

Report of Green, Environment and Energy Audits



Submitted to

**IDEAL COLLEGE FOR ADVANCED STUDIES,
MALAPPURAM – 679 573, KERALA, INDIA**

Date of Audit: 05.12.2022

Valid Till: 03.12.2025



Submitted by

NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)

[ISO Certified and Ministry of MSME Registered Organization]

No. 2669, LIG-II, Gandhi Managar, Peelamedu

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 Secretary

Certificate of Declaration

The **Office of Nature Science Foundation**, Coimbatore, Tamil Nadu declare that

1. Nature Science Foundation has conducted onsite green audit at ***Ideal College for Advanced Studies, Malappuram – 679 573, Kerala, India*** by deputing certified Lead Auditors and Technical Experts.
2. On the basis of audit observations by the auditors and pertinent data collected from the Auditee, the Technical Report has been prepared and being submitted.
3. Data presented in the Technical Report are verified and to best of our knowledge, the data are authentic and reliable.
4. Nature Science Foundation declares that data generated were not shared with any third parties and the soft copy of the report is available with Nature Science Foundation's Office.
5. Provided the Auditee desired to publish or share the data with other agencies, Nature Science Foundation has no conflict of interest.

Date: 12.12.2022
 Place: Coimbatore

Authorized Signatory
 Nature Science Foundation

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4. ENERGY AUDIT

4.1. Introduction

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to a greater extent. Conventionally, electrical energy is generated by means of fossil fuels, hydraulic and wind energy. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of conventional electric energy. In general, the primary objective of an energy auditing and management of energy consumption is to offer goods or services at the lowest possible cost and with the least amount of environmental impact.

Energy Conservation Building Code (ECBC) is established in the year 2017, which provides minimum requirements for the energy-efficient design and construction of buildings across India. It also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements. Bureau of Energy Efficiency (BEE) came into force in 2002 towards implementation of energy saving practices in an organization. Energy-efficiency labels are information affixed to manufactured products and usually communicate the product energy performance.

BEE Star Rating Scheme is based on actual performance of the building as well as equipment in terms of specific energy usage termed as 'Energy Performance Indicator' by means of star ratings labelled items used which will be useful for energy savings in a sustainable manner (Mishra and Patel, 2016). Energy audit programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on (Gnanamangai *et al.*, 2021). In general, an energy audit process dealt with the driving energy conservation concepts into reality by giving technically possible solutions within a specified time limit while considering the economic and other organizational issues. It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of production interms of savings. It serves as a "benchmark" for managing energy in the organization for planning more energy-efficient use across the board.

4.2. Energy audit observations

During onsite audit following departments were verified for physical facility availability.

- Adequate awareness programmes are organized and conducted to the stakeholders for the proper handling and maintenance of the appliances.
- Adequate external and vertical shading are provided to conserve energy.
- Natural ventilation through windows and shading is available adequately to reduce the energy consumption.
- It is observed that large foliage trees are planted inside the campus to reduce noise pollution.

- External and internal signage lits are differentiated to conserve energy.
- ‘Danger’ and ‘warning boards’ are available near transformer, generator and UPS.
- Outside air is introduced through windows for ventilation in the conditioned spaces.
- Five star rated appliances (lift, AC, Air cooler, Refrigerator, etc..) are procured to conserve energy.
- All the fluorescent (tube) lights are replaced with LED lights to conserve energy.
- Awareness posters like ‘Turn off when not in use’, ‘Save Energy’, etc., are displayed for conserving energy.
- Noise level observed in the different location resulted in normal range.
- Adequate training and awareness programmes are conducted to the stakeholders for energy conservation.
- To optimize the energy campus has implemented solar panel, water heater, sensor lights, operation and maintenance, etc.,

4.2.1. Energy Efficient Design and Process

In the campus, it is observed that for lighting, cooling and ventilation renewable sources of energy like solar panel, water heater, etc., are used. Local resources are made available in post occupant stage as per the operation and maintenance plan. Standard Operating Procedures for lifts, UPS, AC are available to conserve energy and to avoid damage.

