



# Rammohan College

102/1, 85A, 85B, 85C & 85D, Raja Rammohan Sarani, Kolkata, West Bengal 700009

## Green, Environmental and Energy Audit Report

2018-2019



Prepared by

**Rammohan College**

In association with

**RSP Green Development & laboratories Pvt. Ltd.**

(ISO Certified and QCI - NABET Accredited Environmental Consultant Organization)





## RSP Green Development & Laboratories Pvt. Ltd.

An ISO 9001: 2015 & ISO 14001: 2015 Certified Company

**QCI-NABET ACCREDITED ENVIRONMENTAL CONSULTANT**

CIN NO: U74999WB2017PTC219565



To  
The Principal  
Rammohan College  
102/1, Raja Rammohan Sarani,  
Kolkata-700009

Sub: Submission of the Green Audit Report Conducted by Rammohan College, 102/1, 85A, 85B, 85C & 85D, Raja Rammohan Sarani, Kolkata-700009 in association with RSP Green Development & Laboratories Pvt. Ltd.

Respected Madam,

On behalf of RSP Green Development & Laboratories Pvt. Ltd., it has been certified that the assigned **Green Audit Programme**, comprising **Energy Audit, Water Audit, Biodiversity Audit, Green Campus Management Audit, Plastic Waste Management, Carbon Foot Print Audit and Carbon Credit**, had been successfully completed by Rammohan College, 102/1, 85A, 85B, 85C & 85D, Raja Rammohan Sarani, Kolkata-700009 in association with RSP Green Development & Laboratories Pvt. Ltd. on 15.03.2019. After completion of the work, **Final Report** has been submitted to you. The report is compiled with **Work-sheets, Comparative Assessment** through analyses and suggestions for your Institution at the end.

The organization is thankful for your necessary support and adequate cooperation by providing needful information, requisite documents and sharing your institutional activities. We are further thankful to your humble hospitality for our staff and volunteers at the time of work.

Yours sincerely,

Pinaki Roy  
Managing Director  
RSP Green Development & Laboratory Pvt. Ltd.



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## 1. Introduction

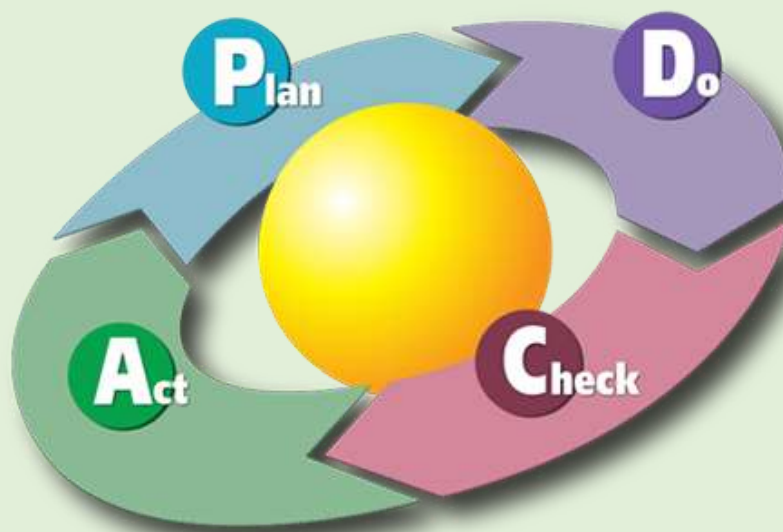
Green Audit is a stage wise review process of systematic identification, quantification, recording, reporting, analysis and documentation of components of environmental diversity of the institute or organization. It is a systematic assessment of day-to-day activity with reference to the utilization of resources as well as waste management. It aims to analyze environmental practices within and outside of the concerned place; leading to an eco-friendly atmosphere. It helps to determine how and where the energy, water or other resources are being used, based on which the institution can design effective management policies and implement changes towards sustainable use of resources. It can create health consciousness and promote environmental awareness, values and ethics. It also helps to enlighten staff and students of the institution for better understanding of Green impact on campus. On this background it becomes essential to adopt the system of the Green Campus for the institutes which will lead for environmental sustainability. Especially in colleges and universities where young minds dwell, ensuring an ecosystem with endurable qualities is the need of the hour. The green influence on the campus is vital to guarantee the best learning environment and healthy ecosystem for everyone associated with the site. The green audit report determines the greenery quotient on the campus and covers other influential environmental aspects. It includes the consumption and management of energy resources and environmental components.

National Assessment and Accreditation Council (NAAC) was introduced by the University Grants Commission or UGC in September 1994. NAAC was established for reviewing the performance and operational quality of Indian universities and colleges. The National Assessment and Accreditation Council have made it mandatory that all Higher Educational Institutions should submit an annual Green Audit Report. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the mitigation of global warming through enforcement of carbon footprint reduction measures and improved management steps.

- **Self-assessment** – It allows the universities and colleges to review the ideal steps and implement them for the campus. The audit assists in self-assessment and the decision-making process.

- **Awareness** – It develops awareness among everyone associated with the campus with conscious and consistent efforts.
- **Improved scopes** – By complying with the norms, universities can ensure higher scopes of getting the best grade from NAAC. It is vital to follow the systematic way and implement the best steps for green audits on the campus under professional guidance.

The PDCA cycle audit is a systematic way of checking and improving the quality and performance and it involves four phases: planning the improvement, implementing the change, measuring the results, and acting on the feedback.



**PDCA Cycle of Green Audit**

### **1.1 Need for Green Audit**

Green Audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India that accredits the institution according to the scores assigned at the time of accreditation.

The Audit report helps to understand the current practices of sustainability with regard to the use of water and energy, generation of wastes, transportation, purchase of goods, etc; establishing a baseline of existing environmental conditions with focus on natural and physical environment and create awareness among students and staff concerning real issues of environment and its



sustainability. Based on the audit report, the college can make the best strategies to make the campus ideal for students, teachers, and anyone associated. It also helps the college acknowledge the wastage volume and consider different recycling projects for developing a sustainable ecosystem for the learners. Simply put, it is a way to minimize wastage and create a more suitable place for learning with improved NAAC grades.

## **1.2 Objectives of Green Audit**

The main aim of this green audit is to assess the environmental quality and the sustainable management strategies being implemented in Rammohan College.

The objectives of Green Audit include:

- Documentation of baseline data of good practices, strategies and action plans towards improving environmental quality for future along with corrective actions and future plans.
- Maintain conformity with the norms and standards in the environmental management system and to design ideal protocols that develop a sustainable ecosystem on the campus.
- Assessment of water use, waste management, energy consumption, health and environmental quality in the campus.
- Identification of the gap areas and suggest recommendations to improve the Green Campus status of the College.
- Generation of awareness among the students, teaching and non teaching members of the institution.

### 1.3 About the Institution

Rammohan College owes its origin to City College, Calcutta which is one of the oldest first grades College in West Bengal. It was founded in 1881 by a band of patriotic and selfless Brahma leaders like Ananda Mohan Bose, Pandit Sivnath Sastri and Umesh Chandra Dutta. Rastraguru Surendranath Banerjee later joined the College as teacher. Up to 1961 City College had a women's Department in morning which has separately affiliated in 1961 to the Calcutta University and renamed as Rammohan College. The Geo coordinates of old building are 22.581023°N and 88.370149°E and Geo coordinates of new building are 22.582952°N and 88.370997°E.

The aim of College according to the founders, is to promote the cause of education in its highest and widest sense, to make education a comprehensive training of the mind, heart and body, and founded on theistic basis conducive to the good of man and glory of God.

The College is open to all female students irrespective of race, creed or caste. It has record of brilliant result. The college located at 102/1, Raja Rammohan Sarani, Kolkata-700 009. It is one of the city group College administered by Brahma Samaj Society, a registered Society, constituted by the Sadharan Brahma Samaj, Calcutta.

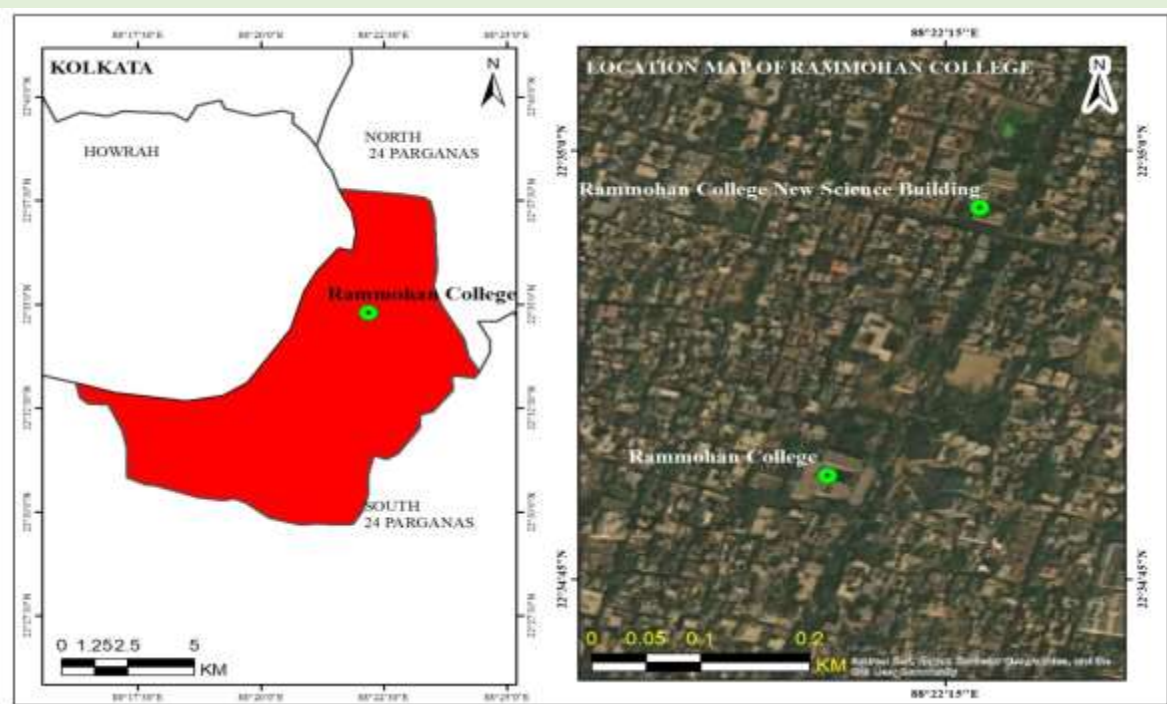


Figure 1: Location Map

### **1.3.1 Vision of the College**

The Vision of the college is "Sradhaban Lavate Gyanam" or "Wisdom Belongth to Reverence". The goal of the college is to make a comprehensive training of mind, body and soul for girl students of all strata of society. Relentless effort is there to ensure an environment conducive for attaining self-respect for the students to trigger their inner strength to attain independence in thought to be aware of their rights so that in time they would be able to make an identity of themselves.

