 1.5 Ton as per BEE spn Jan 2021	5	624.0	1216.80	7179.12	40000	5.57

Table 3.20: Pay Back Period per Unit air Conditioner

3.10.4 Investment, Energy saving and Pay Back Period for all proposed Air Conditioners (AC)

Sr. No.	Existing Air Conditioner details	Proposed Air Conditioner details	Qty	Energy Saving per year per AC (KWh)	Total Energy saving per year (KWh)	Total Cost of Energy saving @ Rs 5.90 (Rs)	Cost of new Five star AC/ Unit (Rs)	Total Cost of new Five star AC/ Unit (Rs)	Pay Back Period (Yrs)
1	2	3	4	5	6=4*5	7=6*8.50	8	9=4*8	10=9/7
1	Window AC 1.5 Ton capacity non star rating more than eight year old	Window AC 1.5 Ton capacity five star rating year 2021	9	969.43	8724.87	51476.73	32000	288000	5.59
2	Split AC non Star 1.5 Ton non star more than 8 years old	Split AC Five Star 1.5 Ton as per BEE spn Jan 2021	21	1216.8	25552.80	150761.52	40000	840000	5.57

Table-3.21: Cost benefit analysis of proposed Air Conditioners

3.10.5 Replacement of CFL with LED Lamp

Sl No	Particulars	Unit	Proposal	
			CFL 36 W to LED Lamp 18 W @ Rs 180/- Lamp	CFL 12 W to LED Lamp 6 W@ Rs 100/- Lamp
1	Total nos of CFLs	Nos.	88	122
2	Total Cost of replacement	Rs	15840	12200
3	Energy saved by replacement based on 8 hours/day and 300 days per year	KWH	3801.6	1756.8
4	Cost of electricity saved per year @ Rs 5.90 per unit	Rs	22429.44	10365.12
5	**Payback period**	**Years**	**0.71**	**1.18**

Table-22: Replacement of CFL with LED lamps

3.10.6 Replacement of conventional Flurocent Tubelight with LED Tube Light

Sr No	Particulars	Quantity	Unit
1	Total nos of FTLs of 40 W capacity	3050	Nos.
2	Cost of replacement of 20 W LED Tube Light @ Rs 300 per each	915000	Rs
3	Energy saved by replacing 40 W FTLs by 20 W LED Tube lite @ 20 wattson 8 hours/day and 300 days per year basis	146400	KWH
4	Cost of electricity savings per year @ Rs 5.90 per unit	863760	Rs
5	**Payback period (Year)**	**1.06**	**Years**

Table-23: Replacement of FTL with LED Tube Light

3.10.7 Abstract of EE Measure for all Equipment

S. No.	Name of Activity	Qty	Total Energy saving per year (KWh)	Total Cost of Energy saving @ Rs 5.90 (Rs)	Total Cost of Replacement (Rs)	Pay Back Period (Yrs)
1	2	3	4	5	6	7=6/5
1	Replacement of 36 W CFL with 18 W LED Lamp	88	3801.6	22429	15840	0.71
2	Replacement of 12 W CFL with 6 W LED Lamp	122	1756.8	10365	12200	1.18
3	Replacement of 40 W FTL with 20 W LED Tube Light	3050	146400	863760	915000	1.06
4	Replacement of Split AC 1.5 Ton capacity non star rating (more than eight year old) with Five Star Split AC year 2021	9	8724.87	51477	288000	5.59
5	Replacement of Window AC 1.5 Ton capacity non star rating more than eight year old with Five Star Window AC year 2022	21	25552.80	150762	840000	5.57

S. No.	Name of Activity	Qty	Total Energy saving per year (KWh)	Total Cost of Energy saving @ Rs 5.90 (Rs)	Total Cost of Replacement (Rs)	Pay Back Period (Yrs)
6	Replacement of Non star Ceiling Fans 75 W capacity with Five star Fan of 26 W capacity	1950	191100	1127490	5850000	5.19
	Total		**377336**	**2226283**	**7921040**	

Table 3.24: Abstract of EE Measure for all Equipment

3.11 Connected Load of University

Sl No	Name of Equipment	Rating (W)	Quantity	Total Load (KW)
1	CFL	36	88	3.168
		12	122	1.464
2	LED Lamps	15	855	12.825
		9	310	2.79
		7	445	3.115
		36	375	13.5
3	Tubelight	40	3050	122
		28	2150	60.2
4	LED Tubelite	20	1560	31.2
		18	755	13.59
5	LED Pole Lights	72	91	6.552
		25	55	1.375
6	Fans	55	3580	196.9
		75	1950	146.25
7	Blower Heater	2000	85	170
8	Room Heaters	800	25	20
9	Refrigerator	500	5	2.5
10	Exaust Fan			
	18 inch	410	28	11.48
	12 inch	50	955	47.75
	9 inch	40	980	39.2

Sl No	Name of Equipment	Rating (W)	Quantity	Total Load (KW)
11	Air Conditioners			
	1.5 T split	1600	21	33.6
	1.5 ton window	1800	9	16.2
	2.0 T split	3200	39	124.8
	3.0 T Split	4800	24	115.2
	2.0 T Cusset	3200	1	3.2
	3.0 T Cusset	4800	1	4.8
12	Packaged Air Conditioners			
	5.5 T	6050	11	66.55
	8.5 T	9350	28	261.8
	11 T	12100	17	205.7
13	Computer system	150	905	135.75
14	Printers	300	99	29.7
15	Photocopier	500	8	4
16	Projectors	800	98	78.4
17	Pumps			
18	Tube wells 17.5 HP	13055	4	52.22
19	Fire Pump Motors 15 HP	11190	2	22.38
20	Fire Pump Motors 7.5 HP	5595	3	16.785
	SubTotal			**2076.944**

Table-3.25: Connected Load of Shri Guru Ram Rai University

Chapter-4

Green Audit

4.1 Scope and Goals of Green Auditing

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. Green Audit is the most efficient and ecological way to manage environmental problems. It is a kind of professional care which is the responsibility of each individual who are the part of economic, financial, social, environmental factor. It is necessary to conduct green audit in University campus because students become aware of the green audit, its advantages to save the planet and they become good citizen of our country. Thus, Green audit becomes necessary at the University level.

4.1.1 Benefits of the Green Auditing

- More efficient resource management
- To provide basis for improved sustainability
- To create a green campus
- To enable waste management through reduction of waste generation, solid-waste and water recycling
- To create plastic free campus and evolve health consciousness among the stakeholders
- Recognize the cost saving methods through waste minimizing and managing
- Authenticate conformity with the implemented laws
- Empower the organizations to frame a better environmental performance
- Enhance the alertness for environmental guidelines and duties
- Impart environmental education through systematic environmental management approach and improving environmental standards
- Benchmarking for environmental protection initiatives
- Financial savings through a reduction in resource use

- Development of ownership, personal and social responsibility for the University and its environment

4.2 Target Areas of Green Auditing

Green audit forms part of a resource management process. Although they are individual events, the real value of green audits is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Target areas included in the green auditing are:

I. Water,
II. Waste,
III. Green campus

4.3 Auditing for Water Management

The world's water resources are finite but exist on a planet with a constantly growing population. The development of water resources to man's benefit has been a fundamental factor in the evolution of civilizations throughout history. But, as our populations continue to grow and shift, the availability of quality water resources is in decline. Pollution, climate change and construction of cities in dry regions are some of the factors exacerbating evolving supply/demand imbalances. Many innovative technologies have been developed in recent times to assist the efficient delivery and utilization of drinking water. Water audits provide a rational, scientific framework that categorizes all water use in your system. It is a tool to overcome drought related problem, shortage, leakage and losses.