4.2.2. Lighting facilities

External shading facilities are made based on the sun path to reduce the energy consumption. Day light integration is implemented in the building by placing adequate number of windows. Electrical lighting facilities during day time increases the energy consumption, it is observed that sufficient day lighting facilities are available through windows which in turn reduce the energy consumption bill of the Organization. Artificial lighting facilities are regularly monitored and maintained. In some areas sensor lights are implemented to save energy. External and internal signage lits are made up of recycled material with maximum light intensity. In the buildings windows head are higher to penetrate day light.



Natural Lighting facilities observed during day time

4.2.3. Building Service Optimization

To save energy in the buildings there should be a proper plan for HVAC system. In the organization it is observed that adequate natural ventilation is implemented and practices. In some places exhaust fans are used for ventilation especially in the canteen and laboratories. To reduce the heat inside the building shading patterns are maintained by planting trees in and around the campus. Solar panels are implemented at the roof top to reduce the heat and to save energy. Air conditioning are provided at specific areas. Energy conservation plays an vital role in maintaining the sustainability. It is observed that the Organization has replaced all the tube light with CFL / LED lamps, has proper metering and submetering facilities, availability of BEE star rated appliances in Air cooler, lift, AC, generator, etc., Solar water heater and panels are implemented to conserve energy. Instruments and meters are properly maintained and calibrated at regular intervals or annual maintenance plan is observed as one of the energy saving opportunity. Adequate energy saving awareness programmes are conducted to the stakeholders. Emissions and leaks are monitored through operation and maintenance manual.



Energy conservation facilities observed in the Campus

4.2.4. Energy consumption and cost profile

The following chart shows the profile of energy consumed and the cost for one year by the auditee (Figures 3 & 4; Table 4).