### **1.3.2 Mission of the College**

The Mission of the institution is reflected in its policies. Principal and committed faculty members and non-teaching staff render their utmost efforts to ensure transparency in the functioning of the college and to maintain core values of the institution. If Vision is the Goal, Mission is the road-map. That pathway is not mere imparting of syllabus oriented lectures in class rooms. The College aspires to train students to be responsible citizens having a wider and positive vision of life.

### **1.3.3 Physical Structure of the College**

Rammohan College in North Kolkata is famed for its immensity. With around 2500 students and nearly 140 teaching and non-teaching staff, it is one of the few colleges in West Bengal running in morning shift and catering to all three streams of Science, Arts and Commerce at undergraduate level along with post graduation in Bengali and Human Physiology.

The college located at 102/1, Raja Rammohan Sarani, Kolkata-700 009. It is one of the city group College administered by Brahma Samaj Society, a registered Society, constituted by the Sadharan Brahma Samaj, Calcutta.

Rammohan College has recently acquired the heritage building at 85A, 85B, 85C and 85D Raja Rammohan Sarani which was once the family residence of Raja Rammohan Roy, and his descendants. A memorial courses especially for women will be housed here under autonomous body of management at the ancestral house. A New 3 storied Science Building (NSB) for Rammohan College is also under construction next to the heritage building. The ground floor

and the first and second floor of this building are complete and both PG and UG classes are being held there. The College has elevator for the teaching, non-teaching members and students. The College received possession of plot nos. 85B, C&D, Raja Rammohan Sarani, Kolkata- 700 009 on the 4th August, 2005 from the First Land Acquisition Collector, Calcutta. Execution and registration of the deed by West Bengal Government in favour of the college will prepare a plan for construction of College building on those premises too.

Rammohan College Central Library is well equipped with books on each subject and with periodicals, magazines of generalized and specialized interest. Teachers and students equally benefit from the library. At present the library has a huge collection of 40000 books (approx.), among which 24962 are purchased books and rests [14582 Approx] are presented. Along with the central library, seminar libraries are also maintained by the various departments. The college infrastructure, strength of student, teaching and non teaching members and departments have been presented in Table 1, 2 and 3.

Infrastructure elements such as wall textures, ceiling heights, window positioning, air flow, lighting, fan designs, and other factors can produce stressful environment. The phrase "environmental stress" is used to characterize the physical, chemical, and biological constraints on the diversification of organisms and ecosystems. Air temperature (dry bulb temperature, wet bulb temperature, and dew point temperature), relative humidity, direct solar radiation and air flow are the four major variables of human thermal comfort which is defined as "condition of mind which express satisfaction with thermal environment". College teachers and other stakeholders may experience professional burnout as a result of the environment's stress. A study by Acharjee et al, 2023, conducted in the classrooms at Rammohan College in two separate buildings showed that the indoor classroom environment of the New Building is consistently within the "Partial Discomfort" range (lowest and highest Thermo hygrometric index (THI) values 75.86 & 79.20). According to the reference range, the indoor classroom atmosphere of the old building runs from "Comfortable to Partial Discomfort" (74.15 & 77.56).

**Table 1: College Infrastructure**

| <b>Campus Area</b>  |   |   |                         |
|---|---|---|-------------------------|
| <b>Old Campus</b>   | <b>Old Building</b><br>102/1, Raja Rammohan Sarani,<br>Kolkata-9, W.B.                    | 1B – 0K – 2CH – 32 Sq.ft.<br>(≈ 0.3333 Acre)        |                         |
| <b>New Campus</b>   | <b>New Science Building &amp; Museum</b><br>85A, Raja Rammohan Sarani,<br>Kolkata-9, W.B. | 2B – 6K – 0CH – 43 Sq.ft.<br>(≈ 0.7613 Acre)        |                         |
|   | <b>85B, 85C &amp; 85D</b><br>Raja Rammohan Sarani,<br>Kolkata-9, W.B.                     | 1B – 10K – 6CH – 15 Sq.ft.<br>(≈ 0.5024 Acre)       |                         |
| <b>Sadhana Sarkar Memorial Hostel</b>                                   | <b>35</b><br>Abhedananda Road,<br>Kolkata-6, W.B.   | 10K – 5CH – 27 Sq.ft.<br>(≈ 0.171 Acre)             |                         |
| <b>Total Campus Area</b>  |   | <b>5B – 6K – 15CH – 27 Sq.ft.</b><br>(≈ 1.768 Acre) |                         |
| <b>Campus Built Up Area</b>   |   |   |                         |
| <b>Campus</b>   | <b>Building Type</b>  | <b>Floor</b>  | <b>Area in sq. mtr.</b> |
| <b>Old Campus</b><br>102/1,<br>Raja Rammohan Sarani,<br>Kolkata-9, W.B. | <b>Old Building</b>   | G+4 floor   | <b>7364</b>             |
| <b>NEW CAMPUS</b><br>85A,<br>Raja Rammohan Sarani,<br>Kolkata-9, W.B.   | <b>New Science Building</b>   | Ground (502.93 sq.m)                                | <b>2514.65</b>          |
|   |   | First (502.93 sq.m)                                 |                         |
|   |   | Second (502.93 sq.m)                                |                         |
|   |   | Third (502.93 sq.m)                                 |                         |
|   |   | Fourth (502.93 sq.m)                                |                         |
|   | <b>Raja Rammohan Roy Memorial Museum</b>  | Ground (537.78 sq.m)                                | <b>1246.78</b>          |
|   |   | First (537.78 sq.m)                                 |                         |
| Second (171.37 sq.m)  |   |   |                         |
| <b>Sadhana Sarkar</b>   | <b>Hostel Building</b>  | Ground Floor (432.58 sq.m.)                         | <b>1481.92</b>          |

|  |  |                 |
|--|--|-----------------|
| <b>Memorial Hostel</b><br>35, Abhedananda Road,<br>Kolkata-6, W.B. | First Floor (349.78 sq.m.)   |                 |
|  | Second (349.78 sq.m)   |                 |
|  | Third (349.78 sq.m)  |                 |
| <b>Total Built Up Area</b>   |  | <b>12607.35</b> |
| No. of Buildings   | 2  |                 |
| No. of Departments   | 17   |                 |
| Teachers' Room   | 8  |                 |
| Principal's Room   | 2  |                 |
| Class Rooms  | 30   |                 |
| Smart Class Rooms  | 4  |                 |
| Dry Laboratories   | 14   |                 |
| Wet Laboratories   | 17   |                 |
| Library  | 2 (Central Library along with Departmental Seminar Libraries) + PG Library |                 |
| Auditorium   | 1  |                 |
| Seminar Hall   | 3  |                 |
| Canteen  | 4  |                 |
| Common Room  | 1 (300sq ft) for students  |                 |
| Office Room  | 3  |                 |
| Hostel   | 1  |                 |
| Gymnasium  | 1  |                 |
| Staff Quarter  | -----  |                 |

**Table 2: Total Strength of Students, Teachers & Non-teaching Staff**

| No. of Teachers |        |        | No. of Students |  |        | No. of Non Teaching Staffs                         |  |        |
|-----------------|--------|--------|-----------------|--|--------|--|--|--------|
| Male            | Female | Others | Male            | Female                                 | Others | Male   | Female   | Others |
| 39              | 60     | 0      | 07<br>(PG)      | 2295<br>(UG) +<br>66<br>(PG) =<br>2361 |        | 16<br>(permanent)<br>+ 19<br>(contractual)<br>= 35 | 02<br>(permanent)<br>+ 04<br>(contractual)<br>= 06 | 0      |



**Table 3: Academic Departments**

| <b>Undergraduate</b>   |                   |                 |
|------------------------|-------------------|-----------------|
| <b>Science</b>         | <b>Humanities</b> | <b>Commerce</b> |
| Botany                 | Bengali           |                 |
| Chemistry              | English           |                 |
| Mathematics            | Economics         |                 |
| Physics                | Education         |                 |
| Physiology             | Geography         |                 |
| Zoology                | Hindi             |                 |
|                        | History           |                 |
|                        | Philosophy        |                 |
|                        | Political Science |                 |
|                        | Sanskrit          |                 |
| <b>Post Graduation</b> |                   |                 |
| Human Physiology       | Bengali           |                 |



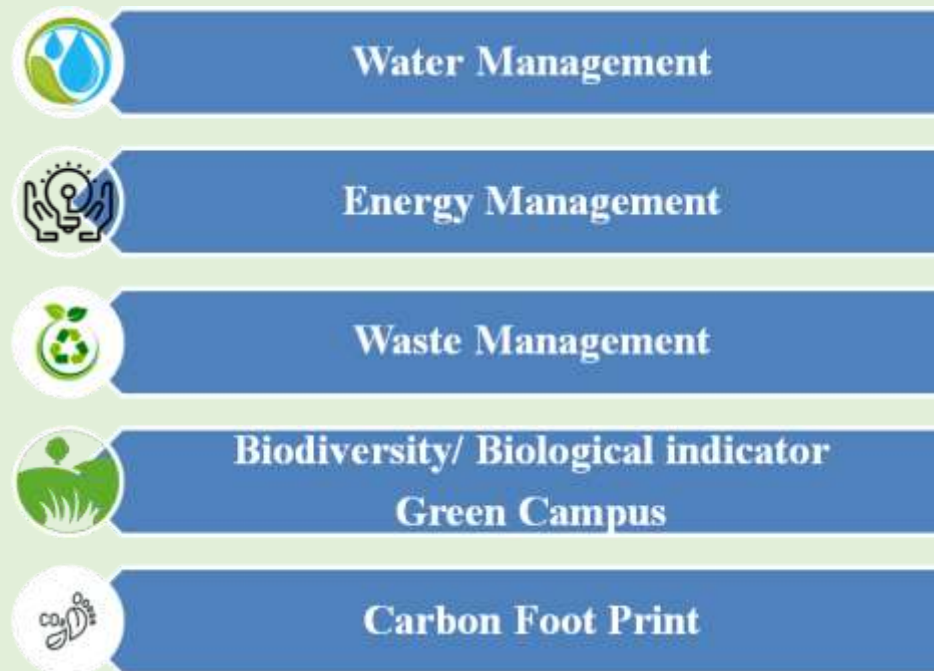
**College Gate**



**New campus of Rammohan college**

## 2. Methodology

In order to perform green audit, the methodology that included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations was adapted.