4.3.1 Advantage of Water Audit:

a. Water audits provide decision making tools to utility managers, directors, and operators. i.e., knowing where water is being used in your system allows you to make informed decisions about investing resources such as time, labour and money.
b. Water audits allow managers to efficiently reduce water losses in the system.
c. Reducing water used at the source may even result in delaying or avoiding

capital investments such as a new well, more treatment technology or additional water rights.

d. Water audits also identify which water uses are earning revenue for the utility and which water uses are not. Thus, System personnel can increase revenue by ensuring all appropriate uses are being accurately measured and billed. This leads to more financial capacity in the water system, reduced cost per customer and better management of the water resource.
e. Creating awareness among water users i.e., customers can see and understand that the utility is taking proactive steps to manage wasted water and save for the future.
f. It is an effective educational and public relations tool for the water system.

4.3.2 Water Usage in the University

Both Treated water and Raw water are used in the University depending on the use such as for drinking purpose and non drinking purpose.

4.3.3 Drinking Water System

Seven nos. Pumps are installed in the University at locations mentioned in Table-4.1.

Sr No	Name of Location	Capacity (KW)
1	I T S	11.19
2	F.M.T	11.19
3	Medical University	11.19
4	J.R Hostel	5.5
5	Pathri Bagh	11.19
6	Paramedical Collage	5.5
7	Nursing Collage	5.5

Table-4.1: Details of Pump installed in the University

No technical details of Pump were available with the University. The pump makes are old and details were not available in manufacture's catalogue.

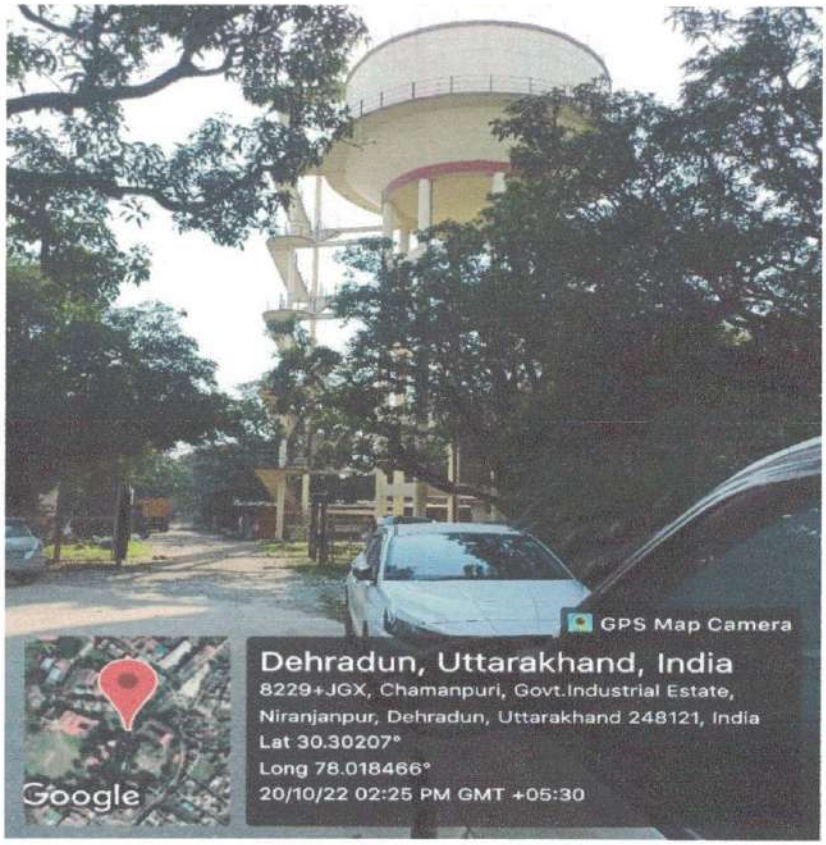


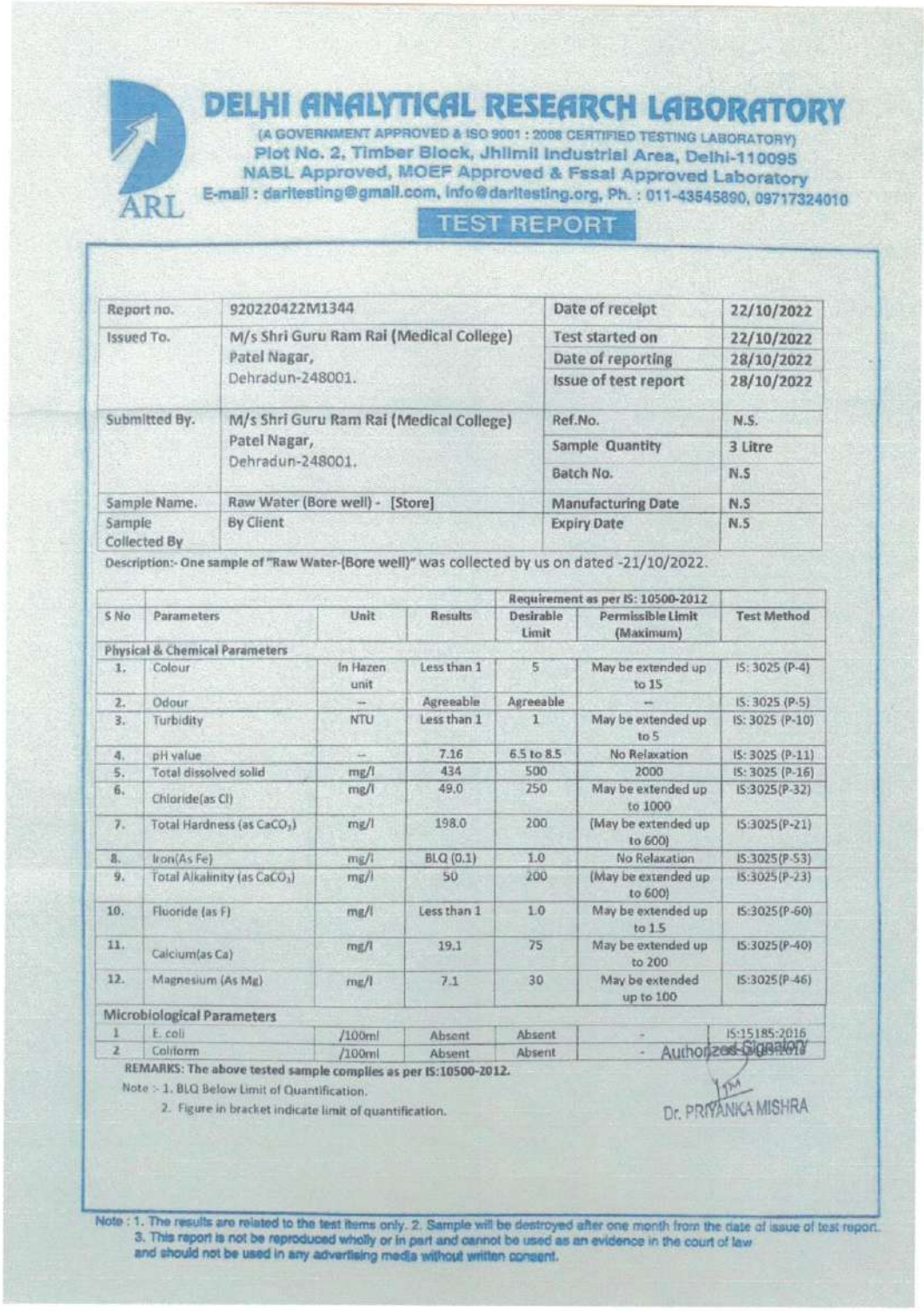
Figure 4.1: Overhead Water Tank

4.3.4 Water Quality of Drinking water:

Water quality of Drinking water is regularly monitored by the University. Drinking water samples are also taken and checked by University's staff regularly and the action is taken by the staff accordingly.

