ENVIRONMENTAL AUDIT REPORT

of

SAPTHAGIRI COLLEGE OF ENGINEERING

#14/5, Chikkasandra, Hesarghatta Main Road, Bangalore 560057

SAPTHAGIRI
College of Engineering
Creating Tomorrow

Year: 2020-21

Principal
Sapthagiri College of Engineering
14/5, Chikkasandra, Hesarghatta Main Road
Bengaluru - 560 057

Prepared by:

Enrich Consultants

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MAHARASHTRA ENERGY DEVELOPMENT AGENCY
An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462

Maharashtra Energy Development Agency
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ECN/2021-22/CR-14/1577

22nd April, 2021

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

We hereby certify that, the firm having following particulars is registered with *MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)* under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm : **M/s Enrich Consultants**
Yashashree, Plot No. 26, Nirmal Bag Society,
Near Muktangan English School, Parvati,
Pune - 411009.

Registration Category : *Empanelled Consultant for Energy Conservation Programme for Class 'A'*

Registration Number : *MEDA/ECN/2021-22/Class A/EA-03*

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **21st April, 2023** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

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Tel: 09890444795 Email: enrichcons@gmail.com

Ref: EC/SCOE/20-21/03

Date: 10/8/2021

CERTIFICATE

This is to certify that we have conducted Environmental Audit at Sapthagiri College of Engineering, Bangalore in the Academic year 2020-21

The College has adopted following Environment Friendly Practices:

- Usage of Energy Efficient LED Light Fitting
- Usage of BEE STAR Rated Energy Efficient Equipment
- Maximum Usage of Day Lighting
- Installation of 40 kWp Roof Top Solar PV Plant.
- Provision of Separate bins for Dry & Wet Waste
- Installation of Bio Composting Plant for organic waste management
- Tree Plantation in the campus
- Provision of Sanitary Waste Incinerator
- Creation of awareness about Plastic Ban by displaying posters

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Green.

For Enrich Consultants,

A Y Mehendale,
Certified Energy Auditor
EA-8192

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INDEX

Sr. No	Particulars	Page No
I	Acknowledgement	5
II	Executive Summary	6
III	Abbreviations	8
1	Introduction	9
2	Study of Consumption of Resources & CO_2 Emission	11
3	Study of CO_2 Emission Reduction	13
4	Study of Indoor Air Quality	14
5	Study of Indoor Comfort Condition Parameters	15
6	Study of Waste Management	16
7	Study of Rain water Harvesting	17
8	Study of Environment Friendly Initiatives	18
	Annexure	
I	Various Standards in respect of Indoor Air Quality, Water, Noise & Indoor Comfort Condition	20

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of Sapthagiri College of Engineering, Bangalore, for awarding us the assignment of Environmental Audit of their Campus for the Academic Year: 2020-21.

We are thankful to:

- Dr. H. Ramakrishna, Principal

We are also thankful to other Staff members for helping us during the field study.

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EXECUTIVE SUMMARY

1. Sapthagiri College of Engineering, Bangalore consumes Energy in the form of **Electrical Energy and Diesel** used for various day to day activities.

2. Various Pollution due to College Activities:

- **Air pollution:** Mainly CO_2 on account of Electricity Consumption
- **Solid Waste:** Recyclable Waste and Bio degradable Garden Waste
- **Liquid Waste:** Human liquid waste

3. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Consumed, kWh	Diesel Consumed, Liters	CO_2 Emissions, MT
1	Total	322211	2115	295.55
2	Maximum	40645	265	36.58
3	Minimum	12062	0	11.17
4	Average	26851	176.25	24.63

4. Various initiatives taken for Energy Conservation:

- Usage of Energy Efficient BEE STAR Rated Equipment
- Usage of Energy Efficient LED Lighting
- Maximum Usage of Day Lighting
- Installation of 40 kWp Roof Top Solar PV Plant

5. Usage of Renewable Energy:

- The College has installed Solar Thermal Water Heating System of Capacity **40 kWp.**
- The Electrical Energy generated in 20-21is **48000 kWh.**
- Reduction in CO_2 Emissions in 2020-21 works out to be **43.2 MT.**

5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	175	91	78
2	Minimum	135	65	56

6. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, ^0C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	25.5	83	975	65
2	Minimum	21.2	63	150	45

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7. Waste Management:

7.1 Solid Waste Management:

The recyclable waste, like paper, plastic waste is segregated at source and is handed over to Authorized waste collecting agent for further recycling.

7.2 Organic Waste Management:

The College has installed a Bio Composting Plant and the organic Waste is composted in the Plant.

7.3 E-Waste Management:

The E-Waste is disposed of through Authorized E-Waste collecting agency.

8. Rain Water Harvesting:

The College has installed the Rainwater harvesting project, the rain water falling on the terrace is collected and is used for increasing the underground water level.

9. Sustainable Initiatives

- Maintenance of Internal Garden
- Provision of Sanitary Waste Incinerator
- Display of Posters on Plastic Ban

10. Notes & Assumptions:

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere
- **1 Kg of Diesel** releases **2.63 Kg of CO_2** into atmosphere

11. References:

- For CO_2 Emissions: www.tatapower.com
- For Energy Saved by Solar Thermal Water Heating System: www.mahaurja.com
- For Various Indoor Air Parameters: www.ishrae.com
- For AQI & Water Quality Standards: www.cpcb.com

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ABBREVIATIONS

Kg	:	Kilo Gram
MT	:	Metric Ton
kWh	:	kilo-Watt Hour
LPD	:	Liters per Day
LED	:	Light Emitting Diode
AQI	:	Air Quality Index
PM-2.5	:	Particulate Matter of Size 2.5 Micron
PM-10	:	Particulate Matter of Size 10 Micron
CPCB	:	Central Pollution Control Board
ISHRAE	:	The Indian Society of Heating & Refrigerating & Air Conditioning Engineers

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CHAPTER-I
INTRODUCTION

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

1927	The Indian Forest Act
1972	The Wildlife Protection Act
1974	The Water (Prevention and Control of Pollution) Act
1977	The Water (Prevention & Control of Pollution) Cess Act
1980	The Forest (Conservation) Act
1981	The Air (Prevention and Control of Pollution) Act
1986	The Environment Protection Act
1991	The Public Liability Insurance Act
2002	The Biological Diversity Act
2010	The National Green Tribunal Act

1.1.5. Some Important Environmental Rules in India: Table No-2:

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Siting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules
2011	E-waste (Management and Handling) Rules

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2011	National Green Tribunal (Practices and Procedure) Rules
2011	Plastic Waste (Management and Handling) Rules

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

1.	National Forest Policy, 1988
2.	National Water Policy, 2002
3.	National Environment Policy or NEP (2006)
4.	National Conservation Strategy and Policy Statement on Environment and Development, 1992
5.	Policy Statement for Abatement of Pollution (1992)
6.	National Action Plan on Climate Change
7.	Vision Statement on Environment and Human Health
8.	Technology Vision 2030 (The Energy Research Institute)
9.	Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency
10	The Road to Copenhagen; India's Position on Climate Change Issues (MoEF)

1.2 Objectives:

1. To study Resource Consumption & CO2 Emissions
2. To Study CO_2 Emission Reduction
3. To study Indoor Air Quality Parameters
4. To study Indoor Comfort Condition Parameters
5. To Study of Waste Management
6. To Study of Rain Water Harvesting
7. To Study of Sustainable Initiatives

1.3 General Details of College: Table No 4:

No	Head	Particulars
1	Name of Institution	Sapthagiri College of Engineering
2	Address	#14/5, Chikkasandra, Hesarghatta Main Road, Bangalore 560057
3	Year of Establishment	2001