**Target Areas of Green Audit**

### 2.1 Target Areas of Green Audit

Green audit aims to evaluate the efficient use of energy and water; minimize waste generation or pollution, biodiversity status and also efficiency in resource utilization. These indicators are assessed focusing on the reduction of contribution to emissions, procure a cost effective and secure supply of energy, encourage and enhance energy use conservation, promotes personal action, reduce the institute's energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. Target areas included in this green auditing are water, energy, waste, biodiversity and carbon footprint.

### **2.1.1 Water Management Auditing**

Water is a natural resource which is required for sustenance of all living creatures. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. Groundwater depletion and water contamination are taking place at an alarming rate. Hence it is essential to examine the quality and usage of water in the Institutions or organizations. Water auditing is conducted for the evaluation of facilities of water intake, water usage and facilities for water treatment &/or reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water.

### **2.1.2 Energy Management Auditing**

Energy conservation is an important aspect of campus sustainability which is also linked with carbon foot print of the campus. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices and incorporate alternative energy resources wherever possible. The energy signature method has been used in to extract the total heat loss coefficient of the building.

### **2.1.3 Waste Management Auditing**

Human activities create waste; and unsustainable ways of waste handling, storage, collection, transport and disposal may pose risks to the environment and public health. Solid waste generated in the campus can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste.

1. Bio-degradable wastes include food wastes, canteen waste, wastes from toilets etc.
2. Non-biodegradable wastes include plastic, tins and glass bottles etc.
3. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol.

Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the college.

Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be utilized through recycling and reuse. Thus the minimization of solid

waste is essential to a sustainable college. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

#### **2.1.4 Biodiversity/ Green Campus Management Auditing**

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 released by the trees of the campus is good for the people in the campus. Campus biodiversity is reflection of the ecological health of the campus. A sustainable strategy is required for adopting environment friendly viable way outs for a green campus. Ecological indicator species like butterflies can be used to assess the environmental quality of the campus.

#### **2.1.5 Carbon Footprint Auditing**

Burning of fossil fuels (such as petrol) has an impact on the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, 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. Vehicular emission is the main source of carbon emission in the campus, hence to assess the method of transportation that is practiced in the college is important.

## **2.2 Methods Adopted**

The methodology adopted to conduct the Green Audit of the Institution had the following components.

### **2.2.1 Onsite Data Collection**

Both Physical and virtual tour of the college campus was organized by the Green Audit Team. The data samples and relevant photographs were collected through geo-tagged photographs. The key focus of the audit was on assessing the status of the green cover of the Institution, species biodiversity, their waste management practices and energy conservation strategies etc.



### **2.2.2 Focus Group Discussion**

The Focus Group discussions were held with the staff members and the management focusing various aspects of Green Audit. The discussion was focused on identifying the attitudes and awareness towards environmental issues at the institutional and local level.

### **2.2.3 Water, Energy, Waste, Biodiversity and Carbon Foot Print Analysis Survey**

With the help of teachers and staff, the audit team has assessed the energy consumption pattern, heat signature, waste generation, disposal and treatment facilities of the college. The monitoring was conducted with a detailed questionnaire survey method.

## **2.3 Audit Team**

A Team comprised of the Faculty members, non teaching staff and student representative of Rammohan College named **BASUDHA** has been formed. The team along with the representatives from the RSP Green Development & Laboratories Pvt. Ltd. (ISO Certified and QCI - NABET Accredited Environmental Consultant Organization) conducted the Green Audit.

### **Members of BASUDHA (Green Team) of Rammohan College**

- Dr. Saswati Sanyal, Principal, Rammohan College
- Dr. Krishnendu Sarkar (Teaching Staff)
- Dr. Samarendra Nath Banerjee (Teaching Staff)
- Dr. Santi Ranjan Dey (Teaching Staff)
- Dr. Kaustav Dutta Chowdhury (Teaching Staff)
- Dr. Ashesh Garai (Teaching Staff)
- Dr. Samiran Mondal (Teaching Staff)
- Dr. Md. Ahmadullah (Teaching Staff)
- Smt. Priti Prava Dutta (Teaching Staff)
- Mr. Tapas Narayan Ray (Teaching Staff)
- Smt. Jayanti Sen (Teaching Staff)
- Smt. Anima Roy (Teaching Staff)
- Mr. Amitava Mahapatra (Non Teaching Staff)
- Ms. Shreyasi Sarkar (Student)



### **Members from RSP Green Development & Laboratories Pvt. Ltd.**

- Ms. Sreerupa Chatterjee (Jr. Environmentalist)
- Ms. Madhumanti Bag (Jr. Environmentalist)

### **2.4 Audit Stages**

Green auditing in Rammohan College, Kolkata began with the assessment of the status of the green cover of the Institution followed by waste management practices and energy conservation strategies etc. The team monitored different facilities at the college, determined different types of appliances and utilities (lights, taps, toilets, air conditioners, etc.) as well as measuring the usage per item (Watts indicated on the appliance, etc.) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and learners were interviewed to get details of usage, frequency or general characteristics of certain appliances. Data collection was done in the sectors such as Energy, Waste, Greening, Carbon footprint and Water use. College records and documents were verified several times to clarify the data received through survey and discussions.

### **3. Observations & Findings**

The findings and observations after campus visit, group interactions, survey and review have been analyzed and represented below.

#### **3.1. Water Management**

##### **3.1.1 Source of water and its uses**

The major source of water used in the College is supplied by Kolkata Municipal Corporation at free of cost. The amount of water supplied is sufficient for the daily college activities and hence no additional tanker water is needed to meet its demand. No ground water is used in the campus by means of well or any other activities.

Total 4 numbers of water tanks are available in the New Science Building (NSB) with capacity of 4000 L each. One tank with 5000 L capacity and another with 3000 L capacity is also installed in the old building and hostel respectively. A total of 9000 L of water is pumped every day using 5 hp (NSB), 5 hp old building, 4.5 hp (hostel) motors. Water consumption meter is not installed and hence no record is maintained for daily water consumption. An average of 2,34,000 L of water is used by the College per month. Water is used for drinking purpose, toilets, canteen, laboratories, hostel and gardening. RO based water purifier units and coolers have been installed in different floors of the campus to treat the water for drinking purpose. Distilled water requirement in laboratories are by the distillation unit set in the college itself. College has displayed signboards for spreading awareness regarding water conservation. Dry mopping/cleaning methods are adopted to ensure water conservation. Uses of low flow/flow control water equipment or gadgets are manually controlled by supervisor. There is no formal water management plan available with the institute. Water consumption at each consumption level is monitored manually. There are two small rain water storage at the New campus in front side of the campus. The stored rain water is used for gardening and plantation. There is no Sewage Water Treatment plant in the campus to recycle the waste water for the use of flushing and gardening. The waste water is being drained to main drainage system of the city. Details of water consumption in hostel could not be procured during audit process.

##### **3.1.2 Water Quality Analysis**

As the water is primarily supplied by the Municipal Corporation, it can be assumed that the water is properly treated and meets the requisite norms of BIS standards. The routine parameters

of drinking water available in the campus (eg. pH, conductivity, salinity, DO etc.) are regularly checked in college laboratory by the students (data attached below).



**Water lily plantation in Rain water storage**



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# RAMMOHAN COLLEGE

(Formerly City College W.Dept.)  
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Accredited B'' Grade by NAAC

Ref. ....

Date 20-02-2019

## Water parameter analysis of drinking water-2018-2019

### At New Science Building

*(85A, Raja Rammohan Sarani, Kolkata-700009)*

**(Data are average of three independent observations)**

| Name of the parameter                 | Dates      |            |            |            |
|---------------------------------------|------------|------------|------------|------------|
|                                       | 14.07.2018 | 27.09.2018 | 08.11.2018 | 18.02.2019 |
| pH                                    | 6.4        | 6.65       | 6.73       | 6.9        |
| Dissolved oxygen (mg/dl)              | 0.58       | 0.53       | 0.55       | 0.5        |
| Free dissolved carbon di oxide (mg/l) | 3.8        | 3.6        | 3.3        | 3.96       |
| Salinity (ppt)                        | 0.0022     | 0.0028     | 0.0026     | 0.0031     |
| TDS (ppm)                             | 156        | 148        | 143        | 141        |

*S Sanjay*  
Principal  
Rammohan College  
Kolkata-9

**Principal  
Rammohan College**



**Test report of water quality parameters in college laboratory**

## 3.2 Energy Audit

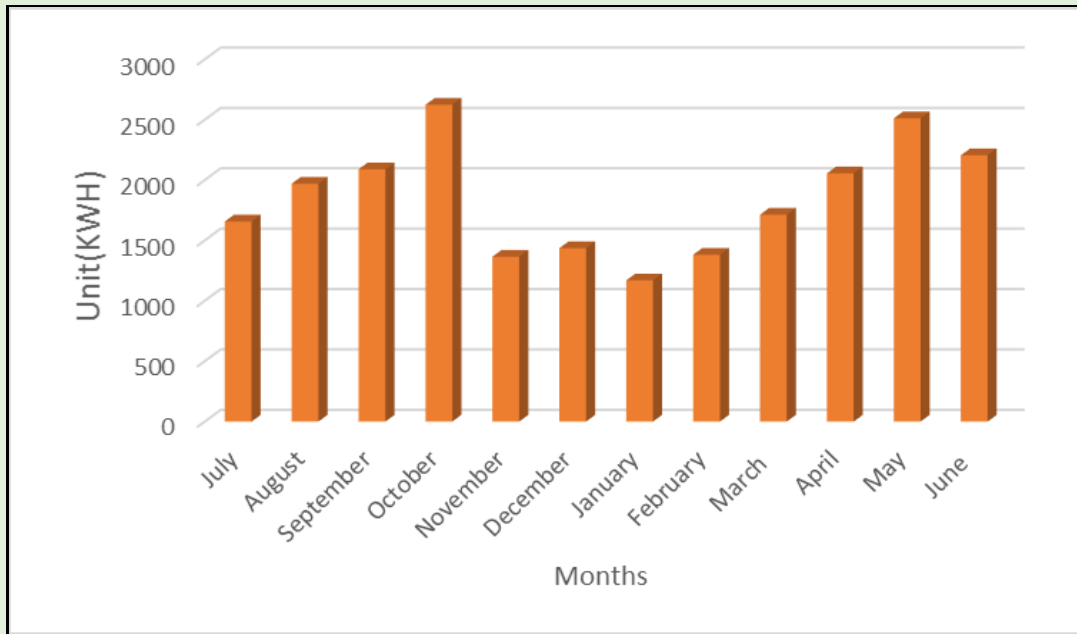
Energy conservation plays a pivotal role in promoting campus sustainability and is intricately connected to the carbon footprint of the institution. Energy auditing is the process of managing and diminishing energy consumption, with a keen focus on minimizing carbon foot print. Consequently, it is imperative for any environmentally-conscious institution to scrutinize its energy utilization practices and embrace alternative energy sources wherever feasible.