Sample Water Testing

Sample Water Testing of various places was done on 22.10.2022. The Test Reports are shown in Fig-4.2 to Fig-4.5.



DELHI ANALYTICAL RESEARCH LABORATORY

(A GOVERNMENT APPROVED & ISO 9001 : 2008 CERTIFIED TESTING LABORATORY)
Plot No. 2, Timber Block, Jhilmil Industrial Area, Delhi-110095
NABL Approved, MOEF Approved & Fssai Approved Laboratory
E-mail : daritesting@gmail.com, info@daritesting.org, Ph. : 011-43545890, 09717324010

ARL

TEST REPORT

Report no.	920220422M1344	Date of receipt	22/10/2022
Issued To.	M/s Shri Guru Ram Rai (Medical College) Patel Nagar, Dehradun-248001.	Test started on	22/10/2022
		Date of reporting	28/10/2022
		Issue of test report	28/10/2022
Submitted By.	M/s Shri Guru Ram Rai (Medical College) Patel Nagar, Dehradun-248001.	Ref.No.	N.S.
		Sample Quantity	3 Litre
		Batch No.	N.S
Sample Name.	Raw Water (Bore well) - [Store]	Manufacturing Date	N.S
Sample Collected By	By Client	Expiry Date	N.S

Description:- One sample of "Raw Water-(Bore well)" was collected by us on dated -21/10/2022.

				Requirement as per IS: 10500-2012		
S No	Parameters	Unit	Results	Desirable Limit	Permissible Limit (Maximum)	Test Method
Physical & Chemical Parameters						
1.	Colour	In Hazen unit	Less than 1	5	May be extended up to 15	IS: 3025 (P-4)
2.	Odour	--	Agreeable	Agreeable	--	IS: 3025 (P-5)
3.	Turbidity	NTU	Less than 1	1	May be extended up to 5	IS: 3025 (P-10)
4.	pH value	--	7.16	6.5 to 8.5	No Relaxation	IS: 3025 (P-11)
5.	Total dissolved solid	mg/l	434	500	2000	IS: 3025 (P-16)
6.	Chloride(as Cl)	mg/l	49.0	250	May be extended up to 1000	IS:3025(P-32)
7.	Total Hardness (as $CaCO_3$)	mg/l	198.0	200	(May be extended up to 600)	IS:3025(P-21)
8.	Iron(As Fe)	mg/l	BLQ (0.1)	1.0	No Relaxation	IS:3025(P-53)
9.	Total Alkalinity (as $CaCO_3$)	mg/l	50	200	(May be extended up to 600)	IS:3025(P-23)
10.	Fluoride (as F)	mg/l	Less than 1	1.0	May be extended up to 1.5	IS:3025(P-60)
11.	Calcium(as Ca)	mg/l	19.1	75	May be extended up to 200	IS:3025(P-40)
12.	Magnesium (As Mg)	mg/l	7.1	30	May be extended up to 100	IS:3025(P-46)
Microbiological Parameters						
1	E. coli	/100ml	Absent	Absent	-	IS:15185:2016
2	Coliform	/100ml	Absent	Absent	-	IS:15185:2016

REMARKS: The above tested sample complies as per IS:10500-2012.

Note :- 1. BLQ Below Limit of Quantification.
2. Figure in bracket indicate limit of quantification.

Authorized Signatory

Dr. PRIYANKA MISHRA

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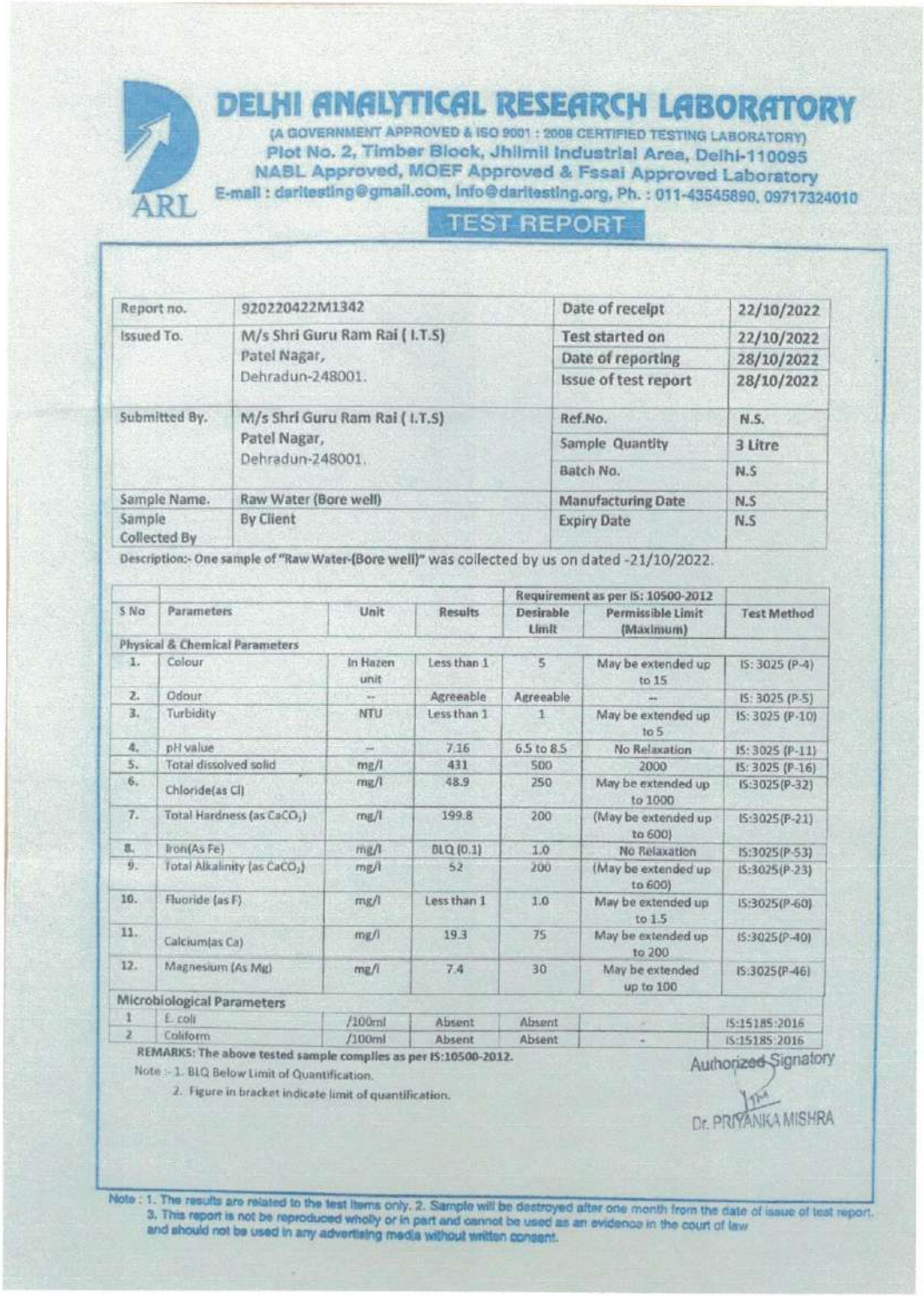
Figure-4.2: Copy of Test Report



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ARL

TEST REPORT

Report no.	920220422M1342	Date of receipt	22/10/2022
Issued To.	M/s Shri Guru Ram Rai (I.T.S) Patel Nagar, Dehradun-248001.	Test started on	22/10/2022
		Date of reporting	28/10/2022
		Issue of test report	28/10/2022
Submitted By.	M/s Shri Guru Ram Rai (I.T.S) Patel Nagar, Dehradun-248001.	Ref.No.	N.S.
		Sample Quantity	3 Litre
		Batch No.	N.S
Sample Name.	Raw Water (Bore well)	Manufacturing Date	N.S
Sample Collected By	By Client	Expiry Date	N.S

Description:- One sample of "Raw Water-(Bore well)" was collected by us on dated -21/10/2022.