Figure 3. Electrical energy consumption profile

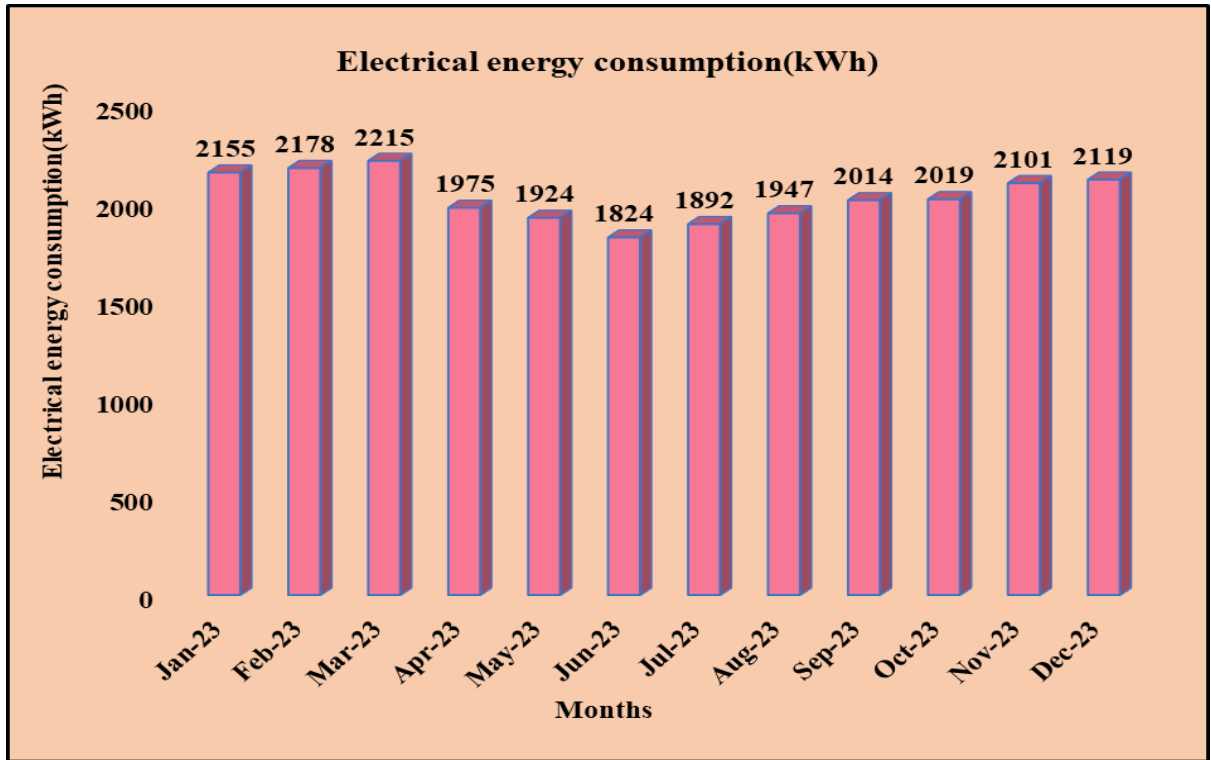


Figure 4. Overall electrical energy consumption and cost profile

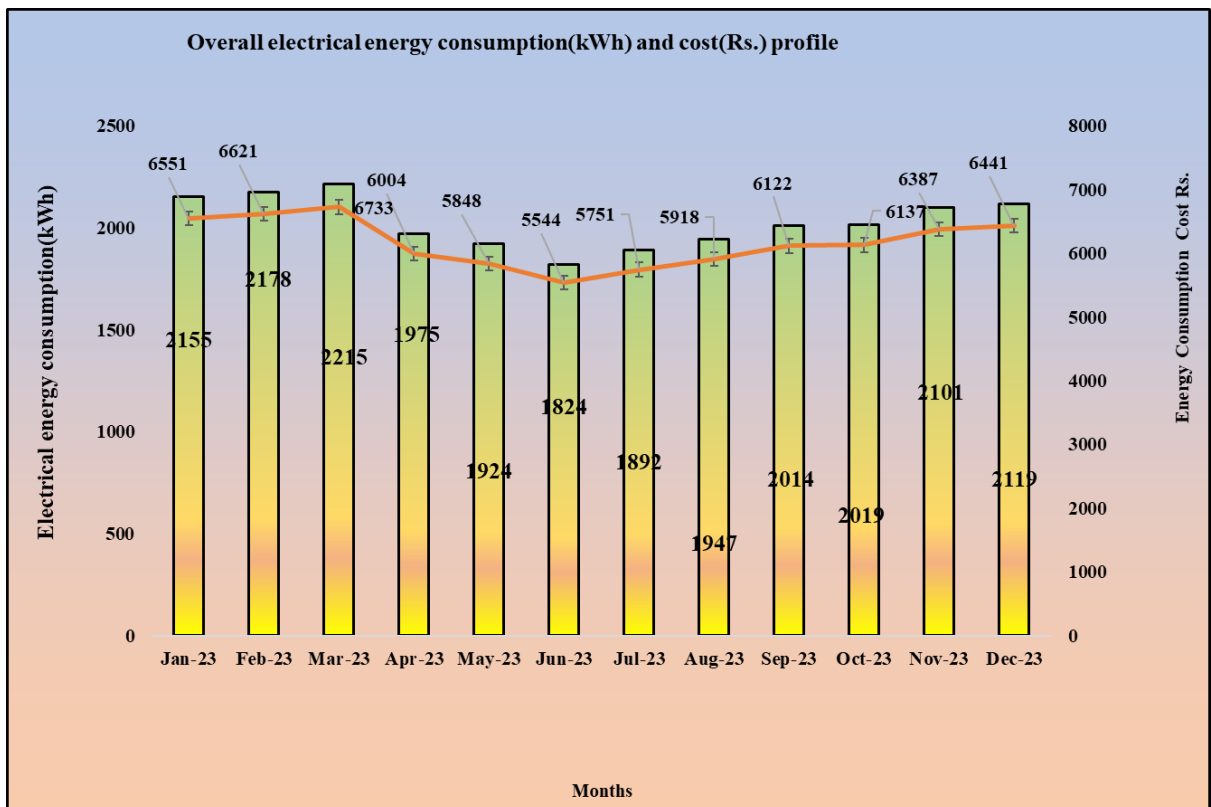


Table 4. Electrical energy consumption and cost profile in the Institution

S. No	Months	Rating / Capacity units in kWh	Cost in Rs.
1.	January	2155	6551
2.	February	2178	6621
3.	March	2215	6733
4.	April	1975	6004
5.	May	1924	5848
6.	June	1824	5544
7.	July	1892	5751
8.	August	1947	5918
9.	September	2014	6122
10.	October	2019	6137
11.	November	2101	6387
12.	December	2119	6441