### 3.2.1 Electrical Bill Analysis

Electricity is supplied by Calcutta Electricity Supply Corporation. All the electrical appliances in the old and new college building and hostel run on three different meters. Electricity consumption in last 12 months has been depicted below. An average consumption of 1848.08kWh/month is estimated in New Science Building during normal operating scenario (Table 4) whereas 12406.33kWh/month is the average consumption of Ram Mohan college old building (Table 6) and 2977.17kWh/ month in hostel as assessed in the season 2021-2022 (Table 8).

**Table 4: New Science Building electricity consumption**

|                                   |                                     |
|-----------------------------------|-------------------------------------|
| <b>Consumer Name</b>              | Teacher in Charge, Rammohan College |
| <b>Consumer No.</b>               | 37038446004                         |
| <b>Meter No.</b>                  | 2354905 01                          |
| <b>Electricity Supply Company</b> | CESC                                |
| <b>Tariff Category</b>            | G/3 Ph                              |
| <b>Contract Demand (kVA)</b>      | 23.5                                |
| <b>50% of Con. Demand (KVA)</b>   | 11.75                               |
| <b>Sanctioned load (KW)</b>       | 23.5                                |



**Fig-2: New Science Building electricity consumption during 2018-2019**

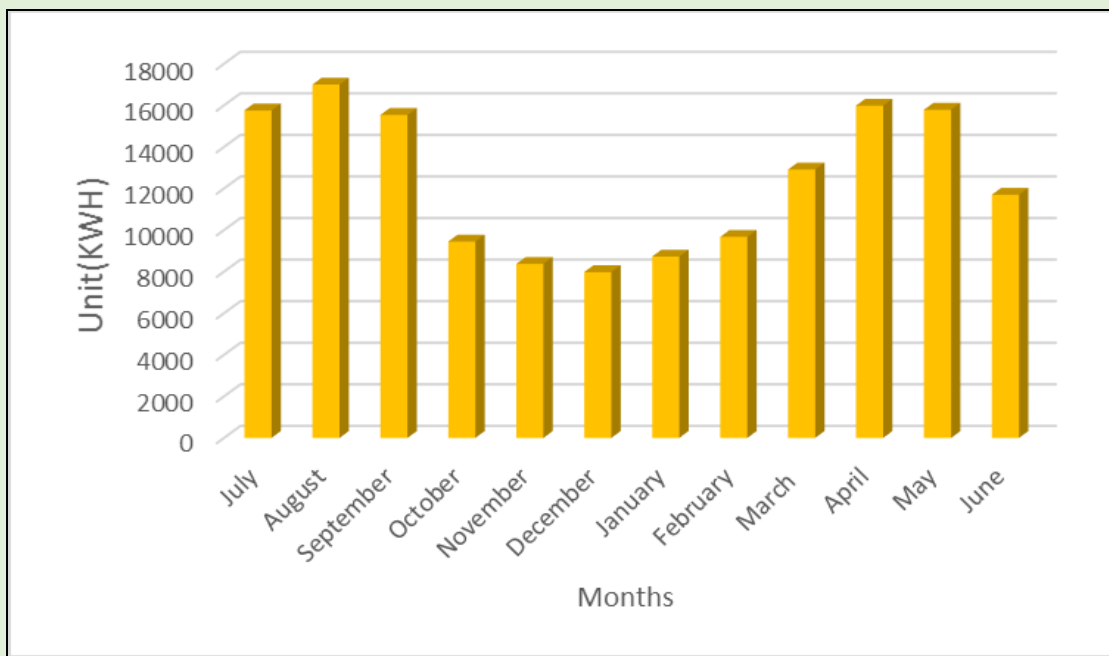
**Table 5: New Science Building electricity consumption during 2018-2019**

| Sl. No.             | Months    | Unit(KWH)      |
|---------------------|-----------|----------------|
| 1                   | July      | 1657           |
| 2                   | August    | 1970           |
| 3                   | September | 2089           |
| 4                   | October   | 2624           |
| 5                   | November  | 1365           |
| 6                   | December  | 1436           |
| 7                   | January   | 1169           |
| 8                   | February  | 1381           |
| 9                   | March     | 1713           |
| 10                  | April     | 2056           |
| 11                  | May       | 2512           |
| 12                  | June      | 2205           |
| <b>Average unit</b> |           | <b>1848.08</b> |



**Table 6: Electricity consumption in Old Building**

|                                   |                         |
|-----------------------------------|-------------------------|
| <b>Consumer Name</b>              | Principal, City College |
| <b>Consumer No.</b>               | 85305001041             |
| <b>Meter No.</b>                  | 2869308 01              |
| <b>Electricity Supply Company</b> | CESC                    |
| <b>Tariff Category</b>            | P/3 Ph                  |
| <b>Contract Demand (kVA)</b>      | 70.6                    |
| <b>50% of Con. Demand (KVA)</b>   | 35.3                    |
| <b>Sanctioned load (KW)</b>       | 70.6                    |



**Fig-3: Old Building electricity consumption during 2018-2019**

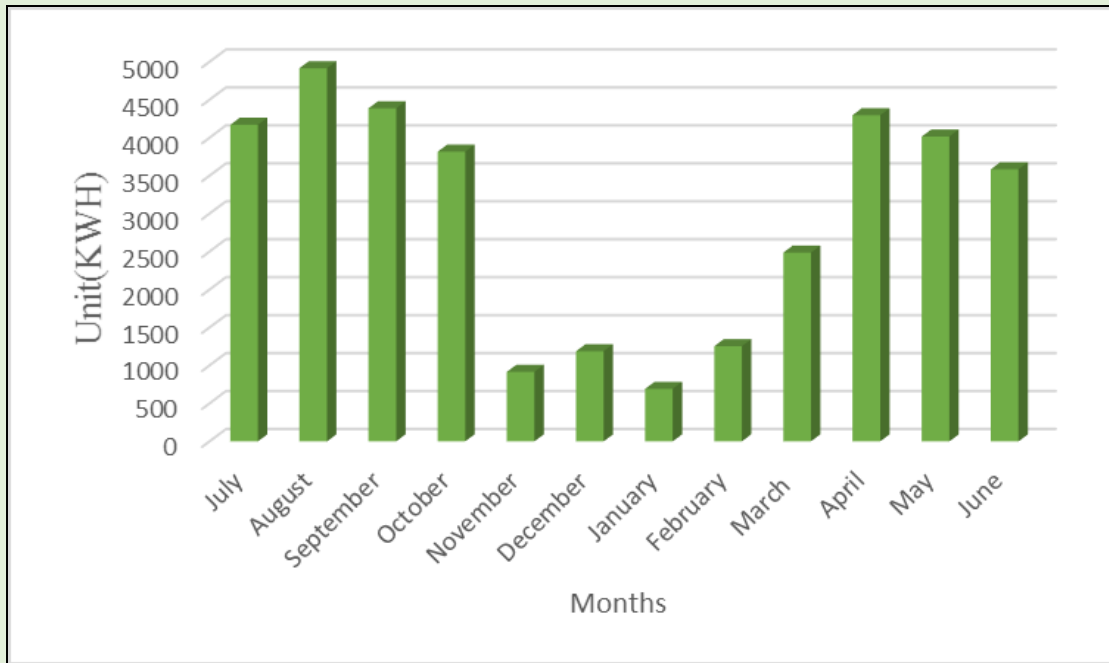
**Table 7: Old Building electricity consumption during 2018-2019**

| Sl. No. | Months | Unit(KWH) |
|---------|--------|-----------|
| 1       | July   | 15756     |
| 2       | August | 17000     |

|                     |           |                 |
|---------------------|-----------|-----------------|
| <b>3</b>            | September | 15540           |
| <b>4</b>            | October   | 9450            |
| <b>5</b>            | November  | 8370            |
| <b>6</b>            | December  | 7976            |
| <b>7</b>            | January   | 8724            |
| <b>8</b>            | February  | 9670            |
| <b>9</b>            | March     | 9670            |
| <b>10</b>           | April     | 12914           |
| <b>11</b>           | May       | 15986           |
| <b>12</b>           | June      | 15790           |
| <b>Average unit</b> |           | <b>12406.33</b> |

**Table 8: Hostel electricity consumption**

|                                   |                                     |
|-----------------------------------|-------------------------------------|
| <b>Consumer Name</b>              | Teacher in Charge, Rammohan College |
| <b>Consumer No.</b>               | 38038091001                         |
| <b>Meter No.</b>                  | 2154477 01                          |
| <b>Electricity Supply Company</b> | CESC                                |
| <b>Tariff Category</b>            | G/3 Ph                              |
| <b>Contract Demand (kVA)</b>      | 14.2                                |
| <b>50% of Con. Demand (KVA)</b>   | 7.1                                 |
| <b>Sanctioned load (KW)</b>       | 14.2                                |



**Fig-4: Electricity Consumption in Hostel during 2018-2019**

**Table 9: Electricity Consumption in Hostel during 2018-2019**

| Sl.No               | Months    | Unit(KWH)      |
|---------------------|-----------|----------------|
| 1                   | July      | 4171           |
| 2                   | August    | 4916           |
| 3                   | September | 4388           |
| 4                   | October   | 3817           |
| 5                   | November  | 916            |
| 6                   | December  | 1187           |
| 7                   | January   | 692            |
| 8                   | February  | 1254           |
| 9                   | March     | 2487           |
| 10                  | April     | 4297           |
| 11                  | May       | 4016           |
| 12                  | June      | 3585           |
| <b>Average unit</b> |           | <b>2977.17</b> |

### 3.2.2 Electrical Appliances

The commonly used electrical appliances in the College include tube lights, CFL lights, Ceiling fans, refrigerators, water purifier, hot air oven, air conditioners, computers, pump, UPS and other power back-ups etc. The average numbers of these appliances have been enlisted in the following table. The correct lux levels (70-300 lux) is maintained to avoid excessive light. The Information Technology Lab has 12 computers in total. The animal house used for Zoology and Physiology Department provides Photocell occupancy sensor for automatic light control. Numbers of different types of electrical devices and their average running time have been presented in Table 10 - 14.

**Table 10: Electrical Appliances in the College**

| Sl. No. | Name of Appliances              | No. of Units                     | KWH |
|---------|---------------------------------|----------------------------------|-----|
| 1       | Tube Light                      | 335                              |     |
| 2       | Compact Fluorescent Lamps (CFL) | 1+1+1+36                         |     |
| 3       | Ceiling Fans                    | 301                              |     |
| 4       | Water Purifiers                 | 7                                |     |
| 5       | Refrigerators                   | 5+5                              |     |
| 6       | Hot air Ovens                   | 4                                |     |
| 7       | Air-conditioners                | 8 (1.5 tones split)              |     |
| 8       | Grinders                        | 56                               |     |
| 9       | Computers                       | Total 140 including 12 in IT Lab |     |
| 10      | Pumping Machines                | 3                                |     |
| 11      | UPS and Other Power Back-up     | 140                              |     |
| 12      | Heater                          | 3                                |     |

**Table 11: Distribution of Electrical appliances (New Science Building)**

| Room No. / Name                | Type of Electrical Device | Quantity Nos                 |     | Operation |            |
|--------------------------------|---------------------------|------------------------------|-----|-----------|------------|
|                                |                           | Light                        | Fan | Hrs/Day   | Days/Month |
| 401                            | Lights, Fans              | 5                            | 3   | 12        | 26         |
| 402                            | Lights, Fans              | 6                            | 5   | 12        | 26         |
| 403(Library)                   | Lights, Fans              | 16                           | 6   | 12        | 26         |
| 404                            | Light, Fans               | 12                           | 8   | 12        | 26         |
| 405                            | Lights, Fan               | 8                            | 6   | 12        | 26         |
| 406(Auditorium)                | Lights, Fan               | 14                           | 9   | -         | -          |
| 4 <sup>th</sup> Floor Corridor | Lights, Fan               | 4 Double                     | 5   | 12        | 26         |
| 307                            | Lights, Fan               | 4                            | 2   | 12        | 26         |
| 306                            | Lights, Fan               | 16                           | 7   | 12        | 26         |
| 3 <sup>rd</sup> Floor Corridor | Lights, Fan               | 6 Single, 4 Double           | 6   | 12        | 26         |
| 305 (IQAC room)                | Lights, Fan               | 2                            | 2   | 12        | 26         |
| 303                            | Lights, Fan               | 12                           | 6   |           |            |
| 101(Principal Room)            | Lights, Fan               | 2 Single Tube                | 2   | 12        | 26         |
| 102 (IT)                       | Lights, Fan               | 2 Single Tube, 1 Double Tube | 3   | 12        | 26         |
| 103 (Office)                   | Lights, Fan               | 1 Single Tube                | 2   | 12        | 26         |
| Canteen                        | Lights, Fan               | 5 Tubes                      |     | 12        | 26         |

**Table 12: Distribution of Electrical appliances (Old Building)**

| Room No. / Name | Type of Electrical Device | Quantity Nos   |           | Operation |            |
|-----------------|---------------------------|----------------|-----------|-----------|------------|
|                 |                           | Light          | Fan       | Hrs/Day   | Days/Month |
| Accounts        | Light and Fan             | 20 Normal Tube | 4+1 Stand | 12        | 26         |
| Office          |                           | 8 Tube         | 10        |           |            |
| Principal Room  |                           |                |           |           |            |
| Front Room      |                           |                |           |           |            |

|     |  |   |   |    |    |
|-----|--|---|---|----|----|
| 5   |  | 8 | 5 | 12 | 26 |
| 6   |  | 8 | 5 | 12 | 26 |
| 7A  |  | 6 | 5 | 12 | 26 |
| 16  |  | 5 | 5 | 12 | 26 |
| 17  |  | 7 | 6 | 12 | 26 |
| 19A |  | 6 | 5 | 12 | 26 |
| 20  |  | 7 | 7 | 12 | 26 |
| 22  |  | 4 | 5 | 12 | 26 |
| 23  |  | 4 | 2 | 12 | 26 |
| 26  |  | 3 | 3 | 12 | 26 |
| 27  |  | 3 | 5 | 12 | 26 |
| 28  |  | 2 | 1 | 12 | 26 |
| 28A |  | 2 | 1 | 12 | 26 |
| 29  |  | 5 | 5 | 12 | 26 |
| 30  |  | 6 | 6 | 12 | 26 |
| 32B |  | 5 | 6 | 12 | 26 |
| 32A |  | 4 | 6 | 12 | 26 |
| 33  |  | 4 | 6 | 12 | 26 |
| 33A |  | 3 | 4 | 12 | 26 |
| 32  |  | 4 | 4 | 12 | 26 |
| N1  |  | 4 | 4 | 12 | 26 |
| N2  |  | 4 | 4 | 12 | 26 |
| N3  |  | 4 | 4 | 12 | 26 |
| N4  |  | 4 | 4 | 12 | 26 |
| N5  |  | 4 | 4 | 12 | 26 |
| N6  |  | 5 | 5 | 12 | 26 |



|                  |  |             |             |    |    |
|------------------|--|-------------|-------------|----|----|
| N7               |  | 5           | 4           | 12 | 26 |
| Commerce Room    |  | 2           | 3           | 12 | 26 |
| Geography Room   |  | 13          | 20          | 12 | 26 |
| Teachers' Room   |  | 4           | 6           | 12 | 26 |
| Bursar Room      |  | 2           | 1           | 12 | 26 |
| NCC Room         |  | 3           | 1           | 12 | 26 |
| Rector Room      |  | 3           | 2           | 12 | 26 |
| Staff Canteen    |  | 2+1 Heater  | 1+ 1 Fridge | 12 | 26 |
| Teachers Canteen |  | 10+1 Heater | 5+ 1 Fridge | 12 | 26 |
| Student Canteen  |  | 10+1 Heater | 7+ 2 Fridge | 12 | 26 |

**Table 13: Distribution of Electrical appliances (Hostel)**

|    | Room No. / Name | Type of Electrical Device | Quantity Nos            |                     | Operation |            |
|----|-----------------|---------------------------|-------------------------|---------------------|-----------|------------|
|    |                 |                           | Light                   | Fan                 | Hrs/Day   | Days/Month |
| 1. | Hostel          | Light and Fan             | 80 Tube light<br>56 CFL | 49 + 2<br>table fan | 24        | 30         |

**Table 14: Air Conditioning System in the Campus**

| Air Conditioners     |                  |          |          |           |           |            |             |
|----------------------|------------------|----------|----------|-----------|-----------|------------|-------------|
| Room No. / Name      | Type             | Capacity | Quantity | Power     | Operation |            | Star Rating |
|                      |                  | TR       | Nos.     | Watt/Unit | Hrs/Day   | Days/Month |             |
|                      | Split/ Window AC |          |          |           |           |            | 3 Star      |
| Old Building         | Split AC         | -        | 0        | -         | 12        | 26         |             |
| New Science Building | Split AC         | 1        | 2        | 1000      | 12        | 26         | ✓           |
|                      |                  | 1.5      | 3        | 1500      |           |            | ✓           |

### **3.2.3 Efficient Energy Management Practices**

All electrical appliances are regular maintained for sustainable energy management. The college is gradually shifting towards LED lights by replacing existing lighting fixtures with LEDs and other energy efficient lighting fixtures to conserve energy. Correct lux levels (70-300 lux) are maintained to avoid excessive light. All ACs are 3 star rated and the temperature is kept between 22-24 degree Celsius. The switching and operation is manual in nature. Servicing of the electrical appliances is done at regular intervals to ensure energy efficiency. Institute is utilizing the natural light to its maximum. The classroom and laboratories are designed in such a way that it allows maximum sun light and reduces requirement of artificial lights. The classrooms and offices in the premises are well ventilated and the wide corridors are open to daylight. The operable glass windows are useful to facilitate natural light. The smart class room, auditorium and linguistic laboratory have insulated and tinted glass to filter heat gain. The fans are operational and adequately placed to affect the sufficient air changes. Fans installed are not star-rated. College has done indoor plantation to provide fresh air inside the premises. LED monitors and Email/ electronic communication mode is preferred to save energy. Awareness posters regarding energy conservation is being displayed in the premises. The canteen uses LPG gas for cooking purpose. However, the Institute has not adapted to any sensor-based energy conservation technique. Since there is limited facility in hostel and canteen, no solar water heating system is installed. Since the biodegradable waste generation is low, there is no Bio-gas plant.

### **3.3 Waste Management**

This indicator addresses waste production and disposal of different wastes like paper, food, plastic, biodegradable, construction, glass, dust etc. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Solid waste generation and management is one of the most challenging issues in academic institutions. Unscientific handling of solid waste can pose threat to everyone. The survey focused on volume, type and current management practice of solid waste generated in the campus.

### 3.3.1 Types of waste generated in the campus

The campus generates different types of biodegradable (paper, food waste etc.) and non-biodegradable (plastic, packaging product etc.) waste in the office, classrooms, canteen, and hostel. The wet and dry laboratories generate biodegradable (tissue, blood, animal and plant parts), chemical waste as well as e waste.

**Table 15: Approximate quantity of waste generated per day (in kg)**

| Office     | Type of Waste              |                                  |           |         |
|------------|----------------------------|----------------------------------|-----------|---------|
| Quantity   | Biodegradable              | Non-Biodegradable                | Hazardous | Others  |
| < 1kg      |                            |                                  | NA        | NA      |
| 2 - 10 kg  |                            | Plastic                          |           |         |
| > 10 kg    | Paper                      |                                  |           |         |
| Classrooms | Type of Waste              |                                  |           |         |
| Quantity   | Biodegradable              | Non-Biodegradable                | Hazardous | Others  |
| < 1kg      | Paper                      | Food wrapper                     | NA        | NA      |
| 2 - 10 kg  |                            |                                  |           |         |
| > 10 kg    |                            |                                  |           |         |
| Labs       | Type of Waste              |                                  |           |         |
| Quantity   | Biodegradable              | Non-Biodegradable                | Hazardous | Others  |
| < 1kg      | Animal and plant parts     | Broken glassware, plastic waste  | Chemical  | E-Waste |
| 2 - 10 kg  |                            |                                  |           |         |
| > 10 kg    |                            |                                  |           |         |
| Canteen    | Type of Waste              |                                  |           |         |
| Quantity   | Biodegradable              | Non-Biodegradable                | Hazardous | Others  |
| < 1kg      |                            |                                  | NA        | NA      |
| 2 - 10 kg  |                            | Plastic, Other Packaging Product |           |         |
| > 10 kg    | Vegetable peel, Food waste |                                  |           |         |

### 3.3.2 Waste Disposal Practices Adopted by the College

The source of wastewater is Domestic Waste Water i.e., Sewage water. The Sewage water mainly comes from toilets and canteen. The wet laboratories also generate waste water. There is

no Sewage Water Treatment plant in the campus to recycle the waste water for the use of flushing and gardening. The waste water is being drained through internal drainage system and carried to main drainage system of the city. The everyday solid waste is collected by Kolkata Municipal Corporation for necessary disposal. The College has color coded waste bins are visibly available in the college. The segregation of waste needs to be done more efficiently. There is no biomedical or radioactive waste getting generated in the college. Old instruments, waste paper, cartons discarded tools, gadgets, computer parts, chemical bottles are discarded following administrative protocol through authorized vendors.

### **3.3.3 Reduce, Reuse, Recycle**

The office and departments follow both sided printing to save energy and reduce waste. Single sided used papers are reused for writing and printing in all the departments to minimize the usage of papers. Broken furniture, appliance or computers are repaired and reused in terms of minimize waste. Examination related documents are stored for a fixed period and disposed as per the University guideline. Waste glass bottles are partially reused in the laboratories. Waste papers, cartons and scraps are occasionally sent to unorganized recyclers and scrap dealers. Dry leaves are used for composting in the garden area. There is a ban on use of single use plastic in the campus area. Very less plastic waste is generated by some departments, office, garden etc. Awareness regarding plastic pollution is spread in the campus.

Discarded electronic products produce electronic garbage, or e-waste. In the last several decades, there has been a notable surge in the production of electronic trash. The rising rate of e-waste generation worldwide is close to 2 metric tons (Mt) annually. The projected amount of e-waste created in 2030 is 74 million tons. E-waste can therefore pose a serious risk to the environment. E-waste releases toxic metals into the environment, including as lead, mercury, nickel, and cadmium, which eventually find their way into surface water, groundwater, soil, and sediment. The health of people, aquatic life, and plants are all negatively impacted when harmful metals are released into the environment. As a result, effective e-waste management is crucial and has become a global issue. According to a survey, home and office electrical appliances account for over half of all e-waste produced, making them the main source of the garbage. The combination of biological, physical, and chemical processes exhibits relatively high removal efficiency among remediation technologies, and it has several advantages over other remediation technologies. Recycling is among the most effective e-waste management techniques. The

College emphasizes on proper disposal of e-waste and use of recycled goods to decrease pollution load in the environment, as a part of social responsibility. E-waste generated in the campus is managed, keeping in mind the environmental hazards that may arise if not disposed properly. The cartridges of laser printers are refilled outside the college campus. Purchase of electronic products from companies which have service for disposal of product with buyback policy or exchange is encouraged by the college. The E- wastes and defective items from computer laboratories are being stored properly and recycled in effective manner. The dismantled electronic spare parts are immediately sold for reuse.



**Flag hoisting ceremony in the new campus of college**



## **3.4 Green Campus**

### **3.4.1 Campus Biodiversity**

Approximately 2000 sq m free space is available in the institution in the form of garden and backyard. There is moderate vegetation in the campus along with some indoor plants. The campus premises have also presence of common birds like crow, sparrow, Myna, Sun bird, Nightingale and squirrel, domestic cat and dogs.

More than 50 medicinal plants have been cultivated in the Medicinal Plants Garden in the new campus at 85A, Raja Rammohan Sarani, Kol-9. The campus also has presence of ornamental trees & shrubs. Some of them are listed in Table 13. More than 70 weed species have been documented in the campus and enlisted in Table 15.

The campus is also a habitat of numbers of butterflies which is a crucial component of the environment due to their role in pollination. It can be used as a tool for management and conservation choices involving butterflies. Institutional campuses with undisturbed natural flora and seasonal flowering plantations provide suitable habitat for butterfly populations since they are frequently free of any development operations and pollutants. They are also regarded as reliable ecological indicators because to their sensitivity to climatic and environmental changes. The species richness, abundance or mortality rate of butterfly species can shed light on the surrounding environmental quality. In Rammohan College campus 21 species of butterflies (Table 17) belonging to 4 families, 8 subfamilies were found more or less throughout the year, but there is no significant correlation between butterfly species richness and Air Quality Index (PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub> ect.) (Mitra et al. 2023 a,b)

**Table 16: Plant species in the campus**

| <b>Medicinal Plants</b>              |                                 |  |
|--------------------------------------|---------------------------------|--|
| Amlaki/Amla                          | <i>Emblica officinalis</i>      | Fruits are good source of vitamin C  |
| Nayantara/Periwinkle                 | <i>Catharanthus roseus</i>      | Roots contain vincristine & vinblastine which are used to treat cancer,                                      |
| Berela                               | <i>Sida rhombifolia</i>         | Leaves contain antibacterial properties & antioxidants. It is used in diarrhoea, malarial fever, asthma etc. |
| <b>Ornamental trees &amp; shrubs</b> |                                 |  |
| Swarna Champa Tree.                  | <i>Michelia champaca</i>        | Flowers intensely fragrant.  |
| Rangan                               | <i>Ixora coccinea</i>           | Shrub  |
| Sheuli                               | <i>Nyctanthes arbor-tristis</i> | Shrub or small tree  |
| Rokto korobi                         | <i>Nerium odoratum</i>          |  |
| Sukhdarshan                          | <i>Crinum asiaticum</i>         |  |
| <b>Wild plants</b>                   |                                 |  |
| Kyllinga                             | <i>Kylling abbrevistylis</i>    |  |
| Tridaksha                            | <i>Tridax procumbens</i>        |  |
| Uchanti                              | <i>Ageratum conyzoides</i>      |  |











**Table 17: Weed flora of New Campus, Rammohan College**


| Sl. No. | Scientific Name                     | Family           | Comment                                      |
|---------|-------------------------------------|------------------|--|
| 1       | <i>Solanum nigrum</i>               | Solanaceae       | Annual herb                                  |
| 2       | <i>Eragrostis tenella</i>           | Poaceae          | Perennial herb with rhizome                  |
| 3       | <i>Eleusine indica</i>              | Poaceae          | Perennial herb with rhizome                  |
| 4       | <i>Cynodon dactylon</i>             | Poaceae          | Perennial herb with wiry rhizome             |
| 5       | <i>Oldenlandi acorymbosa</i>        | Rubiaceae        | Annual herb                                  |
| 6       | <i>Oldenlandi apaniculata</i>       | Rubiaceae        | Annual herb                                  |
| 7       | <i>Dactyloctenium aegyptium</i>     | Poaceae          | Perennial rhizomatous herb                   |
| 8       | <i>Ageratum conyzoides</i>          | Asteraceae       | Annual herb                                  |
| 9       | <i>Blumea lacera</i>                | Asteraceae       | Annual herb                                  |
| 10      | <i>Lindenbergia indica</i>          | Scrophulariaceae | Annual herb                                  |
| 11      | <i>Vandellia crustacea</i>          | Scrophulariaceae | Annual herb                                  |
| 12      | <i>Lindernia parviflora</i>         | Scrophulariaceae | Annual herb                                  |
| 13      | <i>Phylla nodiflora</i>             | Verbenaceae      | Perennial prostrate herb                     |
| 14      | <i>Rungia parviflora</i>            | Acanthaceae      | Annual herb                                  |
| 15      | <i>Desmodium triflorum</i>          | Fabaceae         | Perennial prostrate herb                     |
| 16      | <i>Alternanthera sessilis</i>       | Amaranthaceae    | Perennial herb                               |
| 17      | <i>Alternanthera paronychioides</i> | Amaranthaceae    | Perennial herb                               |
| 18      | <i>Alternanthera ficoides</i>       | Amaranthaceae    | Perennial herb                               |
| 19      | <i>Amaranthus viridis</i>           | Amaranthaceae    | Annual herb                                  |
| 20      | <i>Amaranthus spinosus</i>          | Amaranthaceae    | Annual prickly herb                          |
| 21      | <i>Tillanthera philoxeroides</i>    | Amaranthaceae    | Annual herb                                  |
| 22      | <i>Aerva lanata</i>                 | Amaranthaceae    | Perennial herb with somewhat woody rootstock |
| 23      | <i>Mecardonia procumbens</i>        | Scrophulariaceae | Annual prostrate herb                        |
| 24      | <i>Laportia interrupta</i>          | Urticaceae       | Annual herb with stinging hairs              |
| 25      | <i>Nicotiana plumbaginifolia</i>    | Solanaceae       | Annual herb                                  |
| 26      | <i>Cyperus rotundus</i>             | Cyperaceae       | Perennial herb with corm                     |
| 27      | <i>Cyperus iria</i>                 | Cyperaceae       | Annual herb                                  |
| 28      | <i>Kyllinga brevistylis</i>         | Cyperaceae       | Perennial rhizomatous herb                   |
| 29      | <i>Andrographis paniculata</i>      | Acanthaceae      | Annual/perennial herb                        |
| 30      | <i>Andropogon aciculatus</i>        | Poaceae          | Perennial rhizomatous herb                   |
| 31      | <i>Dentella repens</i>              | Rubiaceae        | Annual prostrate herb                        |
| 32      | <i>Oplismenus burmannii</i>         | Poaceae          | Perennial herb                               |
| 33      | <i>Digitaria ciliaris</i>           | Poaceae          | Annual herb                                  |
| 34      | <i>Digitaria sanguinalis</i>        | Poaceae          | Annual herb                                  |