S No	Parameters	Unit	Results	Requirement as per IS: 10500-2012 Desirable Limit	Permissible Limit (Maximum)	Test Method
Physical & Chemical Parameters						
1.	Colour	In Hazen unit	Less than 1	5	May be extended up to 15	IS: 3025 (P-4)
2.	Odour	--	Agreeable	Agreeable	--	IS: 3025 (P-5)
3.	Turbidity	NTU	Less than 1	1	May be extended up to 5	IS: 3025 (P-10)
4.	pH value	--	7.16	6.5 to 8.5	No Relaxation	IS: 3025 (P-11)
5.	Total dissolved solid	mg/l	431	500	2000	IS: 3025 (P-16)
6.	Chloride(as Cl)	mg/l	48.9	250	May be extended up to 1000	IS:3025(P-32)
7.	Total Hardness (as $CaCO_3$)	mg/l	199.8	200	(May be extended up to 600)	IS:3025(P-21)
8.	Iron(As Fe)	mg/l	BLQ (0.1)	1.0	No Relaxation	IS:3025(P-53)
9.	Total Alkalinity (as $CaCO_3$)	mg/l	52	200	(May be extended up to 600)	IS:3025(P-23)
10.	Fluoride (as F)	mg/l	Less than 1	1.0	May be extended up to 1.5	IS:3025(P-60)
11.	Calcium(as Ca)	mg/l	19.3	75	May be extended up to 200	IS:3025(P-40)
12.	Magnesium (As Mg)	mg/l	7.4	30	May be extended up to 100	IS:3025(P-46)
Microbiological Parameters						
1	E. coli	/100ml	Absent	Absent	-	IS:15185:2016
2	Coliform	/100ml	Absent	Absent	-	IS:15185:2016

REMARKS: The above tested sample complies as per IS:10500-2012.

Note :- 1. BLQ Below Limit of Quantification.
2. Figure in bracket indicate limit of quantification.

Authorized Signatory

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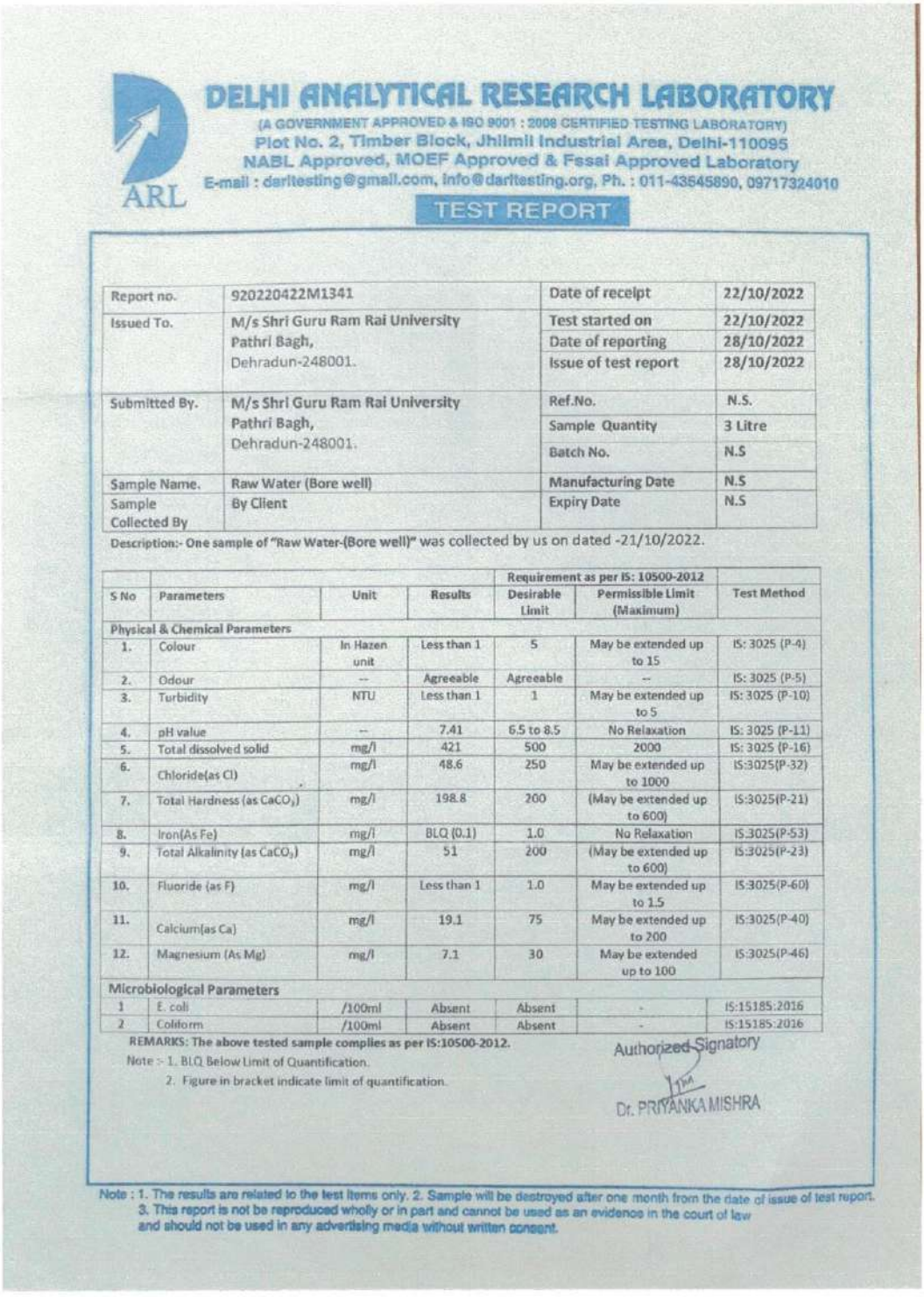
Figure-4.3: Copy of Test Report dated 22.01.2022



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ARL

TEST REPORT

Report no.	920220422M1341	Date of receipt	22/10/2022
Issued To.	M/s Shri Guru Ram Rai University Pathri Bagh, Dehradun-248001.	Test started on	22/10/2022
		Date of reporting	28/10/2022
		Issue of test report	28/10/2022
Submitted By.	M/s Shri Guru Ram Rai University Pathri Bagh, Dehradun-248001.	Ref.No.	N.S.
		Sample Quantity	3 Litre
		Batch No.	N.S
Sample Name.	Raw Water (Bore well)	Manufacturing Date	N.S
Sample Collected By	By Client	Expiry Date	N.S

Description:- One sample of "Raw Water-(Bore well)" was collected by us on dated -21/10/2022.

				Requirement as per IS: 10500-2012		
S No	Parameters	Unit	Results	Desirable Limit	Permissible Limit (Maximum)	Test Method
Physical & Chemical Parameters						
1.	Colour	In Hazen unit	Less than 1	5	May be extended up to 15	IS: 3025 (P-4)
2.	Odour	--	Agreeable	Agreeable	--	IS: 3025 (P-5)
3.	Turbidity	NTU	Less than 1	1	May be extended up to 5	IS: 3025 (P-10)
4.	pH value	--	7.41	6.5 to 8.5	No Relaxation	IS: 3025 (P-11)
5.	Total dissolved solid	mg/l	421	500	2000	IS: 3025 (P-16)
6.	Chloride(as Cl)	mg/l	48.6	250	May be extended up to 1000	IS:3025(P-32)
7.	Total Hardness (as $CaCO_3$)	mg/l	198.8	200	(May be extended up to 600)	IS:3025(P-21)
8.	Iron(As Fe)	mg/l	BLQ (0.1)	1.0	No Relaxation	IS:3025(P-53)
9.	Total Alkalinity (as $CaCO_3$)	mg/l	51	200	(May be extended up to 600)	IS:3025(P-23)
10.	Fluoride (as F)	mg/l	Less than 1	1.0	May be extended up to 1.5	IS:3025(P-60)
11.	Calcium(as Ca)	mg/l	19.1	75	May be extended up to 200	IS:3025(P-40)
12.	Magnesium (As Mg)	mg/l	7.1	30	May be extended up to 100	IS:3025(P-46)
Microbiological Parameters						
1	E. coli	/100ml	Absent	Absent	-	IS:15185:2016
2	Coliform	/100ml	Absent	Absent	-	IS:15185:2016

REMARKS: The above tested sample complies as per IS:10500-2012.