4.2.5. Power consuming equipment and electrical appliances

Other than electrical energy from grid, energy generated using fossil fuels for the year are presented in the Table 5.

Table 5. Annual Energy Consumption of Fuels in the College

S.No	Month	Diesel consumption (Liters)	Petrol consumption (Liters)	LPG consumption (kg)
1	January	116	Nil	2
2	February	117	Nil	2
3	March	116	Nil	2
4	April	89	Nil	1
5	May	84	Nil	1
6	June	101	Nil	2
7	July	116	Nil	2
8	August	118	Nil	2
9	September	121	Nil	2
10	October	119	Nil	2
11	November	114	Nil	2
12	December	122	Nil	2

4.2.6. Carbon footprint

The carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO₂ emission from electricity and the sum of transportation per year in terms of number of the shuttle buses service operated by the Organization and number of cars, motorcycles and trucks entering in the Organization campus. These factors are multiplied with total number of trips in each day and approximate travel distance of vehicles covered in each day with a coefficient (0.01) to calculate the emission of CO₂ in metric tons per year. Humans contribute to a massive increase of carbon dioxide emissions by burning fossil fuels, deforestation, and other industrial activities.

4.2.7. Calculation of carbon footprint

The carbon footprint analysis can be calculated based on the earlier reports as stated in www.carbonfootprint.com which is the sum of electricity usage per year. According to the data provided by the Management, carbon emission due to electricity consumption and fossil fuels are presented hereunder.

The CO₂ emission from electricity

$$\begin{aligned}
 &= (\text{electricity usage per year in kWh}/1000) \times 0.84, \text{ where } 0.84 \text{ is the coefficient} \\
 &\text{to convert kWh to metric tons} \\
 &= (20143 \text{ kWh}/1000) \times 0.84 \\
 &= 16.92 \text{ metric tons}
 \end{aligned}$$

According to the above calculations, carbon emission due to electricity usage per year accounts for 16.92 metric tons.

Transportation per year (Shuttle)

$$\begin{aligned}
 &= (\text{Number of the shuttle vehicle in the campus } (2) \times \text{total trips for shuttle bus} \\
 &\text{service each day} \times \text{approximate travel distance of a vehicle each day inside} \\
 &\text{campus only } (20 \text{ km}) \times 365/100) \times 0.01 \\
 &= (4 \times 2 \times 30 \times 365/100) \times 0.01 \\
 &= 8.76 \text{ metric tons}
 \end{aligned}$$

365 is the number of days per year

0.01 is the coefficient to calculate the emission in metric tons per 100 km for bus

a. Transportation per year (Car)

$$\begin{aligned}
 &= (\text{Number of cars entering the campus } \times 2 \times \text{approximate travel distance of a} \\
 &\text{vehicle each day inside campus only (in kilometers)} \times 365/100) \times 0.02 \\
 &= ((51 \times 20 \times 1 \times 365)/100) \times 0.02 \\
 &= 74.5 \text{ metric tons}
 \end{aligned}$$

365 is the number of days per year

0.02 is the coefficient to calculate the emission in metric tons per 100 km car

b. Transportation per year (Motorcycles)

$$\begin{aligned}
 &= (\text{Number of motorcycles entering the campus } \times 2 \times \text{approximate travel} \\
 &\text{distance of a vehicle each day inside campus only (in kilometers)} \times 365/100) \times \\
 &0.01 \\
 &= ((200 \times 20 \times 1 \times 365)/100) \times 0.01 \\
 &= 146 \text{ metric tons}
 \end{aligned}$$