| Sl. No. | Scientific Name                | Family         | Comment                  |
|---------|--------------------------------|----------------|--------------------------|
| 35      | <i>Chloris barbata</i>         | Poaceae        | Annual herb              |
| 36      | <i>Sida rhombifolia</i>        | Malvaceae      | Perennial undershrub     |
| 37      | <i>Sida acuta</i>              | Malvaceae      | Perennial undershrub     |
| 38      | <i>Sida cordifolia</i>         | Malvaceae      | Perennial undershrub     |
| 39      | <i>Crotalaria pallida</i>      | Fabaceae       | Annual herb              |
| 40      | <i>Euphorbia hirta</i>         | Euphorbiaceae  | Perennial herb           |
| 41      | <i>Euphorbia parviflora</i>    | Euphorbiaceae  | Annual herb              |
| 42      | <i>Euphorbia microphylla</i>   | Euphorbiaceae  | Annual prostrate herb    |
| 43      | <i>Phyllanthus urinaria</i>    | Euphorbiaceae  | annual herb              |
| 44      | <i>Phyllanthus fraternus</i>   | Euphorbiaceae  | Annual herb              |
| 45      | <i>Tribulus terrestris</i>     | Zygophyllaceae | Prostrate herb           |
| 46      | <i>Physalis minima</i>         | Solanaceae     | Annual herb              |
| 47      | <i>Solanum sisymbriifolium</i> | Solanaceae     | Perennial prickly herb   |
| 48      | <i>Evolvulus nummularius</i>   | Convolvulaceae | Perennial prostrate herb |
| 49      | <i>Evolvulus nummularius</i>   | Convolvulaceae | Annual prostrate herb    |
| 50      | <i>Heliotropium indicum</i>    | Boraginaceae   | Annual herb              |
| 51      | <i>Leucas aspera</i>           | Lamiaceae      | Annual aromatic herb     |
| 52      | <i>Leucas cephalotes</i>       | Lamiaceae      | Annual herb              |
| 53      | <i>Leonurus japonicus</i>      | Lamiaceae      | Annual herb              |
| 54      | <i>Cleome viscosa</i>          | Capparidaceae  | Annual herb              |
| 55      | <i>Cleome rutidosperma</i>     | Capparidaceae  | Annual herb              |
| 56      | <i>Cleome gynandra</i>         | Capparidaceae  | Annual herb              |
| 57      | <i>Bulbostylis densa</i>       | Cyperaceae     | Annual herb              |
| 58      | <i>Brachiaria distachya</i>    | Poaceae        | Perennial herb           |
| 59      | <i>Dichanthium annulatum</i>   | Poaceae        | Annual herb              |
| 60      | <i>Echinochloa stagnina</i>    | Poaceae        | Annual herb              |
| 61      | <i>Leptochloa chinensis</i>    | Poaceae        | Annual herb              |
| 62      | <i>Hybanthus enneaspermus</i>  | Violaceae      | Annual herb              |







| Name                          | Photographs  | Name                       | Photographs  |
|-------------------------------|--|----------------------------|--|
| <i>Alternanthera ficoides</i> |   | <i>Mikania scandens</i>    |   |
| <i>Coccinia cordifolia</i>    |   | <i>Peperomia pellucida</i> |   |
| <i>Dentella repens</i>        |  | <i>Sida rhombifolia</i>    |  |

**Selected photographs of the weeds found in the campus**


**Table 18: Butterfly species in the campus**

| Sl. | Scientific Name                         | Common Name | Photograph  |
|-----|---|-------------|---|
| 1   | <i>Graphium agamemnon</i><br>(Linnaeus) | Tailed Jay  |  |

| Sl. | Scientific Name                               | Common Name   | Photograph  |
|-----|---|---------------|---|
| 2   | <i>Papilio polytes</i> (Linnaeus)             | Common Mormon |    |
| 3   | <i>Atrophaneura aristolochiae</i> (Fabricius) | Common Rose   |    |
| 4   | <i>Cepora nerissa</i> (Fabricius)             | Common Gull   |    |
| 5   | <i>Leptosia nina</i> (Fabricius)              | Psyche        |   |
| 6   | <i>Danaus chrysippus</i> (Linnaeus)           | Plain Tiger   |  |
| 7   | <i>Euploea core</i> (Cramer)                  | Common Crow   |  |

| Sl. | Scientific Name                      | Common Name          | Photograph   |
|-----|--------------------------------------|----------------------|--|
| 8   | <i>Melanitis leda</i> (Linnaeus)     | Common Evening Brown |    |
| 9   | <i>Ariadne ariadne</i> (Linnaeus)    | Angled Castor        |    |
| 10  | <i>Ariadne merione</i> (Cramer)      | Common Castor        |   |
| 11  | <i>Junonia atlites</i> (Linnaeus)    | Grey Pansy           |  |
| 12  | <i>Zizeeria karsandra</i> (Moore)    | Dark Grass Blue      |  |
| 13  | <i>Euchrysops cnejus</i> (Fabricius) | Gram Blue            |  |



| Sl. | Scientific Name                | Common Name | Photograph   |
|-----|--------------------------------|-------------|--|
| 14  | <i>Borbo cinnara</i> (Wallace) | Rice Swift  |  |



Avian diversity in the campus



**Mammal biodiversity in the campus**

### **3.4.2 Green Campus Initiatives**

#### **Swachh Bharat Abhiyan**

A cleanliness programme was organized at the premises of New Science building of Rammohan College and the Rammohan Sarani every year. On that day, all the NSS volunteers participated to clean the adjacent path of the college and the nearby street. They picked up the junk from the campus, along the streets and also swept the whole surrounding. Then they spread bleaching powder. This programme was arranged to make the students understand the importance of cleanliness, how they can keep their surrounding clean and also to make them aware of their duty as a responsible member of the community.



**Campus cleaning programme in the college**



### **3.4.3 Sustainable Practices**

- Restricted entry of automobiles
- Walking is encouraged for internal transport.
- Institute has initiated banning plastic in the campus.
- Email/ electronic communication mode is preferred to save papers.
- Both side printing is being adopted to save paper and trees.
- The premises have fire extinguishers installed at required locations which are regularly checked and maintained.
- The campus has established lift and ramp for easy movement of disabled persons.

### **3.4.4 Green Mindset**

- Minimization of waste and proper disposal of e waste
- Composting of leaf litters and use of the compost in gardens
- Utilization of renewable energy resources like solar energy
- Maintenance of the local vegetation and fauna
- Landscaping in the campus to reduce the ambient temperature in the campus

### 3.5 Carbon Foot Print Analysis

**Table 19: Carbon Foot Print Analysis**

| Sl. No. | Parameter  | Numbers  | Annual CO <sub>2</sub> emission   |
|---------|--|--|---|
| 1       | Total no. of vehicles used by the stakeholders (per day) | 5bikes+10car   | (4680 +1903) = 6583 kg CO <sub>2</sub><br>(considering 10 km distance travelled in 6 days a week) |
| 2       | No. of Cycles used.                                      | 5  | -   |
| 3       | No. of two wheelers used                                 |  |   |
| 3a      | Average distance travelled (per day)                     | Within 5km   |   |
| 3b      | Quantity of Fuel Used (per day)                          |  |   |
| 4       | No. of four wheelers used                                |  |   |
| 4a      | Average distance travelled (per day)                     |  |   |
| 4b      | Quantity of Fuel Used (per day)                          |  |   |
| 5       | No. of persons using public transportation               | Most   |   |
| 6       | No. of persons using college conveyance                  |  |   |
| 7       | No. of generators used per day                           |  |   |
| 7a      | Amount of fuel used                                      |  |   |
| 8       | No. of LPG cylinders used in canteens                    | 6 commercial cylinders                                 | 170.4 kg CO <sub>2</sub>  |
| 9       | No. of LPG cylinders used in labs                        | 14.2 kg X2<br>(Chemistry Lab),<br>5 kgX2 (Zoology lab) | 43.5 + 15 = 58.5 kg CO <sub>2</sub>   |
| 10      | Reams of paper used                                      |  |   |
| 11      | Paperless works to reduce paper usage                    |  |   |
| 12      | Use of any other fossil fuels in the college             |  |   |
| 13      | Any efforts to reduce the use of fuels                   |  |   |

As per the estimates from the Central Electricity Authority, the weighted average emission factor for the Indian power grid stands at 0.79 kg CO<sub>2</sub>/kWh. Hence, the total CO<sub>2</sub>emission in a year from electricity consumption of the New Science Building is equivalent to 30575Kg CO<sub>2</sub> and 13372 kg CO<sub>2</sub> in the hostel.

## **4. Suggestions and Recommendations**

### **4.1 Water Management**

- Monitoring of water consumption will be required for ensuring water efficiency. Water meter to be installed to monitor the consumption. The water meter readings to be recorded every day or every week at a fixed time.
- It is recommended to check water quality from water source for dissolved oxygen, acidity, alkalinity, chloride, hardness, pH, and conductivity, total dissolved solids and E-coli/ coliform.
- The wash basin taps may be equipped with water saving fixtures.
- The flush tanks of the toilets may be fitted with dual volume system.
- Awareness campaigns and signboards need to be displayed on every floor.
- A detailed water use and management plan should be prepared and displayed.
- Rain water harvesting to be prepared.

### **4.2 Energy Management**

- The energy audit recommends to avoid the use of more energy consuming electrical appliances and to replace with more environment friendly and energy efficient appliances (for example five stars rated Air conditioner, star rated fans) in the college.
- Ceiling fans have a very good scope for reducing power consumed using a technology called Brushless DC Motor or simply BLDC motor. BLDC technology, in general, has been in the market for a couple of decades. The traditional fan uses an induction motor and typically consumes 70- 90 watts. But BLDC fan, on the other hand, can reduce power consumption up to 65%.
- Prominent advantages of BLDC motor over induction motor are Lower Electricity Consumption, Longer backup on Inverters (even on Solar), improved reliability, Noise reduction, longer lifetime.
- The Hostel and other facilities may use solar heating units to reduce electricity consumption.
- College may adopt sensor-based (occupancy sensors) energy conservation approach for offices, classrooms and washrooms as well.

- College may also replace all existing tube lights with LEDs.
- To increase the carbon offset, it is recommended to extend the Solar PV for not just college building but also for hostel.
- More frequent awareness campaigns to be organized and signboards need to be displayed on every floor.

### **4.3 Waste Management**

- College must arrange color coded, covered and separate waste bin for efficient segregation and disposal of waste at accessible location on each and every floor.
- Workshops need to be conducted regarding stages of waste management and 3R scheme.
- College may undertake feasibility study to install sewage water treatment in the campus to recycle waste water and use it in flush or for gardening purpose.
- Leaf litter from the campus can be effectively used for aerobic/ vermi composting, so that the composted material can also be used as good manure.
- Laboratory waste may be managed efficiently to reduce any scope of contamination.
- Try to completely ban the use of plastic in the campus, and to encourage the use of biodegradable materials as alternatives. Try to achieve the goal of plastic free campus.
- Annual agreement with recyclers/ vendors for all kind of scraps and e waste needs to be followed up.
- Important and confidential reports/ papers can be sent for pulping and recycling after completion of their preservation period.
- Metal waste, wooden waste, unused equipments and scraps should be sent to authorized scrap agents for further processing
- Awareness signboards/ posters need to be displayed on every floor.

#### **4.4 Green Campus**

- Maintenance of biodiversity is needed.
- Review periodically the list of trees planted in the garden, allot numbers to the trees and keep records.
- Nature Club may assign scientific and common name tags on the plants to spread awareness among students.
- College may consider planting tree on the land, away from city, managed by college to offset the carbon footprint.
- Emphasis may be given to develop kitchen garden and roof top garden giving emphasis on indoor and Bonsai plants.
- Students may be encouraged to engage in preparing People's Biodiversity Register (PBR) in and around the campus.
- Environment friendly lifestyles to be encouraged among students, teachers and non teaching staffs.

## 5. Green Audit Checklist

| <b>I. Water Efficiency &amp; Wastewater Management</b>               |  |               |   |
|--|--|---------------|---|
| <b>Sl.No.</b>  | <b>Measures</b>  | <b>Status</b> | <b>Remarks</b>                          |
| 1  | RO based water purifiers for drinking water                                      | Yes           |   |
| 2  | Aerators to water taps   | No            |   |
| 3  | Automatic toilet faucets   | No            |   |
| 4  | Drip irrigation/ Sprinklers (for plant watering system)                          | No            |   |
| 5  | Dual flush toilet with cistern   | No            |   |
| 6  | Dry mopping/ cleaning methods adopted  | Yes           |   |
| 7  | Sewage treatment plant for sewage recycle  | No            |   |
| 8  | Rain water harvesting  |               | Going to install                        |
| 9  | Regular maintenance for leakage free plumbing system                             | Yes           |   |
| 10   | Use of low flow/ flow control water equipment or gadget                          | No            | Manually controlled by the supervisor   |
| 11   | Water balance diagram and water consumption monitoring at each Consumption level | No            | Manually controlled by the supervisor   |
| 12   | Routine monitoring of water quality  |               | Internal assessment by the laboratories |
| 13   | Awareness signs displayed for promoting water conservation                       |               |   |
| <b>II. Energy Efficiency and On-site Energy Generation Mechanism</b> |  |               |   |
| <b>Sl.No.</b>  | <b>Measures</b>  | <b>Status</b> | <b>Remarks</b>                          |
| 1  | Maintaining correct lux levels (70-300 lux) to avoid excessive light             | Yes           |   |
| 2  | Computerized monitoring of electrical system                                     | No            |   |
| 3  | On-site energy generation (Diesel generators, LPG)                               | No            |   |
| 4  | Use of renewable energy (Solar, biogas)  | No            |   |
| 5  | Photocell occupancy sensor for automatic light control                           |               | In animal house                         |
| 7  | Regular maintenance of electrical system   | Yes           |   |

|    |  |     |  |
|----|--|-----|--|
| 8  | Use of energy efficient equipment like VFDs, maximum star rated equipment. | Yes |  |
| 9  | Use of energy saving bulbs (Compact florescent light/LED lights)           | No  |  |
| 10 | Awareness signage on electricity conservation                              | Yes |  |

### III. Solid Waste Management

| Sl.No. | Measures  | Status | Remarks                      |
|--------|---|--------|------------------------------|
| 1      | Waste segregation practices and supporting hardware for waste segregation (Dry recyclable, organic, plastic, hazardous and E-waste) | Yes    | Through proper process       |
| 2      | Setting up recycling/ composting/ bio gas generation facility   | No     | Going to install             |
| 3      | Minimize use of paper through digitalization  | Yes    |                              |
| 4      | Printing on both sides of paper/ Reuse of printed paper/ envelops   | Yes    |                              |
| 5      | Mechanism for collection & disposal of E-waste as applicable regulation   | No     |                              |
| 6      | Single use plastic free campus  | Yes    |                              |
| 7      | Inventories of waste generation and records of waste disposal   |        | Yet to develop               |
| 8      | Recycle/ archiving of paper waste   |        |                              |
| 9      | Segregation of dry and wet waste  |        | As per KMC regulation        |
| 10     | Purchase of electronic products from companies which have service for disposal of product with buy back policy?                     | Yes    | As per Government regulation |
| 11     | Recreating into new sustainable products  | No     |                              |

### IV. Good Day light Design

| Sl.No. | Design Feature   | Status | Remarks |
|--------|--|--------|---------|
| 1      | Wide corridors open to daylight                              | Yes    |         |
| 2      | Broad doors and windows allowing daylight                    | Yes    |         |
| 3      | Building architecture which allows sunlight within buildings | Yes    |         |



|   |   |     |  |
|---|---|-----|--|
| 4 | Presence of Skylight/ Rooflight   | Yes |  |
| 5 | Enough natural illumination in classrooms/ seminar halls/ laboratories  | Yes |  |
| 6 | Ultraviolet (UV) filtering windows/ Use of exterior louvers or light coloured fabric or blinds for windows to control glare | Yes | Only in the auditorium                                     |
| 7 | Operable/ openable windows.   | Yes |  |
| 8 | Use of glass as facilitator of natural light  | Yes |  |
| 9 | Use of insulated and tinted glass to filter heat gain   |     | In smart class room, auditorium and linguistic laboratory. |

#### **V. Ventilation**

| <b>Sr. No.</b> | <b>Design Feature</b>  | <b>Status</b> | <b>Remarks</b> |
|----------------|--|---------------|----------------|
| 1              | Good ceiling height which allows internal air circulation          | Yes           |                |
| 2              | Self-movement ventilators in the roof                              | No            |                |
| 3              | Wide windows and doors for classrooms, laboratories, seminar halls | Yes           |                |
| 4              | Wide corridors   | Yes           |                |
| 5              | Operable louvers   |               |                |
| 6              | Exhaust fans in kitchen/ toilets                                   | Yes           |                |

#### **VI. Temperature and Acoustic Control**

| <b>Sl.No.</b> | <b>Design Feature</b>  | <b>Status</b> | <b>Remarks</b>                                   |
|---------------|--|---------------|--|
| 1             | Roof design & type (Double/ False ceiling with plaster of paris etc.)  | Yes           | Auditorium, Principal's chamber and meeting room |
| 2             | Sand stone cladding/ tiling outside the walls  | No            |  |
| 3             | Specially designed walls for temperature control, Sound noise barriers for windows/ walls  |               | Auditorium and Linguistics Lab                   |
| 4             | Building construction allows diffused sunlight but not the heat. Specially designed glass walls/ windows with better U value/ factor depending upon climate conditions | Yes           | Main campus (old building)                       |

|    |  |     |                                      |
|----|--|-----|--------------------------------------|
| 5  | Use of insulation material (e.g. autoclaved aerated blocks, hollow blocks, Thermocrete etc.)             | No  |                                      |
| 6  | Use of water bodies/ fountain to maintain temperature within campus                                      | Yes |                                      |
| 7  | Climbing creepers on the walls   | No  |                                      |
| 8  | Retro fitting the existing roofs with cool roof technology   | No  |                                      |
| 9  | Use of landscaping gas sound barrier   | No  |                                      |
| 10 | Water free urinals (No flush urinals/ Zero flush urinals/ water less urinals/ air-based flushing system) | No  |                                      |
| 11 | Water balance diagram and water consumption monitoring at each consumption level                         | No  | Manually maintained by supervisor    |
| 12 | Routine monitoring of water quality  | Yes | Internally monitored by laboratories |
| 13 | Awareness signs displayed for promoting water conservation   | Yes |                                      |

#### **VII. Environmental Audit**

| <b>Sl.No.</b> | <b>Type of audit</b>   | <b>Status</b> | <b>Remarks</b> |
|---------------|--|---------------|----------------|
| 1             | Energy audit (includes energy consumption, thermal comfort, visual comfort)  | Yes           |                |
| 2             | Sound/ Noise and lux level monitoring (including indoor noise level, outdoor noise level)                          | Yes           |                |
| 3             | Water and waste audit (including water consumption, quality, solid waste generation, solid waste disposal process) | Yes           |                |
| 4             | Safety Audit   | Yes           |                |

#### **VIII. Universal Access and Efficient Operation and Maintenance of Building**

| <b>Sl.No.</b> | <b>Design feature</b>   | <b>Status</b> | <b>Remarks</b> |
|---------------|---|---------------|----------------|
| 1             | Easy access to the main entrance of the building and minimum two exits  | Yes           |                |
| 2             | Energy efficient elevator   | Yes           |                |
| 3             | Car pooling by staff and students/ use of Public transport/ Use of bicycles and battery-operated vehicles within campus |               |                |

|    |   |     |                  |
|----|---|-----|------------------|
| 4  | Preferred car park spaces for differently abled                     | Yes | New building     |
| 5  | Ramp/ stairs with handrails on at least one side                    | Yes | New building     |
| 6  | Restrooms (toilets) in common areas/ Restroom for differently abled | Yes | New building     |
| 7  | Braille assistance for differently abled                            | No  | Going to procure |
| 8  | Availability of wheelchair  | Yes |                  |
| 9  | Emergency response plan for natural and manmade emergencies         | Yes |                  |
| 10 | Fire exits, assembly points, first aids, firefighting systems       | Yes |                  |
| 11 | Regular maintenance of building                                     | yes |                  |

### **IX. Green Program**

| <b>Sl.No.</b> | <b>Green program</b>   | <b>Status</b> | <b>Remarks</b>       |
|---------------|--|---------------|----------------------|
| 1             | Upcycling of waste. Recycling beyond books i.e. paper, aluminium, plastic, e-waste   | Yes           | By authorized vendor |
| 2             | Creation of “GreenTeam” in the institution/ library  | Yes           | BASUDHA              |
| 3             | Awareness programs on environment, energy management & safety (external Sessions and academic courses)   | Yes           | NSS                  |
| 4             | Outreach, activities, green programs (Tree plantation, waste segregation, plastic waste collection, cleaning etc.) records/ photos of programs                                     | Yes           | NSS                  |
| 5             | Presence of system/ methodology available for implementation of green initiatives and green projects (long term system-based continuity and not an isolated/ stand alone activity) | Yes           | NSS                  |
| 6             | Mindset for reduction, recycle of waste (Green mindsets)   | Yes           |                      |
| 5             | Digitization   | Yes           |                      |
| 6             | E-archiving  | Yes           |                      |
| 7             | E-resources: E-books, Online Journals, membership of consortium  |               | Departmental library |
| 8             | Maintaining green campus/ Greening of campus   | Yes           |                      |