Note :- 1. BLQ Below Limit of Quantification.
2. Figure in bracket indicate limit of quantification.

Authorized Signatory

Dr. PRIYANKA MISHRA

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Figure-4.4: Copy of Test Report dated 22.01.2022

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ARL

TEST REPORT

Report no.	920220422M1343	Date of receipt	22/10/2022
Issued To.	M/s Shri Guru Ram Rai (Medical College) Patel Nagar, Dehradun-248001.	Test started on	22/10/2022
		Date of reporting	28/10/2022
		Issue of test report	28/10/2022
Submitted By.	M/s Shri Guru Ram Rai (Medical College) Patel Nagar, Dehradun-248001.	Ref.No.	N.S.
		Sample Quantity	3 Litre
		Batch No.	N.S
Sample Name.	Raw Water (Bore well) - [Anotomy]	Manufacturing Date	N.S
Sample Collected By	By Client	Expiry Date	N.S

Description:- One sample of "Raw Water-(Bore well)" was collected by us on dated -21/10/2022.

				Requirement as per IS: 10500-2012		
S No	Parameters	Unit	Results	Desirable Limit	Permissible Limit (Maximum)	Test Method
Physical & Chemical Parameters						
1.	Colour	In Hazen unit	Less than 1	5	May be extended up to 15	IS: 3025 (P-4)
2.	Odour	--	Agreeable	Agreeable	--	IS: 3025 (P-5)
3.	Turbidity	NTU	Less than 1	1	May be extended up to 5	IS: 3025 (P-10)
4.	pH value	--	7.17	6.5 to 8.5	No Relaxation	IS: 3025 (P-11)
5.	Total dissolved solid	mg/l	435	500	2000	IS: 3025 (P-16)
6.	Chloride(as Cl)	mg/l	49.0	250	May be extended up to 1000	IS:3025(P-32)
7.	Total Hardness (as $CaCO_3$)	mg/l	198.1	200	(May be extended up to 600)	IS:3025(P-21)
8.	Iron(As Fe)	mg/l	BLQ (0.1)	1.0	No Relaxation	IS:3025(P-53)
9.	Total Alkalinity (as $CaCO_3$)	mg/l	51	200	(May be extended up to 600)	IS:3025(P-23)
10.	Fluoride (as F)	mg/l	Less than 1	1.0	May be extended up to 1.5	IS:3025(P-60)
11.	Calcium(as Ca)	mg/l	19.2	75	May be extended up to 200	IS:3025(P-40)
12.	Magnesium (As Mg)	mg/l	7.2	30	May be extended up to 100	IS:3025(P-46)
Microbiological Parameters						
1	E. coli	/100ml	Absent	Absent	-	IS:15185:2016
2	Coliform	/100ml	Absent	Absent	-	IS:15185:2016

REMARKS: The above tested sample complies as per IS:10500-2012.

Note :- 1. BLQ Below Limit of Quantification.
2. Figure in bracket indicate limit of quantification.

Authorized Signatory

Dr. PRIYANKA MISHRA

Note : 1. The results are related to the test items only. 2. Sample will be destroyed after one month from the date of issue of test report.
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Figure-4.5: Copy of Test Report dated 22.01.2022

4.3.5 Sample Water Test results Summary

Sr No	Parameters	Unit	Desirable Limit	Sample Place			
				Raw Water (Bore Well) Pathri Bagh	Raw Water (Bore Well) Medical Collage (Anotomy)	Raw Water (Bore Well) Medical University (Store)	Raw Water (Bore Well) I T S
1	Colour	In Hazen Uinit	5	Less than 1	Less than 1	Less than 1	Less than 1
2	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Turbidity	NTU	1	Less than 1	Less than 1	Less than 1	Less than 1
4	PH Value		6.5 to 8.5	7.41	7.17	7.16	7.16
5	Total Dissolved Solid	mg/l	500	421	435	434	431
6	Chloride(as Cl)	mg/l	250	48.6	49.9	49	48.9
7	Total Hardness (as CaCO3)	mg/l	200	198.8	198.1	198	199.8
8	Iron (As Fe)	mg/l	1	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)	BLQ (0.1)
9	Total Alkalinity (asCaCO3)	mg/l	200	51	51	50	52
10	Fluoride (as F)	mg/l	1	Less than 1	Less than 1	Less than 1	Less than 1
11	Calcium (as Ca)	mg/l	75	19.1	19.2	19.1	19.3
12	Magnesium (as Mg)	mg/l	30	7.1	7.2	7.1	7.4

Table-4.2: Water test results

The test results are within permissible limits.

4.4 Water consumption

The water for drinking/non drinking purpose is supplied frome Bore wells. No record was available for water consumption as flow meters are not installed on Pumps. The flow of pumps were measured and average running hours were noted based on operator verbal statement. No logsheet was maintained for any Pump.

Thus, the total water consumption for drinking/non drinking and irrigation purpose per day has been calculated based on mathetical calculations as per Table-4.3.

Sr No	Name of Location	Capacity (KW)	Average Discharge measured (Cu Meter/Hr)	Average Running Hours/Day	Total water usage per Day (Cu Meter)
1	I T S	11.19	18	4.5	81
2	Admin Block Medical University	11.19	18	4	72
3	Anatomy Block Medical University	11.19	18	6	108
4	J.R Hostel	5.5	9	2	18
5	Pathri Bagh	11.19	18	4.5	81
6	Paramedical Collage	5.5	9	4	36
7	Nursing Collage	5.5	9	4	36
	Grand Total				**432**

Table-4.3: Total water consumption for drinking/non drinking and irrigation purpose

The average total water consumption per Day is 432 cubic meter/day, which includes water consumption for irrigation purpose. Assuming 10% of water consumption for irrigation purpose, the water consumption for drinking/non drinking water is estimated as 388.8 cubic meter/day by Residents and Day-time users.

4.5 Baseline of water consumption

In India, the design of water supply systems has been done using certain standards. Currently the standard being used is BIS 1172: 1993, reaffirmed in 1998. This specifies a consideration of use of the following:

For communities with a population of between 20,000 to 100,000 – 100 to 150 liters per head per day

For communities with a population of over 100,000 – 150 to 200 liters per head per day.

In its previous avatar there was also an attempt made in IS 1172 to understand the break-up of this demand which was then put as 135 liters per person per day. The break-up was as follows:

I. Bathing: 55 liters

II. Toilet flushing: 30 liters

III. Washing of clothes: 20 liters

IV. Washing the house: 10 liters

V. Washing utensils: 10 liters

VI. Cooking: 5 liters

VII. Drinking: 5 liters.

Based on above standard water consumption of Campus residents should be maximum 135 Liters per person and Day time person should be maximum 40 Liters per person.

As mentioned in Chapter-1, the details of the population is as per Table-4.4:

Sl. No	Particulars	Nos.
1	No of resident Staff/Students, living in the campus for 24 Hours	971
2	No of nonresident Staff/Students, coming in day time only	8146
3	Average No of Daily Visitors	52
Total Population		**9169**

Table-4.4: Total population of the University

Thus, total maximum permissible water Consumption as per Standards laid under IS 1172 is as given in Table-4.5.

Sl. No.	Particulars	Nos.	Maximum water consumption per Person per day (Liters)	Total Maximum water consumption per Day (Liters)
1	Nos. of Campus full time residents	971	135	131085
2	Nos. of Day time persons	8198	40	327920
	Grand Total			**459005**

Table-4.5: Total permissible water Consumption as per IS 1172

Thus the total Maximum water consumption per day is 459 cubic meter per day. Actual water consumption as per Para-4.4 is 388.8 Cubic meter, which is 15.3 % less than total permissible water consumption, as per Table-4.3.

4.6 Rainwater Harvesting

Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off. Rainwater is collected from roofs, and in many places the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment etc. The harvested water can also be used as drinking water, longer-term storage and for other purposes such as groundwater recharge.

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought, can help mitigate flooding of low-lying areas, and reduces demand on wells which may enable groundwater levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts. Application of rainwater harvesting in urban water system provides a substantial benefit for both water supply and wastewater subsystems by reducing the need for clean water in water distribution system, less generated storm water in sewer system, as well as a reduction in storm water runoff polluting freshwater bodies.

Supplying rainwater that has gone through preliminary filtration measures for non-potable water uses, such as toilet flushing, irrigation, and laundry, may be a significant part of a sustainable water management strategy.

4.6.1 Details of Rain Water Harvesting Borings in the University

There are 6 nos Rain Water Harvesting Borings in the University of borewell size 125mmX50meter. These are located between ITS campus and Medical University. The pictures of some Borings have been shown in Fig-4.6.

Fig-4.6:Rain Water Harvesting Pits in the University

4.7 Auditing for Waste Management

Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Plastic bags and discarded ropes and strings can be very dangerous to birds and other animals. This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, and recycling. Solid waste can be divided into two categories: general waste and hazardous waste. General wastes include what is usually thrown away in homes and schools such as garbage, paper, tins and glass bottles. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals and petrol. Unscientific landfills may contain harmful contaminants that leach into soil and water supplies. Separate bins were found in the University campus for segeration of hazardous waste. Waste segregation Buckets were found installed in the University at various places.

Fig-4.7: Waste segregation Buckets installed in Medical University

Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Thus, the minimization of solid waste is essential to a sustainable University. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible institution examine its waste processing practices.

4.7.1 Quantity of Waste Generated

No data could be provided by the University regarding the quantity of waste (Biodegradable, Non-biodegradable and E Waste) generated in the University.

4.7.2 Disposal of Waste generated

(A) Biodegradable

i. Canteen waste

It was shared by the authorities that Canteen waste is being disposed to local Cattle Keepers to feed the waste to their animals.

ii. **Leaves and others:**

Leaves and others are given to Nagar Nigam to prepare Vermicompost. Paper waste is sold to Venders.

(B) Non biodegradable

i. This waste including metals, bottles, plastics, cans, broken glass wares, tins etc., are sold out. Authorities are advised to dispose the non-biodegradable waste to only Government authorized Venders only and keep proper accounting.

ii. **E Waste:**

E Waste is disposed to Local Venders. Authorities are advised to dispose the E Waste to only Government authorized Venders only and keep proper accounting.

4.7.4 Liquid Waste Management System

There is no Sewage Treatment Plant in the University. Lab water is treated through ETP.

4.8 Auditing for Green Campus Management

Newly planted and existing trees decrease the amount of carbon dioxide in the atmosphere. Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen that a single tree produces is enough to provide one day's supply of oxygen for people. Trees in the campus impact our mental health as well. Studies have shown that trees greatly reduce stress, which a huge deal is considering many students are under some amount of stress.

4.8.1 Methodology of Green Auditing

The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution. The

criteria, methods and recommendations used in the audit were based on the identified risks. The methodology includes: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations.

There was heavy plantation and greenery inside the University. The photographs of some places are being pasted in the report.

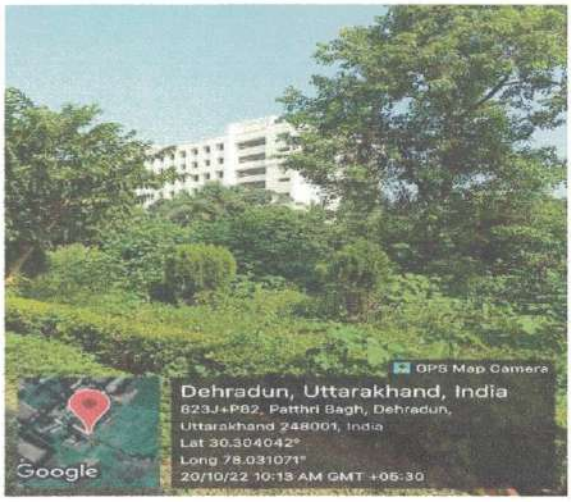


Fig-4.8: Green Plantation inside Pathri Bag Campus

Fig-4.9: Green Plantation Inside Pathri Bag Automated Weather Station

Fig-4.10: Medicinal and Aromatic Plants inside Pathri Bag Campus

Figure-4.11: Green Trees and Field in Pathri Bag Campus

Figure-4.12: Green Trees and Field in Pathri Bag Campus

Figure-4.13: Green Trees and Field in Children Park, Medical University

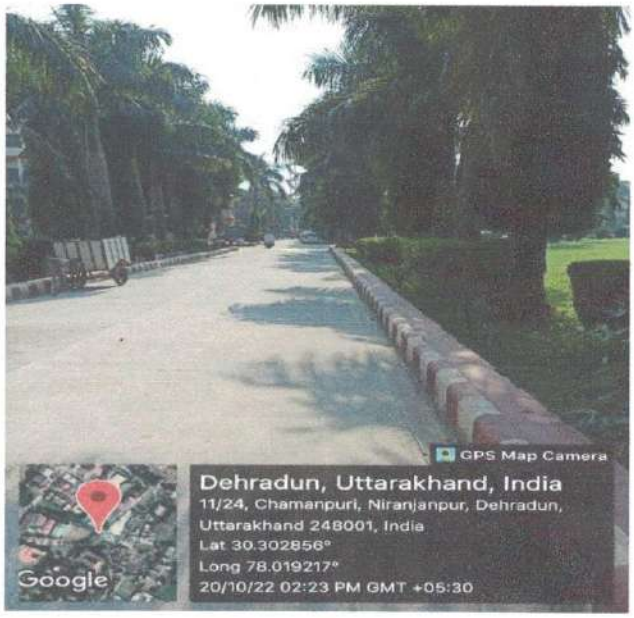


Figure-4.14: Green Trees and Field all round Road side in Medical University

4.8.2 Total Nos of Garden Trees in the Campus

There are approximately 3660 Trees in the University Campus.

4.9 Evaluation of Audit Findings

4.9.1 Major Audit Observations

- There is no green policy/Environmental policy statement indicating the commitment of the University towards its environmental performance.
- Gardens inside the University premises are found well maintained.

- Use of notice boards and signs are inadequate to reduce over exploitation of natural resources.
- Programs on green initiatives have to be increased.
- Environmental education programs have to be strengthened.

4.9.2 Water Audit

- The University does not have waste water treatment for waste water generated from, canteen, hostel, kitchen, toilets, bathrooms and office rooms. However Lab water is treated.
- The waste water from laboratories, canteen and kitchens are not suitably controlled and are not used for gardening.
- Display boards against the misuse of water use are lacking.

4.9.3 Waste Audit

- Solid waste management systems established are insufficient. Bio degradable waste may be used for non conventional Energy Generation or Steam Generation for cooking food/Washing cloths etc.
- The University should have proper communication with the local body for regular collection of solid waste from the campus.
- Implementation of sustainable projects to attain set environmental goals is not in place.
- Waste bins in the class rooms, veranda, canteen and campus are inadequate.
- Bio gas plant should be installed.

4.9.4 Green Campus Audit

- Display boards to all plants identified are lacking.

4.10 Preparation of Action Plan

There should be Committee formation for energy Audit, Green Audit and Environmental Audit, involving Faculties and Students. Policies referring to University's management and approaches towards the use of resources need to be considered. The University should have a green policy/environmental policy for its sustainable development. The environmental policy formulated by the management of the University should be implemented meticulously. The University should have a policy on awareness raising or training programs (for ground staff or kitchen staff for example).

4.11 Criteria wise List of Recommendations

4.11.1 Water

- Manual water Taps should be replaced with Auto closed water Taps
- Drip irrigation for gardens and vegetable cultivation can be initiated.
- Establish water treatment systems to recycle drain water
- Awareness programs on water conservation to be conducted.
- Install display boards to control over exploitation of water.

4.11.2 Waste

- A model solid waste treatment system to be established.
- Practice of waste segregation to be strengthened.
- Establish a plastic free campus.
- Use paper plates and cups in place of Plastic for all functions in the University.

4.11.3 Green Campus

- Not just celebrating environment day but making it a daily habit.
- Beautify the University building with maximum use of oxygen generating indoor plants
- Encouraging students not just through words, but through action for making the campus green
- Conducting competitions among departments for making students more interested in making the campus green.
- All trees in the campus should be named scientifically.

Chapter -5

Environmental Audit

5.1 Background

SGRR University is located in central part of Dehradun. Though the University has taken best steps for clean Enviroment inside the campus but overall Environment largely depend on the Enviroment conditions of the township consisting of campus of the University. As such it is necessary to discuss the Environment condition of Dehradun and plans framed by governing body responsinle for controlling the same.

5.2 About Dehradun City Clean Air Action Plan

Dehradun, is the capital of the Uttarakhand state. The city was developed as a getaway from the hot summers of the plains and hosts several institutions such as the Indian Military Academy, ITBP Academy & Indira Gandhi National Forest Academy (IGNFA), Zoological Survey of India (ZSI), Forest Research Institute (FRI) among several others. Dehradun has increased its population and construction and industry is rapidly growing in the region. The resulting increase in pollution from industrial, domestic, construction and transport activities is responsible for its worsening air quality. According to the WHO study, Dehradun is ranked the 30th most polluted city. The geographical and meteorological conditions do not allow for easy dispersal of pollution. Ambient air is being monitored regularly by the Central Pollution Control Board. At source emission monitoring i.e., stack monitoring of industries is also being done regularly and action is being taken accordingly on the basis of analysis report. If any industry is found violating the standards firstly show-cause notice is issued to the industry followed by closure under Air (Prevention and Control of Pollution) Act, 1981.

5.3 Sources Of Pollution in Dehradun

The main sources of air pollution in Dehradun city are Vehicular, Road dust, Construction & Demolition activities, Industries (Point source & Area's source), etc. Data recorded by Central Pollution Control Board show that the pollution levels are increasing year by year and the air quality index is getting

worst. If we do not take steps now, this can lead to severe consequences.

5.4 Air Quality Index Standards

Air Quality Index Standards have been shown in Table-5.1.

AQI Category, Pollutants and Health Breakpoints								
AQI Category (Range)	**PM_{10} (24hr)**	**$PM_{2.5}$ (24hr)**	**NO_2 (24hr)**	**O_3 (8hr)**	**CO (8hr)**	**SO_2 (24hr)**	**NH_3 (24hr)**	**Pb (24hr)**
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

Table- 5.1: Air Quality Index Standards

5.5 Air Quality Reports

Air Quality Reports at nearby Center Doon University (7 Km distance) are as follows:

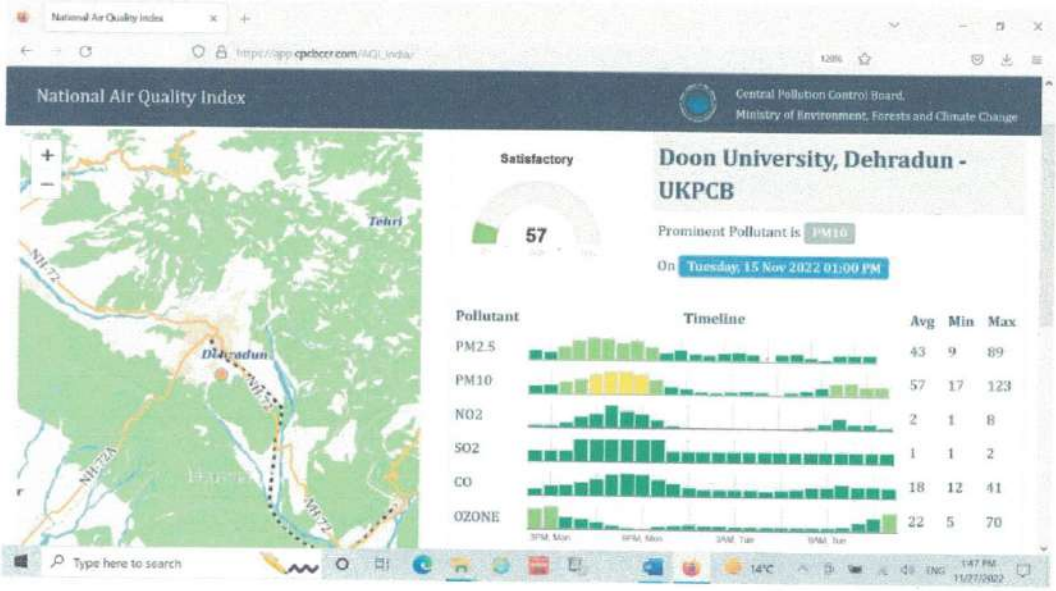
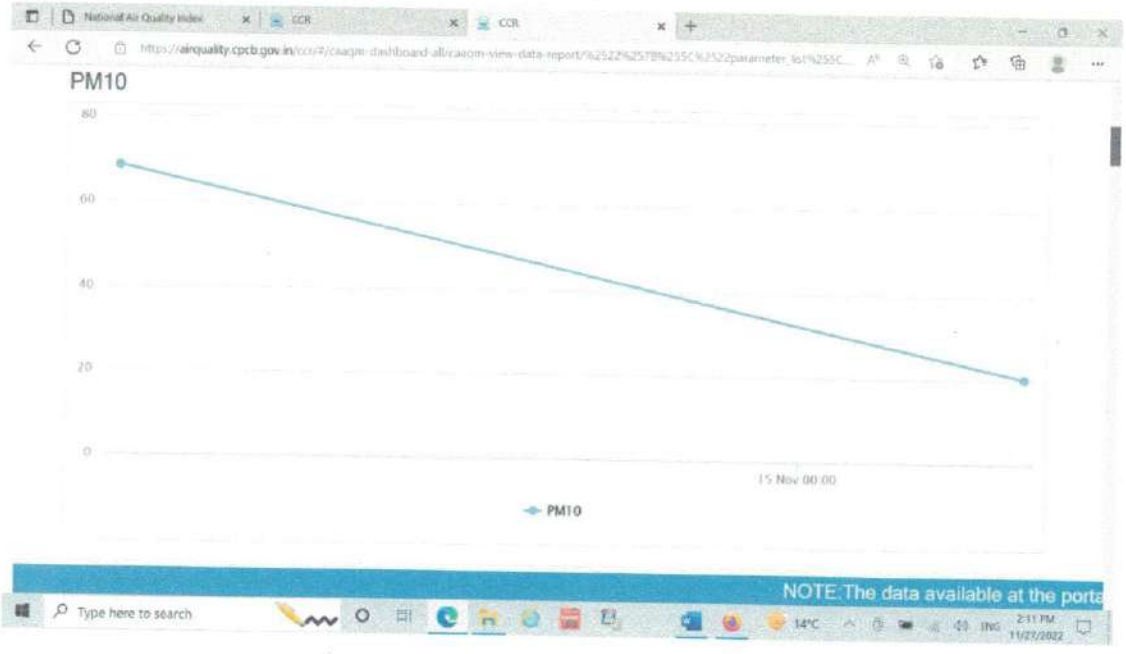


Fig-5.1: Air Quality Index Report

5.6 Graphic Presentation of various Constituents

The Graphic Charts of various constituents of Air Quality at Doon University Center of Dehradun from 6 AM of dated 15.11.2022 to 6 AM of dated 16.11.2022 are as shown below in Figure 5.2:




National Air Quality Index
CCR
CCR
https://anquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-view-data-report/%2522%2578%255C%2522parameter_list%255C...
NO
0.8
0.6
0.4
0.2
0
15 Nov 00:00
NO
vided by different agencies. Any use of this data in research publication or any other form of publication shall duly acknowledge
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National Air Quality Index
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https://anquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-view-data-report/%2522%2578%255C%2522parameter_list%255C...
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ch publication or any other form of publication shall duly acknowledge the contribution of respective agencies in generating the
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National Air Quality Index
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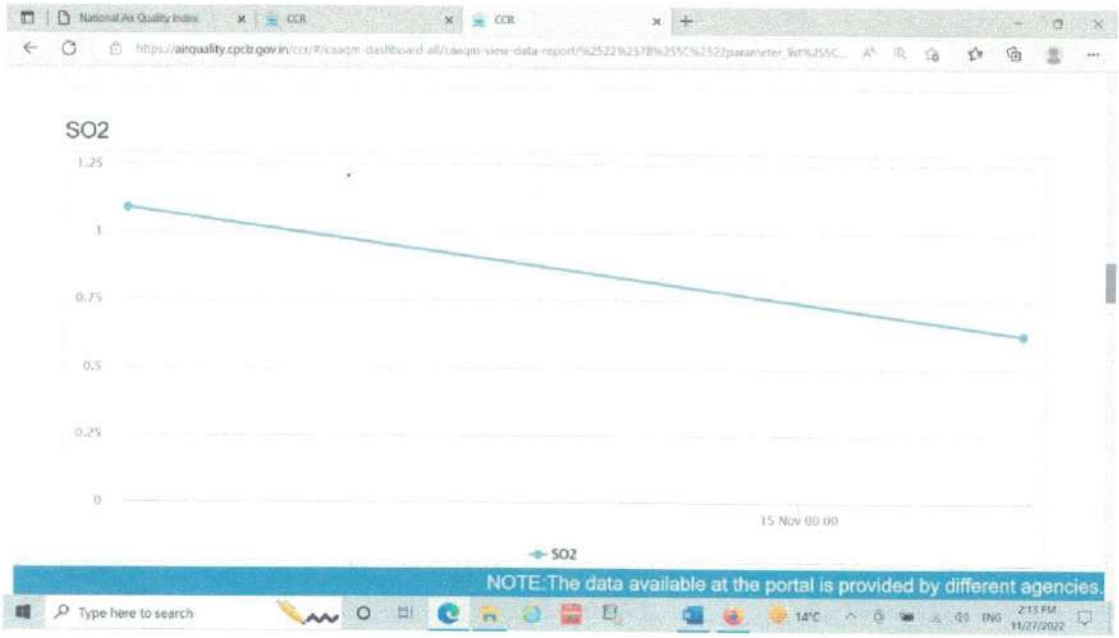
National Air Quality Index
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SO2
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1
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15 Nov 00:00
SO2
NOTE:The data available at the portal is provided by different agencies.
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11/27/2022

Figure-5.2: Graphical reports of different constituents of air quality Index

5.5 Environment Awareness activities

Environment Awareness activities are also organized by the University through plantation drives.

पर्यावरण सही होने पर ही बचेगी जिंदगी

PIC: DAINIK JAGRAN I NEXT

श्रीगुरुराम राय विश्वविद्यालय में किया गया पौधरोपण.

DEHRADUN (25 July): श्रीगुरुराम राय विश्वविद्यालय में कृषि संकाय एवं राष्ट्रीय सेवा योजना इकाई ने संयुक्त रूप से पौधरोपण कार्यक्रम का आयोजन किया. इस मौके पर विश्वविद्यालय के कुलपति डॉ. यूएस रावत ने कहा कि वन संपदा को संरक्षित रखते हुए विकास और पर्यायवरण का संतुलन स्थापित करना सबसे महत्वपूर्ण है. कृषि संकाय की डीन डॉ. मनीषा सिंह ने कहा कि पर्यावरण को संरक्षित करके ही मानव जाति के भविष्य को सुरक्षित कर सकते हैं. इस मौके पर डॉ. हितेन्द्र कुमार, डॉ. कमला ध्यानी, डॉ. प्रियंका बनकोटी, डॉ. हिमांकी डबराल, डॉ. खिलेन्द्र सिंह, डॉ. शोभा, डॉ. वीके सिंह, शालिनी, मधुबाला, अतुल नैनवाल और नाथी राम मौजूद रहे.

Fig-5.3: Environment Awareness activities

5.6 Auditing for Carbon Footprint

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon

dioxide, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions.

Action Plan of the University administration is based on the following points:

- Establish a system of carpooling among the staff to reduce the number of four wheelers coming to the University.
- *Implementation of University bus services to the students and staff.*
- Encourage students and staff to use cycles.
- Establish a more efficient cooking system to save gas.
- Discourage the students using two wheelers for their commutation.
- Minimum use of DG Sets.

Chapter-6

Energy Conservation Tips

6.1 Lighting System

- One of the best energy-saving devices is the light switch. Turn off lights when not required.
- Many automatic devices can help in saving energy used in lighting. Consider employing infrared sensors, motion sensors, automatic timers, dimmers and solar cells wherever applicable, to switch on/off lighting circuits.
- As for as possible use task lighting, which focuses light where it's needed. A reading lamp, for example, lights only reading material rather than the whole room.
- Dirty tube lights and bulbs reflect less light and can absorb 50 percent of the light; dust your tube lights and lamps regularly.
- Fluorescent tube lights and CFLs convert electricity to visible light up to 5 times more efficiently than ordinary bulbs and thus save about 70% of electricity for the same lighting levels.

6.2 Room Air Conditioners

- Use ceiling or table fan as first line of defence against summer heat. Ceiling fans, for instance, cost about 30 paisa an hour to operate - much less than air conditioners (Rs.10.00 per hour).
- You can reduce air-conditioning energy use by as much as 40 percent by shading your home's windows and walls. Plant trees and shrubs to keep the day's hottest sun off your house.
- One will use 3 to 5 percent less energy for each degree air conditioner is set above 22°C (71.5°F), so set the thermostat of room air conditioner at 25°C (77°F) to provide the most comfort at the least cost.
- Using room ceiling or room fans allows you to set the thermostat higher because the air movement will cool the
- A good air conditioner will cool and dehumidify a room in about 30 minutes, so use a timer and leave the unit off for some time.

- Keep doors to air-conditioned rooms closed as often as possible.
- Clean the air-conditioner filter every month. A dirty air filter reduces airflow and may damage the unit. Clean filters enable the unit to cool down quickly and use less energy.
- If room air conditioner is older and needs repair, it's likely to be very inefficient. It may work out cheaper on life cycle costing to buy a new energy-efficient air conditioner.

6.3 PUMPS

• Operate pumping near best efficiency point.

• Adapt to wide load variation with variable speed drives or sequenced control of smaller units.

• Repair seals and packing to minimize water waste.

• Balance the system to minimize flows and reduce pump power requirements

Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return