365 is the number of days per year

0.01 is the coefficient to calculate the emission in metric tons per 100 km for motorcycles.

c. Total Carbon emission per year

$$\begin{aligned}
 &= \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\
 &= (16.92 + 8.76 + 74.5 + 146) \\
 &= 246.18 \text{ metric tons}
 \end{aligned}$$

4.2.8. Noise level measurements

Noise is all unwanted sound or set of sounds that causes annoyance or can have a health impact and noise level is measured in decibels (dB). The body can also respond to lower noise levels. Level of noise are expected to be within 55 dB in residential areas, including institutions. Class room noise levels are supposed to be around 50 db. Sound Level Meter / Noise Thermometer are used to measure the noise level in the surroundings which converts the sound signal to an equivalent electrical signal and the resulting sound pressure level in decibels (dB) referenced to 20 μ Pa. Noise level prescribed by Central Pollution Control Board was presented in the Table 6.

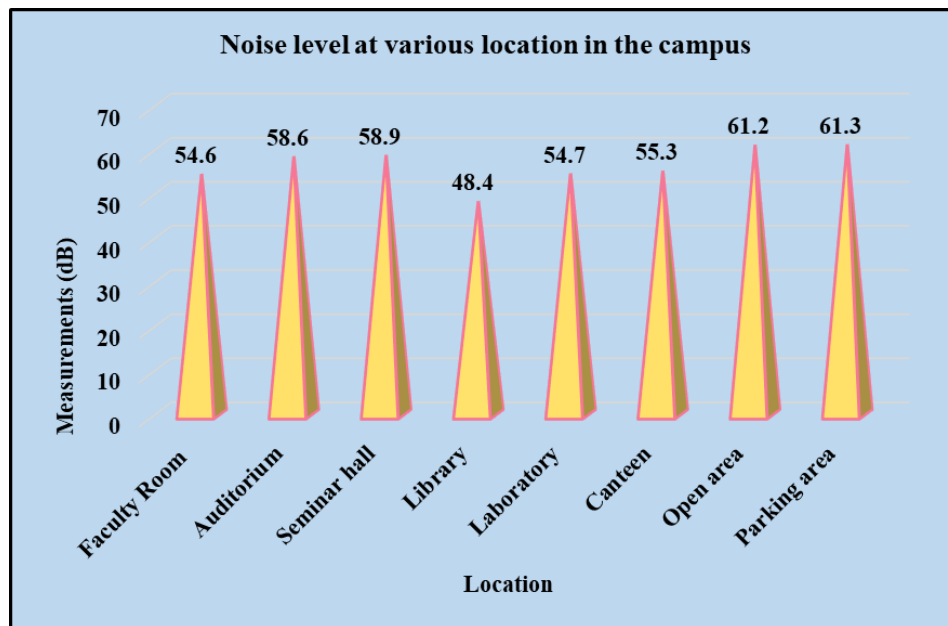
Table 6. Noise level standard prescribed by Central Pollution Control Board, Government of India

Area Code	Zone	Limits in dB (A) Leq	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Source: IS : 12065 - 1987

Table 7. Noise level at various location in the campus

S.No	Locations	Measurements (dB)	Major noise sources	Remarks
1.	Faculty Room	54.6	Students and Staff	No Noise Pollution
2.	Auditorium	58.6	Students	No Noise Pollution
3.	Seminar hall	58.9	Students	No Noise Pollution
4.	Library	48.4	Staff members	No Noise Pollution
5.	Laboratory	54.7	Students	No Noise Pollution
6.	Canteen	55.3	Students and Staff	No Noise Pollution
7.	Open area	61.2	Students and staff	No Noise Pollution
8.	Parking area	61.3	Vehicles	No Noise Pollution
9.	Generator area	62.7	Generator Sound	No Noise Pollution