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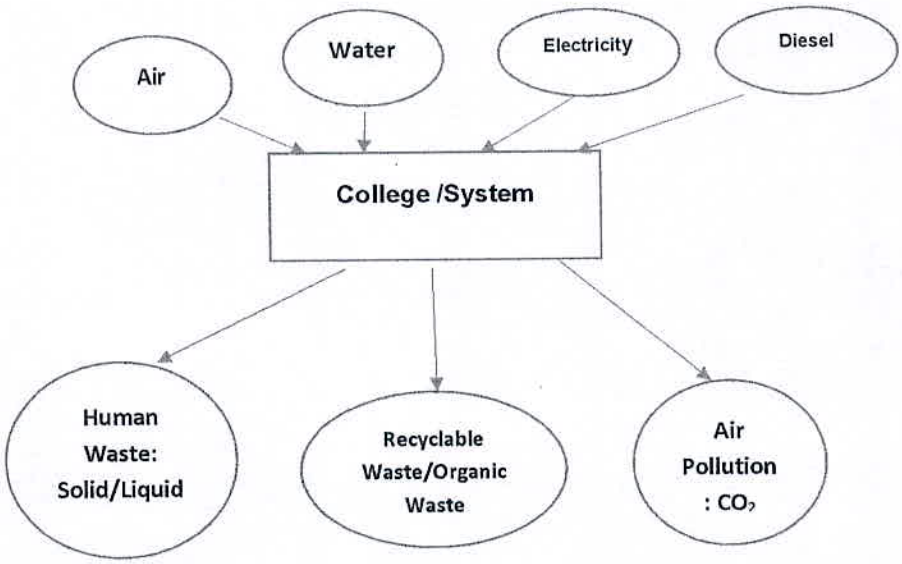
CHAPTER-II
STUDY OF CONSUMPTION OF RECOURCES & CO_2 EMISSION

The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Diesel

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO_2 on account of consumption of Electrical Energy & Diesel.
The basis of Calculation for CO_2 emissions due to Electrical Energy & Diesel are as under

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere
- **1 Liter** of Diesel releases **2.63 Kg of CO_2** into atmosphere.

Table No 5: Computation of Month wise CO_2 Emissions:

No	Month	Energy Consumed, kWh	Diesel Consumed, Liters	CO2 Emissions, MT
1	Aug-20	32770	210	30.05
2	Sep-20	33908	225	31.11
3	Oct-20	31618	250	29.11
4	Nov-20	22330	0	20.10

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5	Dec-20	26968	220	24.85
6	Jan-21	35538	180	32.46
7	Feb-21	26969	265	24.97
8	Mar-21	40645	0	36.58
9	Apr-21	21787	240	20.24
10	May-21	22412	230	20.78
11	Jun-21	12062	120	11.17
12	Jul-21	15206	175	14.15
13	Total	322211	2115	295.55
14	Maximum	40645	265	36.58
15	Minimum	12062	0	11.17
16	Average	26851	176.25	24.63

Chart No 2: Month wise CO_2 Emissions:

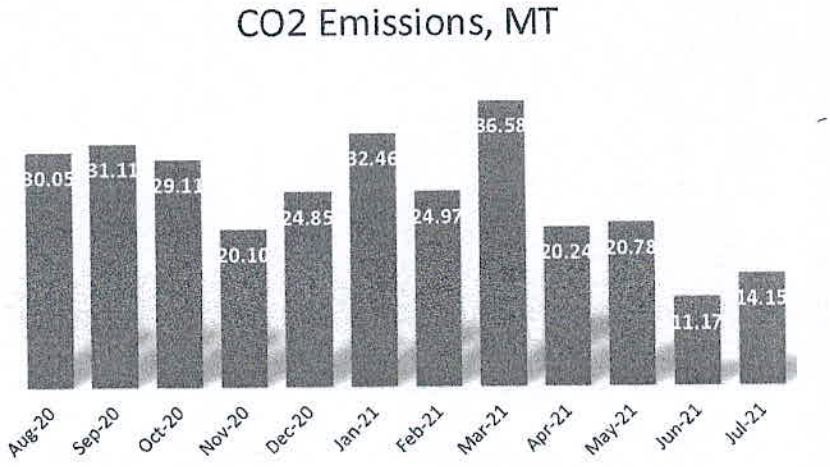

Table No 6: Variation in Important Parameters:

No	Parameter/ Variation	Energy Consumed, kWh	Diesel Consumed, Liters	CO_2 Emissions, MT
1	Total	322211	2115	295.55
2	Maximum	40645	265	36.58
3	Minimum	12062	0	11.17
4	Average	26851	176.25	24.63

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CHAPTER III
STUDY OF CO_2 EMISSION REDUCTION

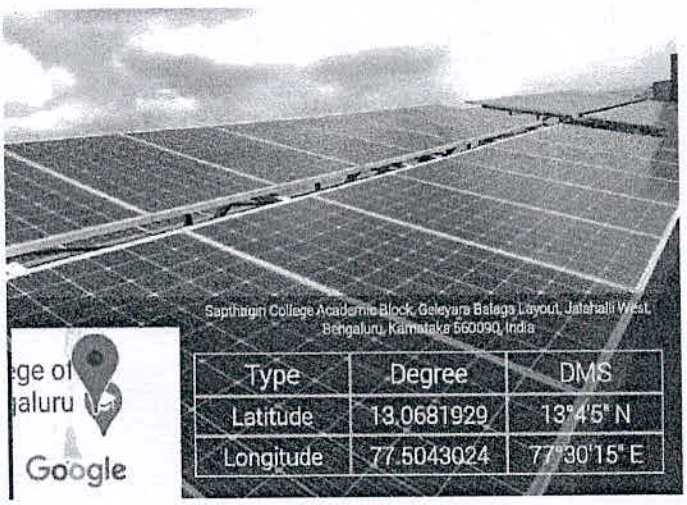
The College has installed Roof Top Solar PV Plant of Capacity **40 kWp.**

In the following Table, we compute the Electrical Energy generated by Solar PV Plant and reduction in CO2 emissions due to usage of Solar Energy.

Table No 7: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Capacity of Roof Top Solar PV Plant	40	kWp
2	Energy generated per kWp by Rooftop Solar PV Plant	4	kWh/kWp
3	Generation Days in 20-21	300	Nos
4	Solar Energy generated in 20-21= 1*2*3	48000	kWh
5	1 kWh of Electrical Energy is equivalent to	0.9	Kg of CO_2
6	Reduction in CO2 Emission in 20-21 = 4*5/1000	**43.2**	MT

Photograph of Roof Top Solar PV Plant:



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CHAPTER IV
STUDY OF INDOOR AIR QUALITY

4.1 Importance of Air Quality:

Air: The common name given to the atmospheric gases used in breathing and photosynthesis.

By volume, Dry Air contains 78.09% Nitrogen, 20.95% Oxygen, 0.93% Argon, 0.039% carbon dioxide, and small amounts of other gases.

On average, a person inhales about **14,000 liters** of air every day. Therefore, poor air quality may affect the quality of life now and for future generations by affecting the health, the environment, the economy and the city's livability.

Rapid urbanization and industrialization has added other elements/compounds to the pure air and thus caused the increase in pollution. In order to prevent, control and abate air pollution, the Air (Prevention and Control of Pollution) Act was enacted in 1981.

Air quality is a measure of the suitability of air for breathing by people, plants and animals.

According to Section 2(b) of Air (Prevention and control of pollution) Act, 1981 '**air pollution**' has been defined as **'the presence in the atmosphere of any air pollutant.'**

As per Section 2(a) of Air (Prevention and control of pollution) Act, 1981 '**air pollutant**' has been defined as **'any solid, liquid or gaseous substance [(including noise)] present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment**

4.2 Air Quality Index:

An **Air Quality Index (AQI)** is a number used by government agencies to measure the **air pollution** levels and communicate it to the population. As the AQI increases, it means that a large percentage of the population will experience severe adverse health effects. The measurement of the **AQI** requires an **air monitor** and an **air pollutant** concentration over a specified **averaging period**.

We present herewith following important Parameters.

1. AQI- Air Quality Index
2. PM-2.5- Particulate Matter of Size 2.5 micron
3. PM-10- Particulate Matter of Size 10 micron

Table No 8: Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	175	91	78
2	Minimum	135	65	56

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CHAPTER V
STUDY OF INDOOR COMFORT CONDITION PARAMETERS

In this Chapter, we present the various Indoor Comfort Parameters measured during the Audit. The Parameters include:

1. Temperature
2. Humidity
3. Lux Level
4. Noise Level.

Table No 9: Study of Indoor Comfort Condition Parameters:

No	Parameter/Value	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	25.5	83	975	65
2	Minimum	21.2	63	150	45

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CHAPTER VI
STUDY OF WASTE MANAGEMENT

6.1 Solid Waste Management:

The Waste is segregated at source and is further disposed of through Authorized vendors.

Photograph of Waste Collection Bins:

6.2 Organic Waste Management:

The Bio degradable waste like leafy waste is composted in a Bio composting Unit.

Photograph of Bio Composting Unit:

6.3 E-Waste Management: The E-Waste is disposed of through Authorized Agency.

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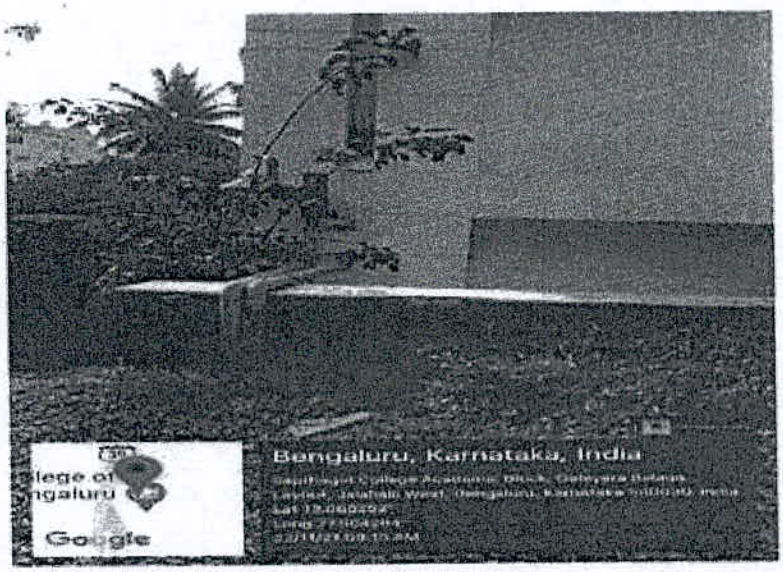
CHAPTER-VII
STUDY OF RAIN WATER HARVESTING

The College has implemented the Rain Water Harvesting Project. The College has installed Pipes from the terrace and the Rain water falling on the terrace is gathered and is used to increase the underground water level.

Photograph of Rain water Harvesting Pipe:



Photograph of Rain water Harvesting Recharge Well:

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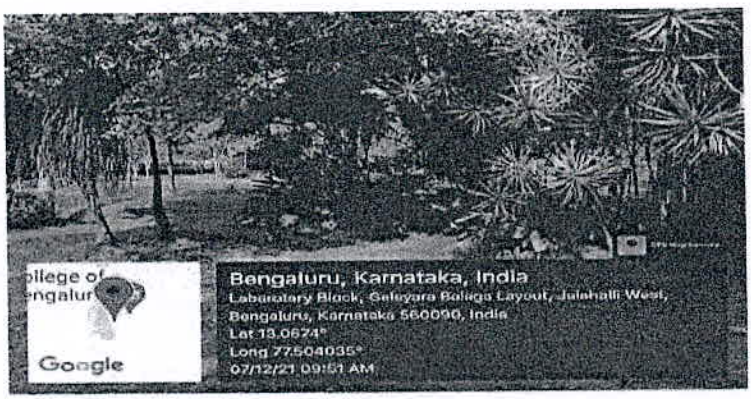
CHAPTER-VIII
STUDY OF ENVIRONMENT FRIENDLY PRACTICES

8.1 Internal Tree Plantation:

The College has well maintained landscaped garden in the campus.

Photograph of Tree plantation:



8.2 Provision of Sanitary Waste Incinerator:

For disposal of Sanitary Waste, a Sanitary Waste Incinerator is installed in the campus.

Photograph of Sanitary Waste Incinerator:

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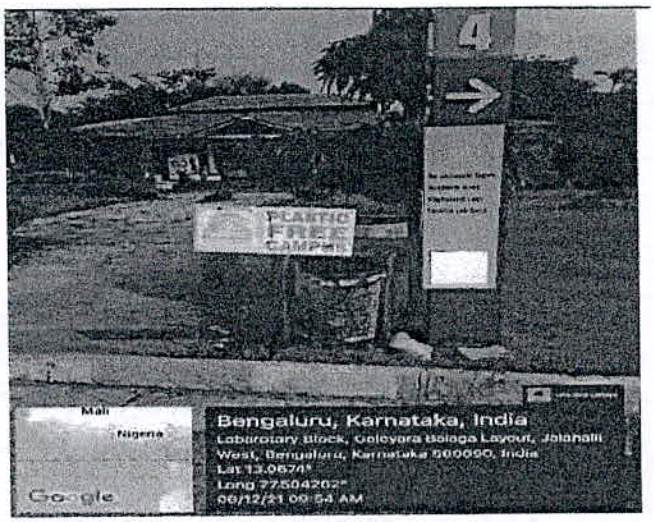
8.3 Creation of Awareness about Green Campus:

The College has displayed posters emphasizing on importance of Plastic Free Campus.

Photograph of Poster on Plastic Free Campus:



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ANNEXURE-I:
VARIOUS AIR QUALITY, WATER QUALITY, NOISE & INDOOR COMFORT STANDARDS:

1. Category Wise Air Quality Index Values & Concentration of PM 2.5 & PM10:

No	Category	AQI Value	Concentration Range, PM 2.5	Concentration Range, PM 10
1	Good	0 to 50	0 to 30	0 to 50
2	Satisfactory	51 to 100	31 to 60	51 to 100
3	Moderately Polluted	101 to 200	61 to 90	101 to 250
4	Poor	201 to 300	91 to 120	251 to 350
5	Very Poor	301 to 400	121 to 250	351 to 430
6	Severe	401 to 500	250 +	430 +

2. Recommended Water Quality Standards:

No	Designated Best Use	Criteria
1	Drinking Water Source without conventional Treatment but after disinfection	pH between **6.5 to 8.5** Dissolved Oxygen **6 mg/l or more**
2	Drinking water source after conventional treatment and disinfection	pH between **6 to 9** Dissolved Oxygen **4 mg/l or more**
3	Outdoor Bathing (Organized)	pH between **6.5 to 8.5** Dissolved Oxygen **5 mg/l or more**
4	Controlled Waste Disposal	pH between **6 to 8.5**

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3. Recommended Noise Level Standards:

No	Location	Noise Level dB
1	Auditoriums	20-25
2	Outdoor Playground	55
3	Occupied Class Room	40-45
4	Un occupied Class Room	35
5	Apartment, Homes	35-40
6	Offices	45-50
7	Libraries	35-40
8	Restaurants	50-55

4. Thermal Comfort Conditions: For Non-conditioned Buildings:

No	Parameter	Value
1	Temperature	Less Than 33^0 C
2	Humidity	Less Than 70%

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