Figure 5. Noise level at various location in the campus

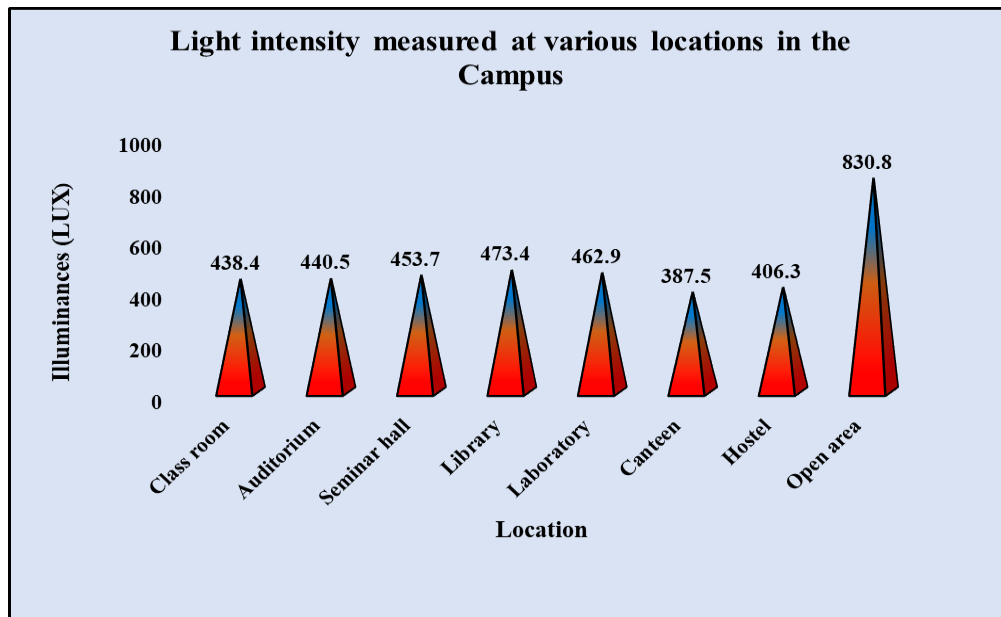
4.2.8.1. Light intensity measurement at the campus

Light intensity or light output is used to measure whether a particular light source provides enough light for an application needed. There is a well-established light level recommendation for a wide range of applications in lighting industry and also for the type of space. Light intensity is measured in terms of lumens per square foot (foot-candles) or lumens per square meter (lux). A light meter (lux meter) is used to measure the amount of light in a space/on a particular work surface. The light meter consists of a sensor that measures the light falling on it and provides the user with a measurable illuminance reading. Light meters are an especially useful tool for measuring light for safety or over-illumination.

Table 8. Light intensity measured at various locations in the College

S. No	Type of Spaces	Illuminances (LUX)
1.	Class room	438.4
2.	Auditorium	440.5
3.	Seminar hall	453.7
4.	Library	473.4
5.	Laboratory	462.9
6.	Canteen	387.5
7.	Hostel	406.3
8.	Open area	830.8
9.	Car Parking area	834.7

Source: IS: 6665-1972

Figure 6. Light intensity Measured at the campus**Light Intensity and Noise level analysis in the Campus**

5. Conclusion

Considering the fact that the organization is a well-established academic institution and there is significant scope for conserving green, environment and energy, which in turn make the campus as self-sustained. The organization has taken enormous efforts to maintain green campus in a sustainable manner. It has conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment. The installation of a rainwater harvesting system and irrigation system to conserve rainwater and improve the ground water levels are noteworthy. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

The energy conservation initiatives taken by the organization are substantial. Water and Soil conservation activities are also implemented and practiced. Proper facilities and procedures are followed for waste collection, segregation, disposal, recycle and reuse. Quality of soil and water observed to be good. Hygienic practices are monitored and maintained considering the health and sustainability of the stakeholders at canteen and hostel premises. Tree plantation at appropriate locations are maintained to resist the indoor climate and conserve energy. The organization has made significant progressive contributions with respect to teaching learning, research and consultancy, innovation and transfer of technology, community service and value education, in toto. It imparts quality education to rural, tribal and urban people across the nation which is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders