

TECHNICAL REPORT OF ENVIRONMENT AUDIT



Submitted to

**LOYOLA COLLEGE OF EDUCATION,
LOYOLA COLLEGE CAMPUS, NUNGAMBAKKAM,
CHENNAI – 600 034, TAMIL NADU, INDIA**

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1. Introduction

Environment (Eco) audit is quantitative and qualitative data to track air, soil and water waste, and to gain actionable insights to improve the operational performance in the atmosphere. This audit is generally used to observe the clean and green environment of an organization. It provides a 360° view of a surrounding campus and makes it easy for Owners / Managers / Environmentalists to collaborate, measure, control, and reduce environmental impacts. Finally, it leads to enhancing the quality of life for human beings, animals and plants. Eco audit initiatives are the need of the hour across the world due to changing environmental conditions and global warming due to increasing human population and anthropogenic activities (Maltby, 1995; Haahkim and Yunus, 2017). It aims to make a sustainable and friendly environment for the stakeholders.

In other words, Environment audit is a well-developed process of extracting information about an Organisation that provides a realistic assessment of how the Organizations take steps towards caring the environment. In this context, to conserve eco-friendly atmosphere of an organization, well-developed environmental objectives and targets should be undertaken to reduce the harmful effects to a greater extent. The audit process can remarkably minimize the environmental pollution in the campus which in turn reduces the impact of global warming scenario. As per the Government law, the environmental legislations should be followed by all the Institutions and Organizations and make sure that their activities should not degrade the environment (Ramachandra and Bachamanda, 2007). An environmental audit gained momentum, in order to create awareness on environmental compliance and implementation gaps in the management system, along with related corrective measures.

The environment audit involves systematic documentation of periodic objective review by a regulated entity on available facilities, their operations and practices related to resolve the environmental requirements. Environment audits include personnel observation, monitoring, data collection, recording/documentation and analysis of various components in an organization related to the environment with cordial support of the management (Conde and Sanchez, 2017). In general, environmental audit is planned to achieve an optimum resource utilisation and improved process performance in the audit sites. Venkataraman (2009) stated that it is a 'Common Sense Approach' to identify the problems and solve those problems pertaining to curb eco-friendly atmosphere (APHA, 2017). Environmental audit enables an overall and complete overview at the audit sites to facilitate our understanding of flow of materials and to focus the priority areas where waste reduction is achieved thereby cost saving is made possible (Gowri and Harikrishnan, 2014).

Environmental audits ensure that the environment is not disturbed from its balanced existence, so that it provides an eco-friendly atmosphere to the stakeholders. Similar to that of Environmental audit, green campus audit is also a type of assessment to ensure that the Institution and Organization campus should grow a large number of trees, shrubs, herbs, lawns, climbers, twins and lianas in their campus to enrich with oxygen and assimilate more amount of carbon dioxide to provide a healthy atmosphere to the stakeholders (Aparajita, 1995). Environmental audit provides vivid dimensions on how waste materials are being managed and the source of wastes along with the solutions for environmental degradation is managed. Environmental Management

System (ISO EMS 14001:2015) should be implemented by every Organization to ensure that the eco-friendly campus is being given to the stakeholders. Eco-friendly youth leadership programmes, green campus practices, social responsibility and Institutional values comprehending the relationship with the ecosystem for a sustainable environment are being evaluated (IGBC, 2021; Shriberg, 2002).

Environmental audit plays a vital role in keep tracking on organizations policy commitments with regard to environmental management and its performance. Audit reports can provide key information to the management in relation to risk areas, progress towards strategic objectives and targets (Adeniji, 2018). Purpose of the audit is to determine performance of the environmental management systems and equipment related to environmental safety. This is also to verify compliance with the appropriate national/local laws and regulations/norms of regulatory bodies to minimize the human exposure to risks from environmental-, health- and safety- aspects.

In order to satisfy the purpose of audit, it is essential that audits should be considered as the responsibility of the company/organisation. Audit work can be undertaken voluntary for the benefit/advantage of the company, and it can be executed with the help of environmental auditing authorities. As mentioned earlier, it helps in the proper natural resource utilization and on the whole, it improves environmental quality.

As stated earlier, environmental auditing is essential tool to monitor the effects of human activities on the environment with respect to set principles/standards. On the basis of various standards and focus of the audit, there are different types of environmental audit existed. At present most of the organisations/institutions recognised the importance of environmental issues and accepted to scrutinise their performance by recognised bodies to minimise the ill effects of their activities and to ensure their sustainable industrial developments.

An environmental auditor will study an organization's performance towards the environment sustainability in a systematic manner which in turn to document the activities carried out for environmental conservation. Environmental organization management systems and equipment are performing with the aims of:

- i. Facilitating management control of environmental practices.
- ii. Assessing compliance with company policies.
- iii. Facilitating professional competence
- iv. Implementing works without harming the environment
- v. Practicing the environmental conservation
- vi. Sustainability in energy utilization

2. Role of Educational Institutions in India

In view of providing eco-friendly atmosphere to the stakeholders, educational institutions are focussed on establishing and maintenance of eco-friendly campus without harming the environment. A clean and healthy surrounding in an organization determine the effective learning and provides a favourable learning environment to the students. Educational institutions are insisted by both Central and State Governments to provide eco-friendly atmosphere to the stakeholders. In addition, all the educational institutions are asked to save the environment for future generations and to solve the

problems associated with environment (recycling the of solid wastes and wastewaters, plastic free zone, napkin disposal, water consumption, rainwater harvesting and storage mechanisms, etc.) through Environmental Education. Implementation of Swachh Bharath Abhiyan Scheme by the Indian Government through Educational institutions imparted neat and clean environment at tribal, rural and urban areas across the country. Seminar, Conference, Workshop, training and awareness programmes on Biodiversity conservation education, environmental awareness programmes, etc. may be conducted periodically by the Management and Administrative people of an organization to the stakeholders.

Similar to that of green campus auditing, environment auditing is a kind of professional tool to identify organization's environmental performance aligning with its policies and compliances of the Government guidelines. This audit process is definitely useful for the educational institutions to maintain the eco-friendly campus in a sustainable manner and can give eco-friendly atmosphere to the students and staff members. Environmental audit is like an official examination of an organization's campus as per the Government guidelines. Audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions specified in the report. Conducting an environmental audit is no longer an option but a sound precaution and a proactive measure in today's heavily regulated conditions. There are some minor differences between green campus auditing and environment auditing with respect to natural and planted vegetation along with flora and fauna in the campus and carbon footprint in which carbon dioxide level is assessed in the campus in using the number vehicles, fossil fuel usage, electrical energy utilization efficiency and human population.

Environmental auditing concerned with following aspects: 1) Assessing compliance with pertinent constitutional and internal requirements, 2) providing management control over environmental activities, 3) Endorsing good environmental management, 4) Maintaining credibility with the public, 5) Creating awareness among the staff on their commitment towards environmental policy, 6) Enduring improved opportunities and 7) Establishing the performance baseline for developing an Environmental Management System (EMS).

3. Energy and Environment Policy

The energy and environment policies aim to afford an understanding/awareness on clean and green environment to the stakeholders in relation to environmental compliance. Scope of this policy applies to all employees and students of the Institution to establish and sustain an Eco-friendly atmosphere. Policy making dealt with cleanliness on the campus is maintained through proper recycling of wastes and/or disposal of hazardous wastes and utilization of eco-friendly supplies. Disseminating the concept of eco-friendly culture among the students and rural community through various awareness programmes (seminars / conferences, reuse and recycle the waste materials) is one of the environmental policies. Attempts are made to limit energy usage and also substitute non-renewable energy sources with renewable energy sources. The Head of the Organization, Department Heads and Senior Managers including Management Representatives are responsible for monitoring the go green initiatives of the College / University and maintain a clean/green campus. In addition, the staff and

student volunteers from Nature club, Eco clubs, Science club, Fine Arts club, Youth Red cross unit, Student Force, NCC and NSS units are committed to establish green campus and strictly follow the environmental policies in the Organization.

4. Environment friendly campus

Literally, Eco-friendly means earth-friendly/environment friendly or not hazardous to the environment. The term commonly refers to the products that contribute to green living or practices that help conserve the natural resources like water and energy. Environment friendly processes are sustainability and marketing terms referring to goods and services, laws, guidelines and policies that claim



reduced, minimal, or no harm upon ecosystems. Companies and Educational Institutions use the ambiguous terms to promote goods and services including working atmosphere/learning conditions, at times with additional, more specific certifications (eco-labels). Their overuse can be referred to as “green washing”. To ensure the successful meeting of Sustainable Development Goals (SDGs) companies and Educational Institutions are advised to implement environmentally friendly processes in their production as well as providing good ambience to the stakeholders in their work place. The International Organization for Standardization has developed ISO 14001:2015, 14020 and ISO 14024 to establish principles and procedures for environmental labels and declarations that certifies the environment friendly campus. Specifically, these standards communicate with avoidance of financial conflicts of interest, utility of sound scientific methods and accepted/standard test procedures and honest and transparent setting of standards.

Environment friendly campus is meant for providing eco-friendly as well as hygienic atmosphere to the stakeholders without harming the environment. In order to provide efficient eco-friendly atmosphere to the stakeholders, the organization should take responsibility in making good drinking water facility to the students and staff members, use of the organic manure, cow dung, farmyard manure and vermicompost for manuring the plants, avoidance of non-compostable, single-use disposable plastic items, single-use plastic utensils, plastic straws and stirrers, commitment to plastic-free alternatives to bags, boxes, containers and etc. and reduction of use of papers alternated with e-services and e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system. These parameters should be considered while implementing the environment friendly campus in an organization. To set a pure atmosphere in an organization campus, waste disposal management should be proper which in turn to confine the environmental pollution. Waste management is an activity that starts from inception of waste to its final disposal. In other words, it includes a chain of action i.e., collection, transport, treatment and disposal of waste, together with monitoring and regulation. Dry waste includes paper, cardboard, glass, tin cans, etc., while wet waste refers to organic waste such as vegetable pods, left-over food, etc. Separation of waste material is necessary for the accountability of amount of waste being generated followed by proper recycling through the composting process and used as a fertilizing material.

5. Environmental Management Plan (EMP)

A clean environment is required for progressive success of an organization to safeguard the upcoming generations to ensure in safe use of air, land and water resources. The management of any organization should attempt to continuously to improve the environmental performance and to prevent/minimise the pollution. All the stakeholders of the organization are expected to support our environmental goals while providing clean and environment friendly work culture.



Main purpose of the EMP is to determine the environmental protection measures to be followed during in day-to-day's activities of the organization and confirm to minimize environmental effects are met. Environmental protection is an imperative component of overall preparation and execution of eco-friendly and green campus of an organization. It addresses the issues start from sanitation pertaining to human health/various stakeholders of an organization and protection of plants, animals and microorganisms including wildlife habitats. Environmental Management Plan (EMP) is an integrated document with various approvals, authorizations and specific components and/or activities that to be carried out in the campus without harming the environment (Table 1). EMP is committed to regulate its assets with its core values to protect the health/safety of people/environment and to comply with Environment Health and Safety laws, regulations and Health and Safety standards. EMP should provide a reference document as per the legislative requirements for employees when planning and/or performing specific activities in the campus surroundings. In line with the Environment Policy, impact on the physical, chemical and biological environment should be determined along with statutory requirements and other environmental commitments.

Table 1. Environmental Management Plan and Execution in the Organization sites

S.No.	Monitoring areas	Parameters Monitored	Monitoring frequency	Reason for monitoring parameters
1.	Dredging	Erosion, landscape, sedimentation, vegetation, disposal of dredging	Continuous	Dredging results in disturbance of Benthic community and causes soil erosion and sedimentation
2.	Marine Ecology	Biodiversity survey and conservation	Continuous	Unmitigated operations may result in loss of biodiversity as per the Indian Biodiversity Act
3.	Vegetation (Flora and Fauna)	Survey of macro and micro plants, animals (mammals, birds, moths, houseflies, reptiles, amphibians, termites) and soil and air microbial biodiversity	Continuous	Conservation of macro and micro plant, animals (mammals, birds, moths, houseflies, reptiles, amphibians, termites) and soil and air microbial biodiversity conservation for future

				generations through modern technology
4.	Air Emission	O ₂ , CO, CO ₂ , SO ₂ , NO ₂ level in the open, car parking and indoor areas	Monthly monitoring	Unmitigated operations may result in deterioration of air quality
5.	Solid Waste	Solid waste quality and quantity, solid waste disposal, reuse, solid waste treatment	Monthly monitoring	Compliance of Environmental Laws and Legislative policy
6.	Wastewater	Primary, secondary and tertiary pollutants and their recycling, wastewater minimization, storage and handling, reuse, treatment before disposal	Monthly monitoring	Minimize the water pollution and to provide quality water as per the Central Pollution Board
7.	Soil	Soil contamination, soil edaphic parameters, soil, gravel and sand composition, water holding capacity, soil erosion	Half yearly	Soil surface and water pollution cause diseases as per the Compliance of Environmental Laws and Legislative policy
8.	Noise	Noise intensity, causes and impact, remedies, standard operating procedure	Monthly monitoring	Uncontrolled noise cause nuisance which affects the health
9.	Occupational Safety & Health	Safety, health and welfare of people at occupation, measures taken, Fire safety, First aid box, Safety protocol, Hospital facility	Continuous	Department of Occupational Safety & Health
10.	Land reclamation	Soil quality, soil micro and macro elements, soil composition	Half yearly	Legal obligation and structure protection, prevention of soil erosion and sedimentation to the port
11.	Restoration of the sites	Forest vegetation, plant vegetation, visual analysis, Photographic records	Continuous	Maintain the soil fertility and soil original reclamation

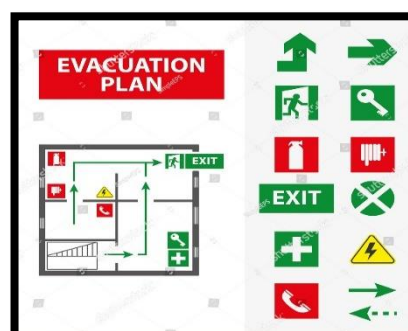
6. Environmental health and safety management system

It is outlined the mitigate measures and the best management practices followed in the organization in terms of developing eco-friendly and green campus. It is suggested to perform complete assessment and control of entirely possible hazardous and risks arise in the organization without harming the environment (Rajalakshmi *et al.*, 2021). It is to ensure that no significant adverse environmental health and safety impacts by carrying out various infrastructure facilities created to improve the human eco-system of the organization may be implemented. The facility should be designed to include fire protection equipment/system including flame, multiple gas, smoke and low- and high temperature detectors/ alarms and automated and manual shut-down systems in terms of planning and implementing the best practices of environmental health and safety management system.

High level of automation, periodical preventative maintenance and safeguards the environmental pollution besides the provision for safe emergency shut downs/exits should be maximized in the organization. In addition, all the employees and management people should be trained properly about environmental health and safety measurements which will be useful for protecting the environment without causing any adverse effect on the environment. All personnel should be advised to undertake an extensive workshop/training programmes to ensure safe operating practices.

7. Evacuation Plan in Human Eco-system of the Organization

The management of an organization should ensure the safety measures to the stakeholders which in turn improve the human eco-system. The alarm signals such as Bells, Horns, Sirens, Verbal (i.e. shouting) may be used to begin evacuation of the facility in the organization if any unfavourable situation takes places like uncertain firing, explosion of acids and gasses, earth quake, electrical current circuits explorations and etc. Evacuation map and important phone numbers (Police, Ambulance, Fire stations, State Office of Emergency Services, National Response Centre, Division of Occupational Safety and Health, Regional Water Quality Control Board, Pollution and threatened hazardous management & control board and Nearest Hospital) may be prominently displayed throughout the facility. Internal facility alarms as well as communications systems, wherever applicable, to notify all facility personnel should be activated. Waste storage areas and waste disposal zone, polluted soil or surface water regions should be demarcated in the organization. The emergency equipment like fire extinguisher, emergency notification and first aid box should be placed in all the dangerous zones to minimize the major environmental impact and problems. It should be developed and practiced a spill clean-up procedure where to find emergency equipment and how to use it properly should be trained to all the stakeholders.



The chemicals/hazardous waste handlers and managers should be regularly trained properly thro' periodical training programmes, workshops, conferences and seminars in order to impart knowledge on the latest developments in chemicals disposal methodologies and hazardous management policies. Safe method of handling (including from storage to disposal) of hazardous materials, and personnel rescue procedures should be known by the chemical handlers, hazardous waste handlers and managers. An areas that are disturbed or polluted by means of discarding the wastewaters, effluents, solid wastes may be recovered and restored by clean-up procedures. These areas may be brought in use after a chain of actions like stabilisation, smoothening, mulching, seed sowing and fertilization as per standard practice. The temporary erosion controls may be removed and permanent landscaping and erosion control measures should be installed wherever required as part of final facility restoration. Restoration of disturbed facility includes planting of various vegetation (trees, shrubs, and herbs) and replanting may be performed in compliance with applicable environmental specifications.

8. Waste Management Plan of the Organization

Waste includes solid wastes, plant litres, bio-medicals, electronic, organic kitchen and food wastes, plastic wastes, wastes, wastewater, effluents, hazardous waste materials, acids and chemicals. Waste Management Plan (WMP) provide guidelines and streamline the process of waste collection, separation, quantification, storage, transportation and disposal/recycling of wastes within the organization without harming the environment. Waste



management is one among the critical operating policies of the organisation. Designed procedures are to assist wide effort to safeguard the environment and to satisfy the laws/legislative policies and regulations regarding proper waste management.







Organization should examine/inspect waste management related facilities and activities which directly resulting in executing the scope and amendments of WMP. Guidelines for each and every step of waste management associated with organization may be undertaken. It should be taken into account while WMP in prepared and executed in the organization. It may be noted that abandoned materials and materials intended to be recycled are also considered as wastes. It is important to understand the above concept because even though something is going to be recycled, it must be managed until it is actually recycled. The wastes are categorized as hazardous and non-hazardous wastes depending upon the quantum of causing the adverse effect to the environment. The hazardous waste should be disposed properly by ignitability, corrosivity, reactivity, irritability and toxicity behaviours.

All recommended safety and handling procedures must be followed appropriately not only by the Management and concerned individuals also follow the norms. Waste production should be eliminated regularly and the material only for its planned purpose should be stored. Attempts should be made to curtail waste production, reprocess/recycle the same and then properly dispose in accordance with the norms. All hazardous waste shall be segregated individually as well as non-hazardous wastes at the point of its generation. For the collection of waste, containers can be used and must be

properly and clearly labelled. Also, if the waste is hazardous, it should be clearly labelled on the container along with its hazardous characteristics (e.g. flammable, toxic, radioactive, etc.). As depicted, containers with colour coding for easy identification should be kept to collect and segregate common wastes across the campus/at all the facilities organic food waste shall be collected in separate containers especially from hostel dining hall, canteen and food courts.

9. Methods of Disposal of wastes

Recycling and reuse methods may be adopted to minimize the quantity of wastes that are generated from the organization requiring proper ways of disposal. Quite a few waste materials can be reused within the facilities/campus while others can be recycled only in the specific sites. The recycling of used oils, acids, solvents and chemicals is possible in some of the laboratories; plastics and e-wastes including

Coding system for different type of waste	
Waste material	(Colour or code)
Glass	(blue); 
Metals	(green); 
Plastic	(white); 
Oily rags	(black); 
Used oil	(red); 
Rubbish / trash	(yellow); 

batteries may be revert back to manufacturer/authorised dealers/distributor while it should not be sold to the unauthorized contractors / companies, who may not have proper recycling facilities and to avoid misuse or to reduce associated liabilities

On-site Disposal facilities: Burial pits may be created in which waste should be buried and covered with soil sufficiently as 'daily cover' to reduce the environmental issues like unpleasant odour from decaying / degrading waste, spreading of waste into nearby areas in response to blowing wind and to avoid vermin and disease spreading vectors, flies, mosquitoes, etc.

Reserve pits: Reserve pits are used temporarily to store drilling waste, chemical waste, oily sludge and contaminated soil. These pits should be appropriately designed and furrowed to eradicate soil-, groundwater-/surface water-contamination.

Incineration: Incineration is another type of waste disposal wherein incinerator are used. Prior to burning, items that are not to be burned should be segregated and incinerated ash shall be buried in the lined landfill as it may contain heavy metals.

Evaporation Ponds: Evaporation ponds are used to eradicate the produced water at some facilities. It may be noted that all evaporation ponds should be lined properly.

10. Aims and Objectives of Environment Audit

Primary objective of an Environment audit is to promote the environment safety management and preservation for future generations. The purpose of environmental audit is to recognise, enumerate, describe and arrange/organise the framework of sustenance of environment in compliance with the appropriate/valid rules, regulations and requirements. In general, environment audit can be achieved by creating awareness on the importance of safeguarding the environment among students, faculties and staff members, including public domain. Environmental audit programme conventionally designed and implemented judiciously which can boost the sustainable healthier

environment of an organisation. It is helpful to monitor the optimum utilization of the resources and evaluating the company at National and International levels. Major objective of environment audit confined to:

- a. Protecting the environmental health and minimise the threats posed to human safety by the performance of the Organization.
- b. Create consciousness among the stakeholders about the importance of requirement of clean environment and conservation of the same as per the Environment Management Systems (ISO standard of 14001:2015) and Environmental Legislations by the Organization.
- c. To establish a baseline information about the eco-friendly environment in the campus to the stakeholders for future sustainability.
- d. Review the disposal of solid- and liquid-waste within the campus and ascertain the sources of waste generation to mitigate with possible solutions in relation to environmental compliance.
- e. To conduct outreach programmes to the rural, tribal and urban community people on the environment damage and conservation.
- f. To correlate the flora and fauna with environmental sustainability in the audit sites to provide a healthy atmosphere to the members of the Organization.
- g. To take steps to minimize the environmental pollution and degradation by means of developing 'Sanitation and hygiene policy', 'Water conservation policy', 'Waste management policy' and 'Green campus and Environment policy' by the Organization.
- h. In accordance with legislative compliances, to adopt measures to reduce waste generation and both solid and water waste recycling.
- i. Establishing plastic free campus/zone with the help of management and the stakeholders and to evolve health consciousness among the stakeholders.
- j. Propose the utility of alternative energy for the conservation of conventional energy resources.
- k. Evaluation and documentation of wastewater quality, its characteristics and their effects on the living system.
- l. In order to classify the solid and hazardous wastes, their source of generation, quantities and characteristics with respect to prevent environmental hazards.
- m. To introduce and implement the time saving technologies in production as well as providing eco-friendly ambience in an organization following the latest IT based techniques and to minimize the wastes through modern cleaner technologies.
- n. Maintenance of Labour/Occupational health & medicine followed by proper documentation of environmental compliance status.
- o. Annual environmental auditing will render educated and technically sound personals with practical knowledge to overcome existing environment issues.

11. Importance of Environment Auditing

The generic term 'Environmental auditing' is to examine the management practices and to evaluate performance of an organization in relation to environmental issues. World along with Indian Green building Council (IGBC), Associated Chambers of Commerce and Industry of India (ASSOCHAM), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Bureau of Energy Efficiency (BEE), Leadership in Energy and Environmental Design

(LEED), CII-GreenCo – GreenCo Rating System (CII-GRS), Food Safety Management System & Occupational Safety & Health (FSMS), Swatch Bharath under India Clean Mission (SBICM) and International Standard Organization (ISO 2021) have formulated a series of standards in the field of environmental auditing. These standards are basically intended to guide organizations and auditors on the general principles common to the execution of environmental audits. In order to set a pure atmosphere free from pollution to the stakeholders in an organization campus, waste disposal management and recycling activities should be proper to restrict the environmental pollutions.

Management of the Organization (Auditee) should be shown their inherent commitment towards making eco-friendly atmosphere through the Environment auditing and ready to encourage all types of Environment related activities. They should promote all kinds of Environment related activities such as conduct of environment awareness programmes, campus farming, planting trees and maintenance of greening, irrigation, use of bio fertilizers and avoidance of chemical fertilizers and agrochemicals etc., before and after the environment auditing.

Environment audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. Environment audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting a large number of trees which is the responsibility of each and every individual. It is necessary to Environment audit frequently at least once in three years in campus because students and staff members should aware of the Advantages of Environment audit is to save the planet by means of ‘Go green concept’ and help the institution to set a “bench-mark” (icon) to the community. It provides an immense opportunity for the development of ownership, personal and social responsibility for the stakeholders.

Scope of an audit can vary from simple compliance testing to a more rigorous examination, depending on the apparent requirements of the management. Environment audit is applied not only to operational environmental, health and safety management monitoring, but increasingly applied to product safety and product quality management besides the areas like loss prevention. Environmental studies includes the site history, storage of materials (above and below ground), the disposal of liquid or hazardous wastes properly in onsite and offsite. It also pays attention in oil or chemical spill prevention. In the subset of safety, it includes special procedures for confined space entry, work on electrical equipment, breaking into pipelines, having firefighting equipment’s, conducting safety training programmes for the stakeholder’s, etc. Waste disposal measures and methods have already detailed in this report.

12. Environmental Audit Schemes and their Components

Environmental audit schemes are useful to the entire management system in terms of its being an asset or a liability for the industry’s environmental performance besides with a broad spectrum of objectives for a green environment.

- The scheme renders ways and means to reducing all types of solid, water, electronic and biomedical wastes.
- It authenticates the assessing compliance with regulatory requirement.

- The system provides prevention control of effect of pollutant in water and soil.
- It promotes relationship among the qualified technicians, professionals and individuals,
- Central as well as State Pollution Control Boards, other public authorities, NGOs and industrial association etc. responsible for the conduct of environmental audit as well as environmental audit schemes
- Environmental Audit Scheme has three following important components.

Central and State Pollution Control Boards: The Board plays participatory role in implementing the environmental audit effectively by preparing format of audit report on all aspect of environmental protection. The board appoints internal auditors to prepare industries audit report and then evaluation followed by verification of audit reports. Initiating the action on evaluated report of environmental audit is also equally important in terms of implementation.

Internal Auditor: Team of selected auditor consist of experienced experts from various fields. A qualified internal auditor should be required as per the rules of State Pollution Control Board with well-equipped laboratory facility for analysis of water and air samples.

External Auditor: Experienced expertise were appointed as External Auditor appointed/approved by the State Pollution Control Board. Evaluated and verified reports along with their comments were sent to the State Pollution Control Board for further action.

13. Role of Environmental Audit and Environmental Management System

A vital role of an environmental audit (EA) is to recognise the areas for development, but an audit does not, in itself, provide the methods to implement changes. However, EA should set the agenda of an environmental management system. System of EA provides a mechanism for methodically handling the environmental matters of an Organization while EMSs provide a framework to 1) identify the environmental effects and document regulatory requirements, 2) set the objectives and targets for ensuing environmental performance/programmes, 3) implement protocols and procedures for achieving the objectives/ targets and 4) undertake audits to measure environmental performance and its efficacy measures to attain the well-defined objectives/targets. All the events pertaining to environmental effects, regulations, objectives and targets and the procedures are usually documented. As far as stakeholders are concerned EMS usually rely heavily on documentation and verification.

14. Target Areas of Environmental Auditing

- Auditing for Water Management (Wastewaters and Industrial effluents)
- Auditing for Waste Management (Solid, Electronic and Biomedical)
- Auditing for Energy Management (Electrical energy and Fossil Fuel use)
- Auditing for Soil Analysis (Soil health, degradation and conservation)
- Auditing for Carbon Footprint (Electrical, vehicles and human population)
- Auditing for Green Campus facility (Correlated with Green Campus Audit)
- Auditing with the Organization's Management for financial allotment

- Auditing with the Stakeholders for their contribution on environment studies
- Environmental Education and Implementing Swachh Bharath Abhiyan Scheme

15. Procedures followed in Environment Audit

15.1. Environment Systems Audit

Environmental audit involves monitoring an organization concerning about the green campus, environment, sanitation and hygiene policies. It is a regular process that is conducted periodically by a regulated entity to check whether an organization meets the requirements of environmental compliance. The process of environmental audit includes examining, collecting, evaluating, documenting data and analysing various components related to environmental aspects (IGBC, 2021; WGBC, 2021). Environmental audit was carried out as per the procedures mentioned of the Manual of Gnanamangai *et al.* (2021). The environmental audit possesses the following characteristic features in which various aspects of wastes generation and steps taken by the Organization to reduce both solid and liquid wastes without harming the environment.

- Identification of various sources to generate wastes and types of degradable and non-degradable wastes in the campus.
- Collection of information related to type of operations, use of various raw materials and products that generate wastes.
- Finding the highlights of inefficiencies in the process that generate wastes and areas that are to be monitored with extra care.
- Setting up the target for reduction of wastes and source of waste generation without affecting the environmental health.
- Steps taken to minimize the environmental pollution and degradation by means of developing internal policy methods.
- Suggestion of cost-effective waste management strategies and zero waste discharge in the Organization.
- Creation of awareness among stakeholders on the benefits of reducing wastes without damaging the ecosystem.
- Aids in increase of process efficiency and status report with regards to environmental compliance and management.
- Converting the waste materials into fertilizing materials by following the method of recycling and composting processes.

15.2. Carbon footprint by measuring Carbon dioxide level in the Campus

The level of Carbon dioxide is measured in different places across the Organization campus using a portable CO₂ Analyzer (Nondispersive infra-red gas analyser). In addition, CO₂ meter is also displayed the readings of atmospheric temperature, relative humidity and dew point in the places, where the level CO₂ is measured. 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/day and approximate distance covered by the vehicle / day (in km) with a coefficient (0.01) to calculate the emission of CO₂ in metric tons per year.

15.3. Steps involved in the Process of Environmental Audit

Step #1: Opening meeting among the audit team and auditees, discussed about the audit procedure and document verification.

Step #2: Visited the on-site of the audit along with the audit team and auditees.

Step #3: Walked around campus to check the facility as walk-through audit and took photographs for preparing the audit report.

Step #4: Monitor the components as per the environmental audit checklist (Sanitation and hygiene, water conservation, waste management and green campus and environment policies).

Step #5: Noted down what all components are present and what are all not available in the campus as of environmental audit components listed by NSF ISO- EMS checklist.

Step #6: Identified the issues in the campus with respect to the environmental compliance and merits/weaknesses of the Auditee's Management controls and risks associated with the audit.

Step #7: Looked into other items to be monitored as per the NSF checklist with respect to Ecology and Environment studies.

Step #8: Exit meeting held after the audit in which the audit findings with the members of the Organization was discussed.

Step #9: Prepared and distributed the findings as a Report and Certificate along with the recommendations including the best practices followed by the Auditee.

Step #10: Comparison between the last audit report with the present audit report in which the number of suggestions and recommendations were taken into consideration and rectified significantly by the Management.

Step #11: Observed the audit process undertaken by the certifying agency between the last audit and current audit processes, whether the same certifying agency has undertaken the audit process or not?

16. Benefits of an Environmental Audit

Environmental audit provides the following benefits to the Organization:

- Discover various issues related to the environment in the Organization.
- Compute the issues, identify and assess the impact of the issues.
- Provide suggestions to minimize the issues found in the Organization. On conducting an Environmental audit, it provides the following results:
- Conservation of resources and reduction of raw materials.
- Minimizing wastes, control of pollution and reduction of costs.
- Improvement in working conditions and improvement in process efficiency.
- Improved corporate image and marketing opportunities.
- Apprehensions about the environmental impact of the Organization.
- Progressive development of ownership, personal and social responsibility in relation to the organisation and its environment.
- Preparation of Environmental management plan and monitoring.
- Assessment of environmental input and risks to the ecosystem.
- Identifying areas of strength and weakness for improvements.
- Evaluation of pollution control status, verification of compliance with environment laws.
- Assuring safety aspects of all living organism in the ecosystem

- Improved production with minimum resource utilisation including manpower and development and marketing.
- Planning for pollution control, waste prevention, reduction/recycling/reuse methods.
- Providing an opportunity for management to give credit for good environmental performance.
- On the whole environmental audit minimize the environmental problem locally which in turn accountable at regional, national and international level.
- Identification of various sources to generate wastes and types of wastes
- Types of degradable and non-degradable wastes in the campus.
- Setting up the target for reduction of wastes and source of waste generation without affecting the environmental health through policy.



Meeting with the Principal, PRO and Management Representatives of Loyola College of Education, Chennai, TN with the Audit Team of the Nature Science Foundation, Coimbatore, Tamil Nadu

17. Phases of an Environmental Audit

The environmental audit encompasses three phases viz., pre-audit, during- audit and post-audit. These phases involve various components to resolve the problems in the campus as well (Arora, 2017; Gnanamangai *et al.*, 2021).

17.1. Pre-Audit

Pre-audit involves the following components:

- ✓ Planning the environmental audit
- ✓ Selecting the audit team based on experience and expertise
- ✓ Scheduling the audit facility and venue of audit

- ✓ Scrutinizing the audit application and checklist
- ✓ Opening meeting between audit team and auditee
- ✓ Acquiring the background information of the organization
- ✓ Visiting the site of audit by the audit team and coordinators
- ✓ Audit programme and briefing
- ✓ Collection of data and documents verification
- ✓ Discussion with the auditee for data verification

17.2. During-Audit

During the audit, the following components are involved:

- ✓ Understanding scope of the audit
- ✓ Analysing strength and weakness of the internal controls audit
- ✓ Conducting the on-site audit
- ✓ Appraising the onsite observations during audit
- ✓ Noting down the key observations and taking photographs
- ✓ Clarifications if required during the audit site and document verification

17.3. Post-Audit

Post-audit involves the following components:

- ✓ Identification of the best practices followed by the Organization
- ✓ Compiling a report of the data collected
- ✓ Distributing the report and certificate to the Organization
- ✓ Preparing an action plan to overcome the flaws
- ✓ Providing suggestions to implement the action plan
- ✓ Setting up the future environmental aims and objectives

18. Components of an Environmental Audit

Environmental audit has ten components, namely:

- 1) Sanitation and hygiene policy
- 2) Green and Environment policy
- 3) Water conservation policy
- 4) Water management policy
- 5) Waste management policy
- 6) Rainwater harvesting policy
- 7) Environment conservation policy
- 8) Waste management initiatives
- 9) Environment management policy
- 10) Environment monitoring policy

18.1. Sanitation and Hygiene Policy

In this component, the following are being considered:

- Physical appearance and overall ambience
- Adequacy of toilets (Student/Employee: toilet ratio)
- Gender balance and disabled-friendly toilets (Male: Women)
- Water taps and sanitation plumbing, adequacy and efficiency
- Adequate clean drinking water facilities
- Kitchen staff apparel and hygiene
- Canteen and hostel hygiene maintenance
- Kitchen hygiene and fly proof condition

- Cutlery, crockery and utensils hygiene
- Dining hall hygiene and bad odour free
- Cleaning equipment and consumables

18.2. Water Conservation Policy

In this component, the following are being considered:

- Know the source of the campus water availability
- Monitor overhead tanks for periodical cleaning
- Reuse of treated water, recycling, leakages etc.
- Drip irrigation / sprinkler irrigation system for watering to plants
- Water efficient dispensing mechanism in campus

18.3. Rainwater Harvesting Policy

In this component, the following are being considered:

- Implementation of rainwater harvesting system
- Functioning status of rainwater harvesting system
- Connectivity between rainwater harvesting and open wells and bore wells

18.4. Waste Management Policy

In this component, the following are being considered:

- Is the campus a 'Plastic free zone'?
- What are the methods adopted for waste segregation and storage?
- Disposal of solid wastes, reuse and recycling process
- Vermicompost, cow dung and organic manure units
- Availability of Biogas plant and its implementation status
- Installation of incinerators and their functioning status
- Adequate number of waste bins, separate bins for dry and wet wastes
- Food waste dumped status methods of disposal

18.5. Waste Management Initiatives

In this component, the following are being considered:

- Sign boards indicating energy / water conservation in respective places
- Awareness sign boards on usage of tobacco and tobacco free campus
- Awareness sign boards on plastic usage and plastic free campus
- Programmes related to waste segregation / waste disposal systems
- Sufficient ventilation facility
- Social responsible activities to rural, tribal and urban areas

18.6. A good environmental audit

- Defines waste generation sources and quantification of its types
- Collects information on raw material, unit operations, products, and water usage
- Highlights process efficiencies and areas to be focused
- Helps in planning targets for waste reduction, development of cost-effective waste management approaches and create awareness among the workforce regarding the benefits of waste reduction
- Helps to improve process efficiency
- Assess the quantity of water usage within the company.
- Find out various sources of organic and solid waste generation and mitigation possibilities.

- Document the waste disposal system
- Release of standing order report on environmental compliance.
- Waste minimization opportunities realized that contributes to reduction in operating price.
- Increased worker cognizance of environmental standards and responsibilities.
- Improve employee relations and morale.
- Improve the image of organization and its good will.

19. About the Organizations

19.1. Loyola College of education

Loyola College of Education, a Jesuit Teacher Education Institution was established in June 2007. It is completely owned and administered by the Loyola College Society registered under the Society Registration Act of 1860 No.5228/1973. It is located in the wide campus of Loyola College of Arts & Science. It is recognized by National Council for Teacher Education (NCTE) and affiliated to Tamil Nadu Teachers Education University (TNTEU). It is accredited at `A` grade with CGPA – 3.79 by NAAC (National Assessment and Accreditation Council) in the 1st cycle which is the highest among the colleges of education in India. In the second cycle it was re-accredited at `A` grade with CGPA–3.48 by NAAC.

The sole aim of Jesuit education is to form compassionate, committed, competent, conscientious and creative men and women for others. The mission of the Jesuits is crystallized in their preferential option for a large number of Catholics, Dalit Catholics, first generation learners, orphans, semi-orphans, differently-abled students, neighbourhood children, refugees, migrants, gypsy children and economically poor and vulnerable students. Thus Jesuits in the education apostolate pay undivided attention to the empowerment of the marginalised and the oppressed.

Since its inception, Loyola College of Education (LCE) has been focussing on the formation of intellectual capacity, training of the will and formation of character of the student-teachers, thus ensuring the integral formation of the prospective teachers. LCE is committed to inculcating desirable social and human values and moral principles that would make the student-teachers self-disciplined, value-oriented and responsible teachers. LCE provides also a wide range of opportunities and experiences for student-teachers to discover their potentialities both physical and intellectual and cultivate their artistic and aesthetic sense through cultural extravaganza and nurture their social responsibility through rural / slum exposure camp.

MOTTO

Let your light shine

VISION

Holistic formation of human engineers with techno-pedagogical skills to develop a humane society.

MISSION

- Forming compassionate, competent, conscientious, creative and committed teachers with techno-pedagogical skills using education as the key to empower

the youth to bring about a desirable social transformation.

- Train and form responsible socially committed teachers who promote the fundamental rights and duties, values of liberty, equality and fraternity, uphold the constitution and affirm the ideas of secularism, social justice and sustainable development

19.2. About Nature Science Foundation (NSF)

NSF is an ISO 9001:2015, EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore- 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017.

In addition, NSF has 12A, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is to “Save the Nature to Save the Future” and “Go Green to Save the Planet”. NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the ‘Go Green Concept’ in a big way. NSF family is wide spread across India with over 115 state-wise Lead auditors to conduct Green and Environment Audits. NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management.

NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs. International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment Day celebration, Ozone Day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation.

NSF is being released ‘Magazine’ and ‘Newsletter’ biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India. In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies across the world, NSF tributes the deserved meritorious candidates with various awards and honours such as ‘Best Faculty Award’, ‘Best Women Faculty’,

‘Best Scientist Award’, ‘Best Student Award’, ‘Best Research Scholar Award’, ‘Best Social Worker Award’, ‘Young Scientist Award’, ‘Life-Time Achievement Award’ and ‘Fellow of NSF’. These award and honours will be given to the deserved meritorious candidates during the ‘Annual Meet and Award Distribution Ceremony’ which will be conducted every year during the first week of January.

NSF has introduced various types of Audits such as ‘Eco Audit’, ‘Green Audit’, ‘Energy Audit’, ‘Hygienic Audit’ Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus.

All audits will be conducted as per the Checklist prepared by the NSF ISO Criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, Energy Policy, MoU, International Eco Club Student Chapter

Audit processes are being conducted through the certified Auditors as per the following by the NSF

Audit	Certified Auditors	Certified Auditors
Green Audit	<ul style="list-style-type: none"> • IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan
Energy Audit	<ul style="list-style-type: none"> • BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator 	<ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam ➤ Dr. P. Thirumoorthi ➤ Dr. G. Muruganath
Environment Audit	<ul style="list-style-type: none"> • IGBC -Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services 	<ul style="list-style-type: none"> ➤ Dr. A. Geetha Karthi ➤ Dr. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan

Hygiene Audit	<ul style="list-style-type: none"> • FSMS – Food Safety Management System & • Occupational Safety & Health (ISO 22000:2018) • SBICM - Swatch Bharath under India Clean Mission 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R, Sudhakaran ➤ Dr. N. Saranya
Waste Management Audits	<ul style="list-style-type: none"> • Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R, Sudhakaran ➤ Er. N. Shanmugapriyan
Academic & Administrative Audits	<ul style="list-style-type: none"> • Academic & Administrative Audits as per the NAAC Criteria and ISO implantation procedure • In compliance with the Environmental legislations and rules and regulations 	<ul style="list-style-type: none"> ➤ Dr. B. Anirudhan ➤ Dr. B. Shreeram
ISO Certification	<ul style="list-style-type: none"> • QMS (9001:2015), EMS (14001:2015), OHS (45001:2018), • ISMS (27001:2018), FSMS (22000:2018), QMSMD (13485:2016), EnMS (50001:2018) 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R. Mary Josephine

Table 2. Total Campus Area, Building Spread Area, Vehicles and human population

S.No.	Details of Area	Total area
1.	Total Campus area	4866.26 sq. m
2.	Total Built up area	2877.13 sq. m
3.	Covered Car parking area	NA
4.	Air Conditioned area	231.13 sq. m
5.	Gross Floor area	2648.98 sq. m
	Forest Vegetation	30%
6.	Planted vegetation	55%
7.	Total number of Girl students	266
8.	Total number of Boy students	34
9.	Total number of Teaching Staff	21
10.	Total number of Non-teaching staff	7
11.	Total number of College Vehicles	12



Loyola College of Education campus Infrastructure

20. Audit Details

Date / Day of Audit	: 31.01.2023
Venue of Audit	: Loyola College of Education, Chennai, Tamil Nadu, India.
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Environment Audit
Name of Auditing Chairman	: Dr. S. Rajalakshmi Jayaseelan, Chairman of NSF & ISO QMS, EMS, OHSMS, EnMS Auditor.
Name of IGBC AP Auditor	: Dr. B. Mythili Gnanamangai, Vice Chairman of NSF, Indian Green Building Council Accredited Professional.
Name of Subject Expert-I	: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of Subject Expert-II	: Er. D. Dinesh Kumar, Certified Lead Auditor, IGBC, ASSOCEM, GRIHA & LEED
Name of the Energy Auditor	: Dr. N. Balasubramanian, Certified Bureau of Energy Efficiency Auditors of NSF.

Name of the Eco Auditor : **Er. S. Srinivash,**
Tamil Nadu Fire and Rescue Services,
Coimbatore.

Name of Eco & Green Officer : **Ms. M. Nithya,**
Environment, Energy & Green Council
Programme Officer, NSF.



**Nature Science Foundation Environment Audit Team in
Loyola College of Education, Chennai, Tamil Nadu.**

21. Qualitative and quantitative measurements of the Environment Audit

It covers both qualitative and quantitative measurements including physical observation of eco-friendly environment set-up (Table 3 & 4). The qualitative and quantitative measurements such as achievement of environmental objectives and targets by implementing agency (Auditee), appointment of Environmental Engineers and Agriculture Staff working for environment monitoring, Drinking water / RO water / Borewell water / Open well water / Pond water / Municipal or Corporation water facility to the stakeholders and periodical checking of drinking water quality through Physio-chemical properties analysis, Wastewater treatment facility, Hazardous and toxic material disposal facility, Solid waste management facility, Renewable energy utilization (Solar panel, wind mill, solar water heater, etc.), Air ventilation at Indoor / Outdoor auditorium, seminar / conference halls, classrooms, hostel, canteen, staff rooms, laboratories, restrooms, etc., Availability of Biogas plant, Rain harvesting system, water reservoirs, etc (Vinothkumar *et al.*,2021).

Incinerator for napkin disposal use, Housekeeping, storage, areas, piping, plumping and etc. facility, Sign boards indicating plastic free campus, tobacco free campus, don't waste water, don't walk on the lawns, don't plug flowers, etc. The ratio of Environment sustainability courses (Environmental Science, Engineering, Technology, Management, Monitoring, Climate change, Global warming, etc.) to total courses / subjects to undergraduate and post graduate course students including research scholars, Per capita water consumption per day and carbon footprint in the Organization campus due to an extensive use of vehicles, electricity usage and human population load are also analysed during the environment audit. These qualitative and quantitative

measurements are playing important role in environment sustainable development in the campus. An account of a large number of Oxygen releasing and Carbon dioxide assimilating plants planted in the Campus are taken into consideration to give pure atmosphere to the stakeholders. Establishment of different types of gardens in the campus, rainwater harvesting system, operation of water irrigation, drip and sprinkler irrigation are a quite a few methods are already under implementation in the Institute in order to establish the green campus. Biofertilizers, organic and green manures, cow dung manures and farmyard manures may be used for the cultivation of plants which may be protected the environmental health that will not cause any air, water and soil pollution.

The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, SF and NSS bodies may be involved in green campus as well as eco-friendly atmosphere initiatives, planning and efforts among stakeholders. Outreach programmes may be conducted for dissemination of natural resources management, environmental pollution studies, green and eco-friendly atmosphere pledge initiatives to rural, tribal and urban people across the country. Signing of MoU with Govt. and NGOs to ensure eco-friendly campus maintenance, conduct of awareness programmes and cultural activities for environmental monitoring and ecosystem maintenance to the stakeholders. Waste management methods, documentation of energy utilisation and carbon footprints were given due importance in the audit in relation to healthier environment under climate change and global warming scenario. In addition, academic credentials like taking up major and minor Projects, Dissertations, Thesis work and Scholarly publications on environmental science, engineering, technology and management domains carried out by students and staff members may be taken into account towards environment sustainability management. Best practices followed on green campus and eco-friendly set-up initiatives, planning and efforts in the Organization and recommendations for improvement are illustrated in the audit report as well.

Table 3. Qualitative Measurements of Environmental Audit

S.No	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have Internal Environment Audit procedures been developed and implemented in the Organization?	√		
2.	Have programmes for the achievement of environmental objectives and targets been established and implemented as on today?	√		
3.	Have responsibilities been assigned for programmes at each appropriate function and level? (Environmental Engineer and Agriculture Staff working for environment monitoring in the campus)	√		
4.	Are the following environmental aspects considered in sufficient detail?			

	a. Drinking water / RO water / Borewell water / Open well water / Pond water / Municipal or Corporation water use and to check quality of water through Physio-chemical properties analysis	√		
	b. Wastewater treatment facility	√		
	c. Hazardous and toxic material disposal facility	√		
	d. Solid waste management facility	√		
	e. Renewable energy utilization (Solar panel, wind mill, solar water heater, etc.)	√		
	f. Air ventilation at Indoor / Outdoor auditorium, seminar / conference halls, classrooms, hostel, canteen, staff rooms, laboratories, restrooms, etc.	√		
	g. Acoustic proof in indoor auditorium, seminar / conference halls		√	
	h. Availability of Biogas plant	√		
	i. Rain harvesting system, water reservoirs, etc.	√		
	j. Incinerator for napkin disposal use	√		
	k. Housekeeping, storage, areas, piping, plumbing and etc. in a proper way	√		
	l. Sign boards indicating plastic free campus, tobacco free campus, don't waste water, don't walk on the lawns, don't plug flowers, etc.	√		
	m. The ratio of Environment sustainability courses (Environmental Science, Engineering, Technology, Management, Monitoring, Climate change, Global warming,) to total courses / subjects	√		
	n. Per capita water consumption per day	23 L		
5.	Signing of MoU with Govt. and NGOs to ensure eco-friendly campus maintenance	√		
6.	Implementation of Government schemes (Swachh Bharath Abhiyan under Clean India Mission)		√	
7.	Functioning of Nature club, Eco club, Cell, Forum, Association, SF (NCC), NSS bodies and Social Service League for students and staff members on environment conservation, pollution control and nature protection.	√		
8.	Conduction of awareness programmes and cultural activities for environmental monitoring and ecosystem maintenance to the stakeholders	√		
9.	Conduction of outreach programmes for dissemination of natural resources and environmental pollution		√	

10.	Implementation of composting pits, vermicompost unit, recycling of kitchen wastes collected from hostels, canteens, and other places	√		
11.	Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods	√		
12.	Public transport, low-carbon emitting vehicles, battery operated vehicles, bicycles, biofuel use and control of car smokes and exhaust with respect to routine FC services		√	
13.	Observation on the site preservation, soil erosion control and landscape management	√		
14.	Projects and Dissertation works and Scholarly publications on environmental science, engineering, technology and management carried out by students and staff members	√		
15.	Steps taken to take care of daylighting, AC machine heat and carbon dioxide emission & carbon sequestration*			√
16.	Eco-friendly Refrigerants, instruments and materials use including Energy efficiency measures taken *			√
17.	Mechanism of monitoring environmental parameters (Temperature, Relative humidity, Rainfall, Sunshine, Wind speed, dew point) *			√
18.	Are the required resources (e.g., personnel skill development, procurement, finance, etc.) for implementation and control of the environmental management system provided by Management?	√		
19.	Any mosquitos and vectors and predators identified in the campus which are the root cause of various diseases spreading to students?		√	
20.	Any Digital / Automatic technology is adopted to reduce consumption of paper, gas, water, energy, etc.		√	
21.	Are all monitoring equipment appropriately maintained and calibrated?	√		
22.	Impactful Organization programmes on climate change, global warming, environmental protection, etc.	√		
23.	New initiatives to decrease private vehicles on campus to reduce carbon emission	√		

* Applicable for Industrial sectors

** A minimum of 50% criteria should be attained

Table 4. Quantitative Measurements of Environmental Audit

S. No	Requirements and checklists of the audit	Numbers / Percentage
1.	Number of RO water Plant in the campus for drinking water	--
2.	Number of Borewell water and Open well water facility	1+1
3.	Number of Percolation Pond and Check Dam facility	--
4.	Number of Wastewater treatment facility	--
5.	Number of Solid waste management facility	100%
6.	Number of Renewable energy utilization (Solar panel and solar water heater)	--
7.	Number of Rain harvesting system and water reservoirs	03
8.	The ratio of Environment sustainability courses (Environmental Science, Engineering, Technology, Management, Monitoring, Climate change, Global warming) to total courses / subjects	1:14
9.	Functioning of Nature club, Eco club, Association, and NSS on environment conservation, environmental pollution, nature protection and natural resources maintenance.	Yes (1+1)
10.	Signing of MoU with Govt. and NGOs to ensure eco-friendly campus maintenance	01
11.	Implementation of Government schemes (Swachh Bharath Abhiyan under Clean India Mission) programmes conducted	-
12.	Number of composting pits and vermicompost unit for recycling of kitchen wastes and plant leaf litters degradation	01
13.	Usage of Water (liter/day) in our institution	23 litres & 1.6 litres
14.	Carbon footprint in the campus due to Electrical energy usage	24.639 metric tons
15.	Carbon footprint in the campus due to Vehicle's usage	25.15 metric tons
16.	Carbon footprint in the campus due to Petroleum gas usage	--
17.	Carbon footprint in the campus due to Human population load	--
18.	Carbon footprint in the campus due to use of Petrol and Diesel for operating Generators for power generation	--

22. Observations of the Environment Audit.

22.1. Plastics use and their impact on the environment

The Ministry of Environment, Forest and Climate Change, Government of India has advised the Plastic Waste Management Rules, 2016. A Central Pollution Control Board report specified that the total annual plastic waste generation is quite huge and accounts around 3.3 million metric tonnes/year for which the data were collected from 60 major cities in India. The country generates around 26,000 tonnes of plastic waste/day out of which 60% of plastic produced is recycled. It doesn't degradable, rot, like paper or organic waste like food and hence, it can hang around in the environment for hundreds of years. More than eight million tonnes of plastic escapes from the land cover and enters the world's oceans each year while only 9 per cent of the total plastic waste in the world is recycled. It is observed that 96% of plastic wastes are collected and segregated by the respective urban bodies in which the recyclable plastic waste is sold to the recyclers and non-recyclable plastic waste are sent for co-incineration in cement plants. People should be probed to use reusable substances and initiate models which allow up-cycling of waste for better use. This will help to reduce plastic waste from urban local bodies, as well as curb the value for waste among the citizens. Plastic waste management is very important, because plastic not only pollute the environment, it destroys food chains.



People use plastic bags and plastic ware items every day to hold objects like meals, clothes, grocery and stationary items, which can be bought from shops. Generally, the plastic items are non-degradable in nature that led to soil pollution and affect the soil health significantly. Most of the plastic items are considered as solid waste and enhance the unwanted animal choking, water pollution, blockage of channels, rivers and streams, and landscape disfigurement. According to the World Health Organization (WHO) report, plastic items take at least 400 years to decompose completely in the soil which illustrates the subsequent effects on the environment. Plastic pollutants form a basis for damage to the healthier environment besides the living organisms in the ecosystem. It impacts all organisms in the food chain from tiny species to big ones. And hence, reduction of plastic usage is the need of the hour to protect at least the present-day natural resources. There is a need to reduce the plastic use to effectively limit plastic waste in the campus. College has taken sufficient attempts not to use plastics in the campus and displayed a slogan 'say no to plastics' in College's like canteen, hostel dining halls, seminar halls, corridors, etc. to the students, parents and public. The College Management insisted the people use eco-friendly bags made from organic materials like plant fibres which are easily decomposable in nature. These efforts are very much essential to keep the environment neat and clean to conserve nature.

22.2. Solid Waste Management Practices at the Loyola College of Education

The term, solid waste control refers to the method of accumulating and treating solid wastes by following eco- friendly methods. It also offers solutions for recycling objects that do not belong to garbage. In the solid waste management, the wastes are accrued from different parts and are disposed of based on degradability materials like paper and non- degradability materials like glasses, plastics and metals. Integrated Solid Waste Management (ISWM) is an activity that promotes reduction of waste, recycling, composting, and disposal besides offering methods/solution to manage stable wastes in the context of protect all living organisms in the ecosystem. As per Solid Waste Management Rules, 2016 (Ministry of Environment, Forest and Climate Change, Government of India), solid waste refers to solid or semi-solid wastes generated from domestic, commercial, institutional, catering, and markets and other non-residential wastes (street sweepings, silt removed or collected from surface drains, horticulture/agriculture and dairy waste, bio-medical waste excluding industrial waste, and e-waste, battery/radio-active waste). According to the rules, the local authorities are responsible to collect, treat and dispose the solid wastes. The ‘Central Board of Solid Waste Management’ is the monitoring authority and is responsible for granting authorization to local bodies for processing and disposal of solid waste.



College has a very good solid waste recycling unit which operates a few vehicles to collect wastes using compostable bags across the campus. Both degradable and non-degradable items are being collected from different canteens, cafeteria, stationary shops and hostels every day and dumped in the place which is subsequently segregated based on the nature of degradability. The segregated items are neatly packed in eco-friendly covers and subjected to degradation without harming the environment. In addition, dust bins are kept in different places across the campus to provide a dust free atmosphere to the stakeholders. The dust bins are labelled properly for the indication of Bio-degradable and non-degradable. These bio composts are utilized for cultivation of plants in the campus and enhance the health of soils and population density of beneficial microorganisms to a greater extend.

22.2.1. Waste Management Practices

Waste management has a common mandate that the “Producer Owns the Responsibility”. The community that generates waste should develop more responsibility in handling the waste with more care thus reducing negative impact on the environment. In a study conducted in 2013 by ‘M/S Hand in Hand India Ltd.’ In LCE had quantified a daily average of wastes in which food waste is about 37%, recyclable waste is about 27% and other organic waste is about 36%. The study revealed that the solid wastes need to be professionally handled. The solid wastes are collected from different places of campus and segregated based on bio-degradable and non-degradable materials subsequently subjected for recycling and degradation processes like composting. Details of the waste management practices in college are 1) Bio-degradable waste handling, 2) Sewage Treatment Plant 3) Bio-gas plant, 4) Disposal of E-Waste and 5) Rainwater Harvesting System.

Regarding the food wastes, a portion of food wastes being pulverized and used in the bio-gas digester and the balance quantity is sent to piggeries. Organic wastes like dry leaves, vegetable cuttings, etc. are sent for bio-composting (Setyowati *et al.*, 2017)

2.2.2. Bio-degradable and non-degradable waste materials Management Practice

For segregation of waste (Organic, recyclable, non-recyclable and e-waste) at source and collecting the same 'Waste Bins' are placed at designated locations in the LCE viz. Students Hostels and Staff rooms, Students Service Centre, Sports Complex and Guest rooms. A Contractor (M/s Metro Support Services) is engaged for the collection and further process of waste generated within the campus where biodegradable wastes subjected to preparation of organic compost.



Segregation of waste at the source of observation observed at LCE, Chennai, TN

2.2.3. Disposal of E-Waste at the Loyola College of Education

According to E-Waste Management Rules, 2016 (Ministry of Environment, Forest and Climate Change, Government of India), electronic waste or e-waste includes old and non-functional electrical and electronic appliances (telephones, cellular telephones, computers, laptops, television sets, refrigerators, washing machines, air-conditioners, fluorescent and other mercury containing lamps etc.). As per the Rules, the producer of the electrical and electronic equipment shall be responsible to collect and channelize the e-wastes generated under the criteria Extended Producer Responsibility. E-waste Management Rules applicable not only to Manufacturer/Producer, it is also applicable to Consumers, Collection Centre/Dealer, Retailer, Dismantler and Recycler. In compliance to the E-Waste Management Rules, 2016, Government of India, e-waste materials were collected from the College are being segregated and then sold to Authorised Agencies which are approved by the Pollution Control Board (PCB) for handling e-waste. Due to this e-waste activity disposal, the e-waste pollution is significantly reduced in the College Campus. However, a proper method of e-waste disposal should be done in coming years in collaboration with Tamil Nadu State Pollution Control Board as per the E-Waste Management Rules, 2016.

2.2.4. Construction & Demolition of Waste Management

The Ministry of Environment, Forest and Climate Change, Government of India has notified the Construction and Demolition Waste Management Rules, 2016 exclusively to manage waste (building materials, debris and rubble) from construction activities like new construction, re-modelling, repair and demolition.

According to the Rules, the local authorities need to ensure proper management of construction and demolition wastes. State Pollution Control Board is to grant authorization for the waste processing facility and to monitor the implementation of these Rules. One of the best waste management practices is rebuilding of construction waste into pillars, pathway road. The construction waste inside the campus is found to be very low.

22.2.5. Hazardous Waste Management

According to the Hazardous and Other Wastes (Management and Trans Boundary Movement) Rules 2016 (The Ministry of Environment, Forest and Climate Change, Government of India) under Environment (Protection) Act, 1986 Hazardous waste refers to "any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances". Hazardous waste generator shall follow various steps (minimising the utility of hazardous elements, prevention, recovery, reuse by co processing, recycling, and safe disposal) of hazardous waste. The State Board of 'Hazardous Waste Management' is taking operative steps in handling and management of hazardous wastes, its treatment and disposal in an environmentally safe manner. Hazardous chemical waste is not used in Loyola College of Education and also its not applicable.

The State Board of 'Hazardous Waste Management' is taking operative steps in handling and management of hazardous wastes, its treatment and disposal in an environmentally safe manner. LCE has taken pioneering efforts to dispose the hazardous waste properly that are generated from various Department laboratories. Acids, solvents, salts, reagents and cancer-causing substances (carcinogens) like Acetaldehydes, Acrylamide, Aristolochic acids, Arsenic and its derivatives, Azathioprine, Benzene, Ethidium bromide, Ethylene oxide, Formaldehyde, Hexachloroethane, Hydrazine sulphate, Hydrazo benzene, Lead compounds, Naphthalene, Naphthylamine, Selenium sulphide, Streptozotocin, Styrene, Sulfallate, Tetrachloroethylene, Urethane, Vinyl chloride, Vinyl fluoride and etc. will cause cancer to the stakeholders those who doing research and/or experiments. The other carcinogenic materials such as Aflatoxins, Alcoholic beverages, Areca nut, Asbestos (all forms), Coal, indoor emissions from household combustion, Glass wool fibres (inhalable), Leather dust, Ionizing radiation, Solar radiation, X-ray and Gamma radiation, Iron and steel founding (workplace exposure), Tobacco smoke, Welding fumes, Wood dust, Painter (workplace exposure), Rubber manufacturing place Salted fish (Chinese-style), Silica dust, Crystalline, in the form of quartz or cristobalite will cause various types of cancer to the students and staff members. Hepatitis B virus, Hepatitis C virus, Human immunodeficiency virus type 1 (HIV-1), Human papilloma virus (HPV) and Human T-cell lymphotropic virus type I act as carcinogenic to humans.

Acids and Reagents should be carefully mixed with 2 to 5 gallons of water and diluted solution poured slowly down the sink followed by flushing with large quantum of water without splashes. It's very important to note that always add the chemical to the water and not the water to the chemicals. Disposal of acids with very low pH (<2) found to be safely. If the acid doesn't contain heavy metals/toxic substances, neutralize the pH to a less acidic level (pH 6.6-7.4) allows to dispose of the substance in the

standard sewer system. Chemical wastes are regulated by the Environmental Protection Agency (EPA) through the Resource Conservation and Recovery Act (RCRA). Chemical waste cannot be disposed of in regular trash or in the drainage system. Most chemical wastes must be disposed of safely without affecting the environment, soil health and water quality as per the directions of World Hazardous Waste Programme. Carcinogenic substances should not dispose of from the laboratories directly through drains or by evaporation into the atmosphere, nor should they be buried since they might be released later.

Carcinogenic substances should be treated strictly as per the protocol and the degraded products should be non-toxic and non-carcinogenic in nature. Procedures involved in treatment and disposal do not result in exposure to the personnel in charge of the work and the procedures on treatment and disposal do not end with contamination of equipment or workplace. Biological and animal wastes, human or animal blood and body fluids can be disseminated through drains (sanitary sewer), under running water after it has been decontaminated by autoclave or using chemicals. In addition, animal wastes and microorganisms including some biological waste materials should be disinfected with liquid detergents and disinfectant solution and then poured down the drainage after dilution with water (pH 6.6-7.4). The campus has a certain protocol to dispose waste as well as expiry chemicals properly (Table 5). But there is no proper record for disposing of acids, reagents, carcinogenic and hazardous chemicals as per the rule of Central Pollution Control Board.

22.2.6. Waste Disposal and Tracking Form

Name of the Organization : Loyola College of Education
 Address of the Organization : Chennai, Tamil Nadu, India.
 Date of Waste Disposal : From April 2021 to March 2023
 Reporting Team and details : IQAC and NAAC Teams

Table 5. Details of waste disposal and tracking form

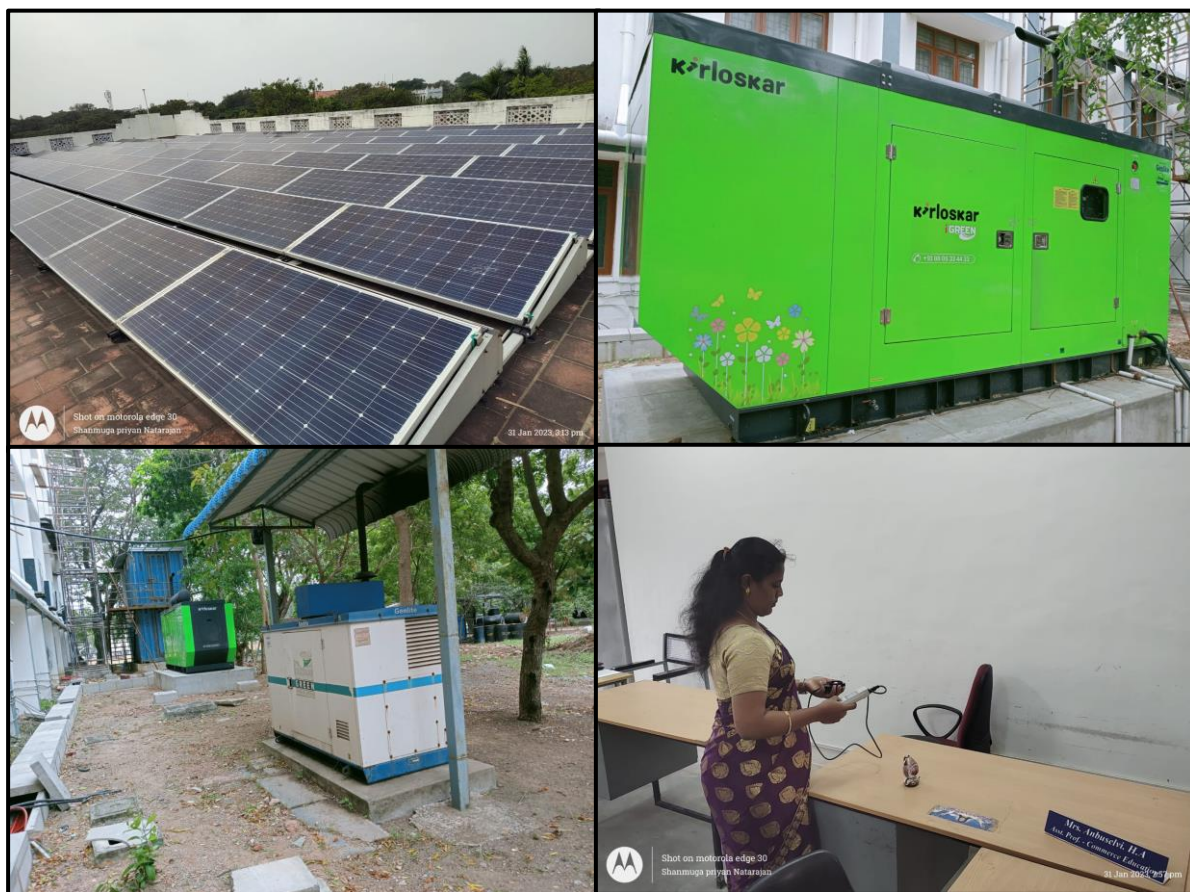
S.No.	Types of Waste	Approximate Quantity / Unit Disposed	Disposal Location (On-site / Off-site)	Authorized Company responsible for recycling
1.	Acids and Bases	NA	NA	NA
2.	Aerosol Cans (Empty)	NA	NA	NA
3.	Agriculture Waste	NA	NA	NA
4.	Aluminium, Metal Cans, Tins	NA	NA	NA
5.	Asbestos	NA	NA	NA
6.	Batteries (Dry)	NA	NA	NA
7.	Batteries (Lead Acid)	NA	NA	NA
8.	Biomedical Waste	NA	NA	NA
9.	Car exhaust	NA	NA	NA

10.	Charcoal	NA	NA	NA
11.	Clinical Waste	NA	NA	NA
12.	Cloth Materials Waste	NA	NA	NA
13.	Construction Waste	NA	NA	NA
14.	Condensate Waste	NA	NA	NA
15.	Crude Oil	NA	NA	NA
16.	Descaling Acids	NA	NA	NA
17.	Drilling Fluids / Solids	NA	NA	NA
18.	Drums and Containers (Empty)	NA	NA	NA
19.	Effluents from major equipment	NA	NA	NA
20.	Electrical Waste (Wires, Switches, Fans, A/C machines, Holders, Meters, Coils, etc.)	NA	NA	NA
21.	Electronic Waste (Computer, Laptop, CD, Pen drive, Keyboards, Mouse, Printers, UPS)	NA	NA	NA
22.	Fertilizer Waste	NA	NA	NA
23.	Filters	NA	NA	NA
24.	Fluorescent Light Tubes	NA	NA	NA
25.	Food Waste	NA	NA	NA
26.	Furniture Items	NA	NA	NA
27.	Garbage and Cardboards	NA	NA	NA
28.	Glass Bottles	NA	NA	NA
29.	Glassware items Waste	NA	NA	NA
30.	Glycols	NA	NA	NA
31.	Hazardous Waste	NA	NA	NA
32.	Household items	NA	NA	NA
33.	Human Waste	NA	NA	NA
34.	Inert Waste	NA	NA	NA
35.	Laboratory Wastes	NA	NA	NA
36.	Lights and Bulbs	NA	NA	NA
37.	Kitchen Waste	NA	NA	NA
38.	Metal Waste	NA	NA	NA
39.	Napkins	NA	Incinerator	NA

40.	Oil Contaminated Soil	NA	NA	NA
41.	Oily Sludge & Rags (Used)	NA	NA	NA
42.	Packaging Waste	NA	NA	NA
43.	Paint Waste	NA	NA	NA
44.	Paper Waste	NA	NA	NA
45.	Pathological Wastes	NA	NA	NA
46.	Pigging Wastes	NA	NA	NA
47.	Plant Wastewater	NA	NA	NA
48.	Plastic Waste	NA	NA	NA
49.	Plasticware items waste			
50.	Produced Water Waste	NA	NA	NA
51.	Radioactive Waste	NA	NA	NA
52.	Rinsate Waste	NA	NA	NA
53.	Rubber Waste	NA	NA	NA
54.	Salts used in Laboratories (Used & Expiry Chemicals)	NA	NA	NA
55.	Sanitary Wastewater	NA	NA	NA
56.	Scale (Pipe and Equipment)	NA	NA	NA
57.	Sewage Sludge	NA	NA	NA
58.	Solvents	NA	NA	NA
59.	Sludge and allied	NA	NA	NA
60.	Trash (i) Glass (ii) Metal (iii) Plastic (iv) Oils (v) General Trash	NA	NA	NA
61.	Synthetic Dyes, other items	NA	NA	NA
62.	Textile Waste	NA	NA	NA
63.	Used Engine Oil	NA	NA	NA
64.	Wastewaters (Liquid Waste: Detergents, Soap, Oil, etc)	NA	NA	NA
65.	Wood Waste	NA	NA	NA

22.2.7. Auditing for Energy Conservation and Management

Energy cannot be seen but we recognise its existence because of its properties in the forms of heat, light and power. Energy use is clearly an important feature of campus sustainability and needs no explanation for its inclusion in the assessment. For example, an old incandescent bulb uses ~60 to 100W while light emitting diode (LED) uses <10 W. Energy auditing offers a guideline to save energy by adopting conservation methods which include 1) Reducing the risk of energy scarcity, 2) Reducing the greenhouse gas emissions, 3) Renewables have overhead costs too and 4) Energy Management saves costs. An energy audit is a useful tool for developing and implementing comprehensive energy management plans. Scope of an energy audit is to identify the energy efficiency, conservation, and savings opportunities at the premises of the audit sites in a systematic manner. The audit process is carried out to review of energy saving opportunities and measures implemented in the audit sites and to identify the various energy conservation measures and saving opportunities. In addition, Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management along with creating awareness among the stakeholders on energy conservation and utilization are being carried out.



Energy Conservation and Management Activities at LCE, Chennai, TN

College has a substantial the energy conservation initiatives with very good savings opportunities. Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. There are some best Practices followed on Energy Audit in the Organization like Transformers, Generators and UPS are protected properly with fencing and kept

awareness boards on ‘Dangers’ and ‘Warnings’. It is observed that the most of place, sign board of ‘Switch ON’ and ‘Switch OFF’ are kept towards saving energy measures to the stakeholders. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members. Adaptation of drip and sprinkler irrigation and solar streetlights in the campus to minimize the energy potential are well appreciated. Few recommendations, in addition, can further improve the energy savings of the Organization. This may lead to the flourishing future in the context of Energy Efficiency Campus and thus sustainable eco-friendly environment and community development to the stakeholders in coming years to come.

22.3. Biogas plant facility at Loyola College of Education

A biogas plant is the structure where it is produced by fermenting biomass (cow dung and plant waste products). This is done by developing methane-containing fuel that is usually present in energy crops like corn, or waste substances (manure or organic food waste). The fermentation residue left over from the substrates at the end of fermentation can be used as fertilizer. Biogas is produced by the microbial/bacterial decomposition of the substrate under anaerobic situations. This is implemented by pumping the substrate into the fermenters. The substrate is stored beneath anaerobic conditions and is periodically shifted *via* agitators to avoid the formation of surface scum and sinking layers which allows the biogas to rise greater effortlessly. Installing biogas in educational institutions and industries help in the waste management process, as the wastes accumulated in canteen, hostels, mess and restaurants can be used for biogas plant, which in turn can be used for cooking. This fulfils two purposes simultaneously by energy saving and waste management. Loyola College of Education waste are collected and processed in the Biogas placed near LICET Campus.



Biogas observed at LCE Campus, Chennai, TN

22.4. Vermicompost, Organic and Green manures

Natural or eco-friendly methods should be used to grow plants vigorously in the campus which could reduce the environmental pollution. Use of biofertilizers, organic manures (cow dung, vermicompost and plant wastes and litters) and green manures to grow healthy plants in the medicinal plant garden, kitchen garden and terrace garden should be ensured to keep the campus organic. The plant waste such as fallen leaves,

stems, fruits, nuts, seeds and other plant parts should be used to make green manures. A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal-based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but nil use of chemical fertilizers is highly appreciable and also helps to keep the campus more of an organic ecosystem. Proper use and conservation of these resources are mandatory in green campus audit sites. Biofertilizers such as Nitrogen fixing bacteria, Potassium and Phosphorus solubilizing bacteria, Potassium mobilizing fungi (VAM), farmyard manure, dried cow dung manure, vermicompost manures and bio fungicides and biopesticides are extensively used in Campus to cultivate plants. Agrochemicals, chemical fertilizers, pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which turn to improve the soil health significantly.

22.5. Recycling of Wastewaters at the Loyola College of Education

Wastewater recyclers are important features in any Organization or Industry. Once for all the implementations should follow the proper guidelines for wastewater treatment system discharge standards as per Central Pollution Control Board (CPCB). The main feature of these discharge standards is the treated water should not be harmful to the biodiversity, resources and the environment. If an industry or Organization has the wastewater treatment plan, proper records on the analysis of water input and output parameters including the running time of the wastewater treatment plant; its operation cost, its maintenance and the reuse records of the treated water should be well accounted.



STP Observed at LCE Campus, Chennai, TN

A typical wastewater treatment system should be based on the waste characterization and the treatment of wastes which can be modified so as to fit into the motto of treating the wastewater which in turn to release of safe water. Rain water harvesting is implemented in our campus to collect and to recycle water to promote self-sufficiency and sustainability which is used for toilets. Rain Water tank is available in the campus at the ground level as well below ground level i.e. filtered and stored in sump. Sewage Treatment plant is used at Loyola College of Education as one of the water conservation activities and its used for plantation purpose.

22.6. Establishment of Eco-friendly Campus at Loyola College of Education

Eco-friendly environment is very essential to any Organization is concern in terms of protection of earth planet. Go green concept is the ideal way to conserve the environment. Eco-friendly products also prevent contributions to air, water and land pollution to a greater extent and designed to have little or no damage to the environment. Products, events, and services that are eco-friendly lead less cost without harming the earth as well as lead less pollution. Anthropogenic activities *viz.*, deforestation, construction of new establishments, besides pollution, global warming are the major threat to the environment. Air pollution is instigated by solid and liquid particles and certain gases that are suspended in the air. All-natural products ensure safety from all dangerous chemicals and allows the humans to avoid risky additives. On the whole using eco-friendly natural products improves quality of life without harmful effects. In order to save the environment, college has taken sufficient attempts by means of creating environment awareness programme to the rural, tribal and urban people across the country and also offering various core and elective courses to the students and scholars in their curriculum.



Loyola College of Education - Greenery view

22.7. Napkin disposal facility

Menstrual Hygiene Management (MHM) is an indispensable part of the Swachh Bharath Mission Guidelines (SBM-G) for adolescent girls and ladies. As in step with MHM hints, 'Safe disposal' method making sure that the process of destruction of used and dirty materials is performed without human touch and with minimum environmental pollutants and 'Unsafe disposal' method throwing used material into ponds, rivers, or inside the fields exposes others inside the vicinity to decaying material and must be averted. Some of the unsafe practices of napkins include throwing them unwrapped into fields and rooftops, wrapping them in paper/plastic bags and throwing them outdoors or in dustbins, burying them for decomposting, throwing them in latrine / toilets, burning it. These unsafe practices are

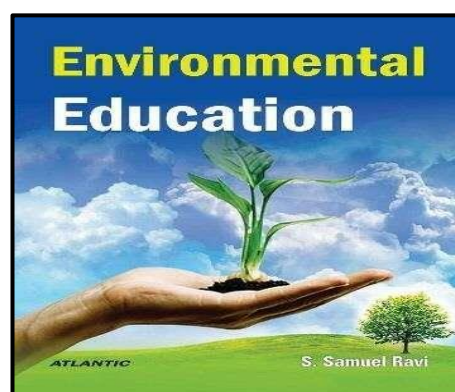
to be avoided and rather health practices can be adopted. The Campus Management is implementing the safe practices of disposing of napkins using small scale incinerators in ladies' hostels. Incinerator's facility and disposal structures in the proper directions and other social stigmas connected to menstruation influences the sanitary waste disposal conduct of women within the campus is very much appreciated. The College is taking care of adolescent girls and ladies significantly in their personal hygiene.



Napkin Collection and disposal facility in LCE, Chennai, Tamil Nadu

22.8. Environmental Education

An environmental study is the learning principle of the ecosystem and how it will expand sustainable techniques to defend the surroundings. It enables people to develop an understanding of the environment in which we live and helps to overcome tough environmental troubles affecting nature. In addition, the physical aspects of the environment should be studied, it also emphasizes the need to conserve biodiversity and undertake an extra sustainable way of life and make use of sources in a responsible manner. To create attention amongst today's generation on pressing environmental troubles, the University Grants Commission (UGC) in India has made it mandatory for the Universities and Autonomous Colleges to introduce a course in 'Environmental studies' and teach to the students about the ecosystem, pollution and problems associated with the environment. Environmental education refers to structured efforts to deliver how natural environments function, how human beings can manage to protect the ecosystems in sustained manner (Breiting and Mogensen, 1999).





Environment Education Syllabus and Books observed at LCE, Chennai, TN.

22.9. Public transport, Low emitting vehicles and Control of Car smokes.

A smart method is to pick out public transportation as much as feasible without polluting the environment by way of driving a car or bike. It additionally often is cheaper, and it leaves much tear in personal automobile expenses. Public transportation cars together with buses reduce carbon emissions which greatly decreases the development of smog within the towns. This means that human beings have healthy air to respire. Comparing a bus travelling with seven people to one single person using a vehicle, it's been observed that buses are the most effective by producing 1/5 the quantity of carbon gas emissions compared to the findings of the car effects. This is a huge decrease in discharge of natural resources per person. Public transportation is better for the surroundings which have been proven through research on emissions. Other than this, it also gives more benefits like less noise and traffic congestion. Whenever possible, try to take public transport in place of one's own vehicle. Fewer miles mean approaching fewer emissions

Loyola College of Education operates 12 vehicles to pick up the students and staff members around Chennai city to enhance the teaching and learning processes. In addition, a few vehicles are operated to collect the garbage for day-to-day activities with respect to running of hostels, canteens, cafeterias, mechanical workshops and other departments like construction, plumbing and wiring. The vehicles are maintained properly by following periodical services, changing oil filters and belts, grease and lubricate, batteries, etc... Some of the students and scholars are coming to the campus using their own bicycles and battery bikes which is highly appreciated in view of making pollution free environment in addition to that college is providing bicycle to maintain eco-friendly in the campus and to reduce carbon-di-oxide.



Vehicles parked at proper places in LCE, Chennai, TN

22.10. Ventilation and Exhaust systems in Buildings

Ventilation is necessary in the buildings and continuous air flow removes 'stale' air and replace it with 'fresh' air which facilitates to moderate internal temperatures, reduce the accumulation of moisture, odours and other gases. In addition, ventilation create air movement which improves the comfort of occupants. Mechanical (or 'forced') ventilation tends to be driven by exhaust fans to replace stale air with fresh air along with moderating the optimum temperature to the occupants. Natural ventilation is driven by pressure differences from one part of the building to another. Internal partitions may prevent the air paths, hence the creation of draughts adjacent to openings for adequate flow of air. Natural ventilation can be wind driven, or buoyancy driven. If air quality is poor, nature ventilation by means of opening windows may be adopted to use in the building. It may also be useful to reduce the noise level to a greater extent. It is recorded that the College has a large number of ventilators for effective air circulation.



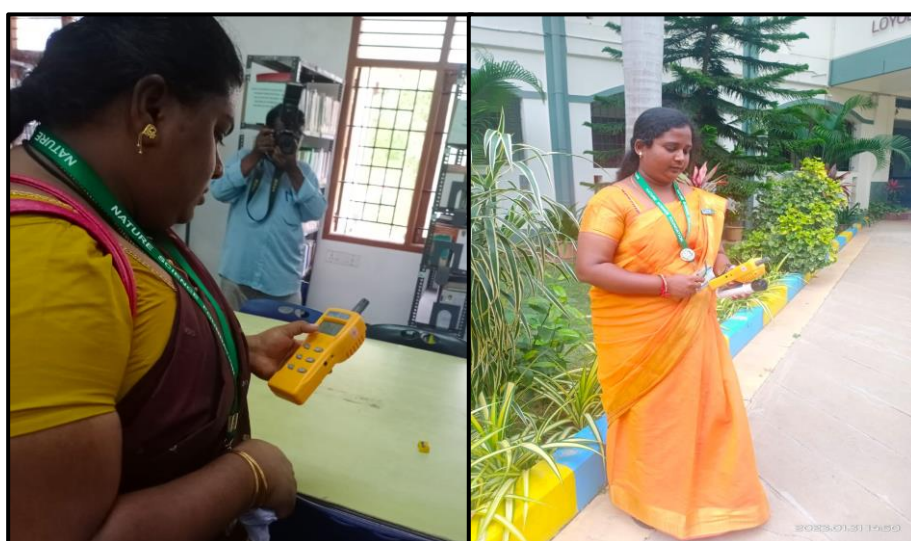
Ventilation Facilities in Loyola College of Education Campus

22.11. Measurement of Carbon dioxide level in the Campus

Climatic conditions of the earth changed now-a-days due to a massive increase in global warming and environmental changes including human population and human activities. In addition, primarily fossil fuel burning and an extensive usage enhances heat-trapping greenhouse gas levels in the atmosphere which lead to assimilation of carbon dioxide. Global warming is driven by human-induced emissions of greenhouse gases which resulted in paramount shifts in weather patterns. It is playing an important role to act as a global indicator for checking the purity of the atmosphere. In general, a portable CO₂ Analyzer is used to measure the level of carbon dioxide in the atmosphere at different places across the campus. The observation showed that the concentration of CO₂ in the atmosphere is found to be low which did not exceed the critical limit of CO₂. It is further revealed that all the selected locations are having pure air without any air contaminants with good air exchange/circulation in the campus. Some of the places like Bank, Post Office, ATM Centre and Examination Centre are recorded with high level of carbon dioxide level due to student mobilization and the maximum number of electrical items fixed from which the carbon dioxide emission and poor ventilation were observed followed by all laboratories and seminar and auditorium halls (Table 6).

Table 6. Measurement of CO₂ concentration in the LCE Campus

S.No.	Different locations of the Organization's Campus	Carbon dioxide level (ppm)	Remarks
1.	Library	425	Aspirational
2.	Classroom	525	Within permissible limits
3.	Parking area	510	Within permissible limits
4.	Open place	408	Within permissible limits
5.	Canteen	465	Within permissible limits



Measurement of CO₂ level at Loyola College of Education, Chennai, TN

Reference of Set values of CO₂ level

As per (ASHARE 62-2019) Indoor air Quality parameters Threshold values

- Class A (Aspirational) = Ambient+ 350
- Class B (Within permissible limits) = Ambient + 500
- Class C (Marginally Acceptable) = Ambient + 700

22.12. Atmospheric Oxygen level measurements analysis and interpretation

Oxygen level refers to the amount of oxygen available within the atmosphere or water bodies. Oxygen is produced/released as a by-product of photosynthesis, the metabolic activity of all green plants besides certain microbes. Production and burial of plant litres over a period resulted in rise in oxygen levels. Oxygen plays a paramount role in metabolic activities like respiration and the energy-producing chemistry of all living organisms. In order to quantify the oxygen level, Oxygen Meter is used and it also records the ambient Temperature The atmosphere contains 18-21% oxygen concentration, 75-78.5% nitrogen and 2-3% other gases like carbon dioxide, neon, and hydrogen. The amount of oxygen level in the atmosphere is determined by abiotic factors like altitude, latitude and longitude and biotic factors like plantations in the surroundings. If oxygen level is low in the atmosphere lead to headaches and shortness of breath to human beings. If it excess, it causes oxygen toxicity and oxygen poisoning by creating coughing, breathing trouble and damage the lungs to human beings. The Oxygen level of different places at LCE Campus are monitored and presented (Table 7).

Table 7. The Oxygen concentration in the Loyola College of Education

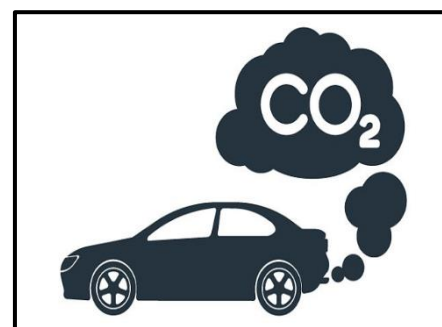
S. No	Location	Oxygen Level (%)	Remarks
1.	Library	19.3	O ₂ level is good
2.	Classroom	18.6	O ₂ level is good
3.	Parking area	20.9	O ₂ level is good
4.	Open place	20.2	O ₂ level is good
5.	Canteen	19.4	O ₂ level is good



Measurement of O₂ level at Loyola College of Education, Chennai, TN

22.13. Auditing for Carbon Footprint at Educational Institutions

Carbon footprint means of measuring/recording the greenhouse gases (GHG) emissions of an organization within its defined boundary. The carbon footprint is one of the components of Ecological Footprint since it is one competing demand for biologically productive space. Burning fossil fuel (such as petrol, diesel and kerosene) emits Carbon which accumulate in the atmosphere if there is not sufficient bio capacity dedicated to absorb the same. Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels. The most common greenhouse gases are carbon dioxide, methane, nitrous oxide and ozone; among them, carbon dioxide is the prominent one, comprising 402 ppm in the atmosphere. An important aspect of doing an audit is to access the impact within defined boundary which can helpful to derive better ways to minimise its impact. It is necessary to assess the Carbon foot prints of an organisation to understand how far they contributing towards sustainable development. It is therefore essential that any environmentally responsible organizations should examine their carbon emission and subjected to calculate carbon footprint (Woo and Choi, 2013). The observation on carbon footprint due to electricity usage per year at the college showed 114.59 metric tons. It is calculated based on CO₂ emission from electricity per year in kWh/1000 units.



The carbon footprint due to transportation (Shuttle services) per year at campus showed 0 metric tons. It is calculated based on the number of the shuttle bus in the college multiplied with total trips for shuttle bus service each day and approximate travel distance of a vehicle each day inside campus (in kilometres), wherein, 365 is the number of working days per year is taken into account. Similar to that of the carbon footprint due to transportation in shuttle services, Carbon footprint due to car usage per year is calculated based on the number of cars entering into the campus multiplied with the approximate travel distance of a vehicle each day inside campus (in kilometres), wherein, 365 is the number of working days per year is taken into account. The recorded value of carbon footprint due to car usage per year is 0 metric tons.

The Carbon footprint due to Motorcycle's usage per year is 0.876 metric tons which is derived based on the number of motorcycles entering into the College multiplied with the approximate travel distance of a vehicle each day inside campus (in kilometres). The overall results indicated that total carbon emission at Campus per year is 25.15 metric tons which is the sum of the carbon emission from electricity plus transportation (bus, car, motorcycle) per year.

Calculation of Carbon Footprint Per Year at Loyola College of Education

The Carbon footprint calculation can be conducted based on the stage of calculation as stated in www.carbonfootprint.com, which is the sum of electricity usage per year and transportation (shuttle bus services and Car and Motorcycles) per year.

a. Electricity usage per year

$$\begin{aligned} &\text{The CO}_2 \text{ emission from electricity} \\ &= (\text{electricity usage per year in kWh/1000}) \times 0.84 \\ &= (29333 \text{ kWh/1000}) \times 0.84 \\ &= 24.63972 \text{ metric tons} \end{aligned}$$

b. Transportation per year (Shuttle)

$$\begin{aligned} &= (\text{Number of the shuttle bus in the campus} \times \text{total trips for shuttle bus service each day} \\ &\times \text{approximate travel distance of a vehicle each day inside campus only (in kilometres)} \\ &\times 365/100) \times 0.01 \\ &= ((0 \times 2 \times 1 \times 365)/100) \times 0.01 \\ &= 0 \text{ metric tons} \end{aligned}$$

Notes:

365 is the number of working days per year

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

c. Transportation per year (Car)

$$\begin{aligned} &= (\text{Number of cars entering the campus} \times 2 \times \text{approximate travel distance of a vehicle} \\ &\text{each day inside campus only (in kilometres)} \times 365/100) \times 0.02 \\ &= ((0 \times 2 \times 1 \times 365)/100) \times 0.02 \\ &= 0 \text{ metric tons} \end{aligned}$$

Notes:

365 is the number of working days per year

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

d. Transportation per year (Motorcycles)

$$\begin{aligned} &= (\text{Number of motorcycles entering the campus} \times 2 \times \text{approximate travel distance of a} \\ &\text{vehicle each day inside campus only (in kilometres)} \times 365/100) \times 0.01 \\ &= ((12 \times 2 \times 1 \times 365)/100) \times 0.01 \\ &= 0.876 \text{ metric tons} \end{aligned}$$

Notes:

365 is the number of working days per year

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

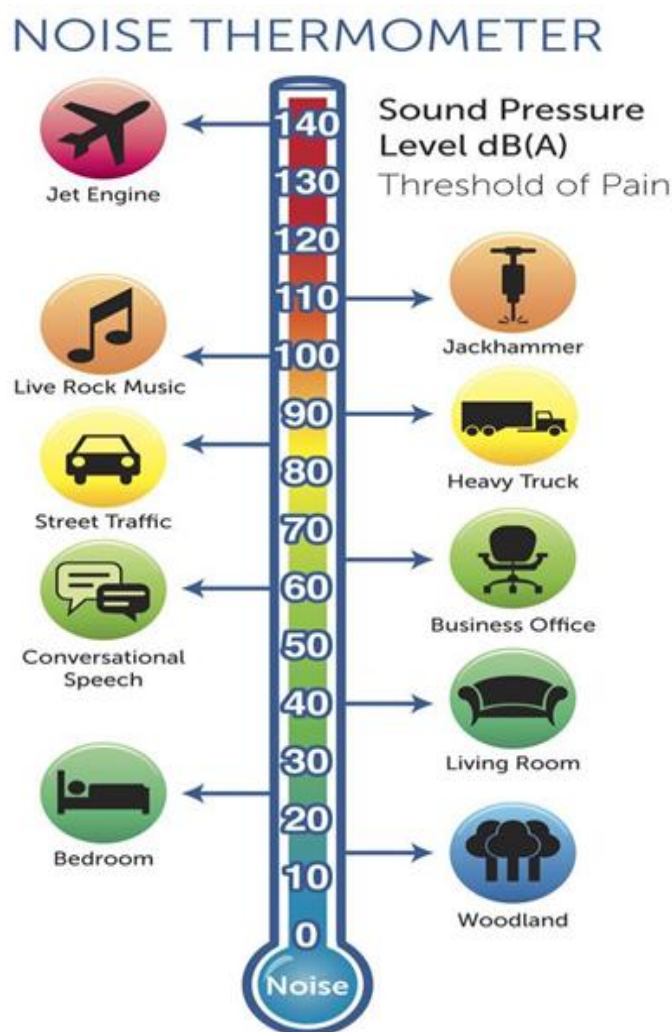
e. Total Carbon emission per year

$$\begin{aligned} &= \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\ &= ((24.639 + 0 + 0 + 0.876)) \\ &= 25.515 \text{ metric tons} \end{aligned}$$

22.14. Noise level Measurements, Analysis, and Interpretation

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). Noise pollution is defined

as consistent exposure to elevated sound levels that may cause adverse effects in humans or other living organisms. World Health Organization (WHO) defined environmental noise (sound produced by transport, industrial activities, construction sites, public works and services, cultural, sporting and leisure activities and neighbourhood) as noise from all sources with the exception of workplace noise and recognizes that noise pollution is an increasing problem. Prolonged exposure to loud noises (75 dB (A) over eight hours a day for years) can lead to hearing loss. 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 (Table 8). From the graph above, it is evident that most of the noise level values across campus are above the normal permissible range. Within the auditorium the noise levels were within range. Sound levels in other areas of campus are largely due to the interactions of people on campus than any other causes like construction or traffic. 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 Table 9.



Level of noise in various locations and working place



**Measurement of Noise level at various places in
Loyola College of Education, Chennai, TN**

Table 8. Noise level at the Loyola College of Education

S. No	Locations	Measurements (dB)	Major Noise Sources	Remarks
1.	Library hall	20.3	Students and staff members	No Noise Pollution
2.	Auditorium	29.6	Students	No Noise Pollution
3.	Class Rooms	34.6	Students	No Noise Pollution
4.	Staff Rooms	28.2	Staff members	No Noise Pollution
5.	Parking area	52.3	Publics	No Noise Pollution

Table 9. Noise Level Standard Prescribed by Central Pollution Control Board, India Government

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

22.15. Auditing for Water Management at the Loyola College of Education

Water is a natural resource which is an essential element for all life organisms. It has been reported that on earth only 3% is of fresh water and two-thirds of the same is locked up as ice caps and glaciers. Of Out of remaining one percent, a fifth is available at remote areas and much seasonal rainfall and floods cannot easily be used. At present only about 0.08 percent of all the world's fresh water is exploited by mankind (in terms of sanitation, drinking, manufacturing, leisure and agriculture).

Water management (management of water resources under set policies and regulations) is important since it helps determine future irrigation expectations. Once water is an abundant natural resource and becoming a more valuable commodity due to droughts and over exploitation. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. At this juncture, it is time to use water wisely to ensure that drinkable water is available to all, at present and in the future.

22.15.1. Water Management Activities

In order to conserve water resources, it is essential that any environmentally responsible institution should examine its water use practices. Water auditing is conducted for the appraisal of facilities of raw water intake and determining the facilities for water treatment and reuse. Auditor concerned investigates the relevant method that can be adopted and implemented to balance the demand and supply of water. The college is taking enough attempt to manage wastewater that are coming out from various Department laboratories, hostels and canteens. In general, water management activities are very important in terms of conserving water and its resources for future generations which in turn useful to reduce the land contamination.



Water management activities at LCE, Chennai, TN

22.15.2. Role of Higher Education Institutions in Water Conservation

- Build unanimity on the need for water conservation within the campus (with students, administration, faculty and other internal stakeholders).
- Initiate unanimous water conservation measures in collaboration with nearby village residents, local administration/“Grama sabha” and internal/external stakeholder institutions (schools, self-help groups, health centres, and village panchayats).
- Facilitate strategic measures to become self-sufficient in water requirement and efficient water usage by adoption of suitable standards and accepted parameters.
- Facilitate specific methods for making the village as water sufficient and water efficient by following best available standards and accepted parameters
- Periodical monitoring of existing water management system in the campus with participation and transparency
- Development of a detailed guideline for conserving water on the campus and village
- Generate case studies on best water conservation practices adopted in the campus and in the villages. This can serve as models for other institutions and villages to adopt.
- The team that would be involved in all aspects of water management (exploring, surveying, fact-finding, recording, planning, taking action and monitoring) will also include all relevant stakeholders’ viz., citizens, student teams, their teachers, village leaders apart from administrative officials concerned in both campuses and villages.
- A couple of environmentally-concerned-inclined faculty members or village community leaders may be given the responsibility to lead the water conservation movement in the respective realms.
- Water Conservation Initiative can be a successful only if the Head of the Institution ignites the spirit of everybody in the organization. She/he needs to direct the departments, pay attention to the findings of student teams and ensure that their valuable suggestions are followed in letter and spirit by all students, faculty members as well as administrative, non-teaching and support staff.
- A motivated leader can bring a sea-change in the system and therefore she/he is the cornerstone of this campaign. An advisory committee may be constituted to guide the initiative on water conservation.

22.15.3. Physical Appearance and Overall Ambience on Water Conservation Water Conservation

Water Conservation strategies broadly rely on a) adequacy of water, b) elaborate plumbing facilities with adequate, suitable water taps and sanitary fixtures, c) establishing water use efficient toilets with two levels of flushing facilities, d) well organised water usage, e) dedicated staff for water management including inspection, f) periodic service/repairs/corrective measure of leaks in taps and pipes, g) improved sanitization for cleanliness, h) use of carbonated water, i) planting and maintenance of indigenous variety of plants and less water consuming plants, and j) organising water conservation workshops to the faculty and students and conducting awareness programme on water conservation for the benefit of public.



Rainwater Harvesting

Rainwater harvesting programme concerned with a) installation of rain gauge rain recording system (equipment), b) establishment of implements for rainwater harvesting within the campus, c) creating rainwater harvesting pits inside the campus and d) creating awareness on rainwater harvesting among the stakeholders and public through workshops and seminars.

Renovation of Traditional and other Water Bodies/Tanks

Renovation of Tanks and water bodies include a) groundwater recharge and maintenance of water balance, b) reuse and recharge structures and preservation of existing water bodies, c) watershed development and biomass management and finally d) adopting land and water management protocols.

Leakages

Leakage accounts a largest share of wastage of available water resource as well as unauthorized water use. Each source meter required to be tested for its accuracy, either by reviewing available meter test results or retesting the meter. System valves mandatorily reviewed periodically to detect malfunction. For instance, altitude control valves on storage tanks might be damaged or installed improperly, allowing the tank to overflow. These valves need periodic inspection, more so when there is observed leakage or overflow. Pressure relief valves set too low might cause spill when pressures reach the high range. These pressure relief valves need to be calibrated accordingly. When leakage problems are discovered during routine inspections, possible water losses need to be estimated and corrective action can be taken up immediately.



Proper Maintenance of Taps without any leakages in LCE Campus, Chennai , TN

Other Interventions

Other interferences are given attention on priority basis that include i) technological and sociological interventions, ii) planning, preparing and reporting mechanisms, iii) appropriate display, publicity and sharing of knowledge, iv) treating personnel/concerned staff with respect and considering their welfare, v) adhering to reporting mechanisms and vi) more importantly, monitoring and taking corrective measures with respect to water management by enthusiastic designated staff

22.15.4. Water Quantity Estimation

The quantity of water required for municipal uses for which the water supply scheme has to be designed which requires data on a) Water consumption rate (Per Capita Demand in litres per day per head) and b) Population to be served.

$$\text{Quantity} = \text{Per capita demand} \times \text{Human population}$$

22.15.5. Water Consumption Rate

Since several variables are influenced water consumption by various stakeholders of an organization, it is hard enough to precisely assess the water quantity demanded by the public. Water required by various set-ups, which a city may have, is listed hereunder (Table 10):

Table 10. Water consumption for various purposes at the LCE

S. No	Types of Consumption	Normal Range (lit/capita/day)	Average	Percentage
1.	Domestic Consumption at Hostel and Canteen	NA	NA	NA
2.	Industrial and Commercial Demand at Laboratories	NA	NA	NA
3.	Public Uses including Fire Demand, Transport washes	NA	NA	NA
4.	Losses and Waste as routine consumption	NA	NA	NA
5.	Daily use (Day-to-day use)	NA	NA	NA

22.15.6. Estimation of Water requirements for drinking and domestic use

(Source: National Building Code 2016 BIS)

As a general rule the following rates per capita per day may be considered for domestic and non-domestic needs. For Communities with population 20,000 to 1,00,000 together with flushing the per capita per day rates may be considered for domestic and non-domestic needs ranges from 100 to 135 lphd (Table 11).

Table 11. Water requirements calculation

S. No	Educational Institutions water requirements	Domestic use (lphd)	Flushing (lphd)	Total use (lphd)
1.	Without Boarding Facility	18	20	38
2.	With Boarding Facility	150	80	230

22.15.7. Fire Fighting Demand

The per capita fire protection demand is very less on an average basis but the quantum of water is required is very huge. The rate of fire demand is sometimes treated as a function of population and is worked out from following empirical formulae (Table 12):

Table 12. Per capita fire demand calculation

S. No	Authority	Formulae (P in thousand)	Q for 1 lakh Population)
1.	American Insurance Association	$Q \text{ (L/min)} = 4637 \sqrt{P(1-0.01 \sqrt{P})}$	41760
2.	Kuchling's Formula: per capita fire demand	$Q \text{ (L/min)} = 3182 \sqrt{P}$	31800
3.	Freeman's Formula: per capita fire demand	$Q \text{ (L/min)} = 1136.5(P/5+10)$	35050
4.	Ministry of Urban Development Manual Formula	$Q \text{ (kilo litres/d)} = 100 \sqrt{P}$ for $P > 50000$	31623

22.15.8. Factors affecting per capita demand of water consumption

As stated earlier, so many factors affecting the precise calculation of per capita demand of water consumption which include, a) Size of the city: Per capita demand for big cities is generally huge when compared to that of smaller towns where big cities have skewed houses. b) Existence of number of industries. c) Prevailing environmental conditions. d) Habits of people and their economic status. e) Quality of water plays an important role in water consumption rate. If water is aesthetically and medically safe, the consumption will increase as people will not resort to private wells, etc. f) Pressure in the distribution system. g) Efficiency of water works administration: Leaks in water mains and services; and unauthorized use of water can be kept to a minimum by surveys. h) Cost of water and i) Policy of metering and charging method: Water tax is charged in two different ways: on the basis of meter reading and on the basis of certain fixed monthly rate.

22.15.9. Fluctuations in Rate of Demand/consumption of water

- Average Daily per Capita Demand = Quantity Required in 12 Months/ (365 x Population); If this average demand is supplied at all the times, it will not be sufficient to meet the fluctuations.
- Seasonal variation: The demand peaks during summer. Firebreak outs are generally more in summer, increasing demand.
- Daily variation in water demand depends on human activities. People draw out more water on Sundays and Festival days, thus increasing demand on these days.
- Hourly variations in water demand is widely varied. During active household working hours i.e., from six to ten in the morning and four to eight in the evening, the bulk of the daily requirement is taken. During other hours the requirement is negligible.
- Adequate quantity of water must be available to meet the peak demand. To resolve all the fluctuation issues, the supply pipes, service reservoirs and distribution pipes must be properly proportioned. The water is supplied by pumping directly and the

pumps and distribution system must be designed to meet the peak demand. Effect of monthly variation impacts the design of storage reservoirs and hourly variations influences the design of pumps and service reservoirs. It may be noted that as the population decreases, the fluctuation rate increases.

Maximum daily demand = 1.8 x average daily demand

Maximum hourly demand of maximum day i.e., Peak demand

= 1.5 x average hourly demand

= 1.5 x Maximum daily demand/24

= 1.5 x (1.8 x average daily demand)/24

= 2.7 x average daily demand/24

= 2.7 x annual average hourly demand

22.16. Auditing for Waste Management

Waste management reduces the effect of waste in the environment and improves the ecological conditions, so on. Auditing for waste management can help in reuse/recycle resources, such as; paper, cans, glass, and so on. Pollution from waste is aesthetically unpleasing and results in large amounts of litter in the ecosystem which can cause health problems. The most important reason for audit for waste management is simply relies on environment protection and human health. Various type of waste management practices, from collection to disposal of solid, liquid, gaseous, or hazardous substances were illustrated in this report earlier (Section 22.2.). Particularly, information on waste management practices (Section, 22.2.1), biodegradable and non-biodegradable waste materials management (Section, 22.2.2.), disposal of e-waste (Section, 22.2.3.) and management of hazardous waste (Section, 22.2.5.) were detailed elaborately. It is needless to say production of waste to be minimised to ensure the sustainable environment of any organisation. In this connection, auditor diagnoses the prevailing waste management/collection to disposal policies and suggests the possible ways to combat the issues related with waste management for adoption.

22.17. Biomedical Waste

The Ministry of Environment, Forest and Climate Change, Government of India has issued the Bio-Medical Waste Management Rules, 2016. As per the rules, bio-medical waste represents any waste materials which is generated during diagnosis, treatment or immunization of human beings or animals besides research activities pertaining to the production or testing of biological or in health camps. The biomedical waste generator and the operator of the common bio-medical waste treatment and disposal facility (CBMWTF) shall be responsible for safe handling and disposal of the same. The State Government of Health shall ensure for implementation of the rule in all health care facilities. SPCB shall issue authorization to the health care facilities and CBMWTF. It shall monitor the compliance of various provisions of the rules. Central Pollution Control Board has so far authorized 25426 Private and Government hospitals in the State under the rules. Hospitals have made agreement with the CBMWTF for the collection, transport, treatment and scientific disposal of the biomedical waste. The CBMWTF consists of autoclave, shredder, incinerator and secured land fill facilities.



Health room with few Bio medical waste and proper disposal observed at Loyola College of Education, Chennai, Tamil Nadu

22.18. Climatic condition

Prevailing climatic conditions of the campus revealed that it experiences warm conditions almost most part of the year. Rise in day temperature starts after March and attains the peak during May where temperature maximum ranges between of 35 and 36°C with a daily record of 35°C. Mean minimum temperature ranges between 15 and 35°C (Table 13).

The Chennai District experienced the annual rainfall ranging between 650 and 1500 mm for the last two decades. Since the district located on the mountain pass, it experiences southwest monsoon from June to August. Southwest monsoon is irregular as the masses of clouds are intercepted only very little rains in September. After a warm, humid break in September, regular monsoon starts from October to; early November. Out of total rainfall, 25% received during southwest monsoon, 49% between October and November and remaining 21% during September.

Table 13. Soil edaphic and Environmental conditions of Loyola College of Education

S. No	Details of Parameters	Data collected
Soil Edaphic parameters		
1.	Soil pH	8
2.	Soil type	Alluvial, Clayey Soil
3.	Total Organic carbon	11%
4.	Electrical conductivity	8 dSm-1
5.	Water holding capacity	80%
6.	Total Nitrogen	8 ppm
7.	Available Phosphorous	7 ppm
8.	Exchangeable Potassium	3 ppm
9.	Available Mg and Mn contents	2.4, 2.2 ppm
10.	Available Zn and Fe contents	0.59, 2.9 ppm
Environmental parameters		
1.	Minimum Temperature	21°C
2.	Maximum Temperature	35°C
3.	Minimum Relative humidity	63%

4.	Maximum Relative humidity	80%
5.	Annual Average Rainfall	1014 mm/avg.year
6.	Annual Average Sunshine	7.5 hrs/day
7.	Wind speed	9 -12 miles/h

22.19. Safety measures and green building conservation code

Environmental safety measures are very important in college buildings as far as students, staff members and other stakeholders are concerned and it requires vigilance and awareness. Colleges and Universities work to foster safe environments; however, students honestly share equal responsibility. College/university Management should extend by issuing noble guidance and the best safety tools. The organization should have a police force, escort services, call boxes, first aid box, fire extinguishers, fire alarms, security systems and staffs towards the safety measures. College has very good safety measures as per the green building conservation code such as fire extinguisher and fire bell and alarms in all the place. In addition, in all the place, 'Exit', 'Entry' and other sign boards kept across the place to give cent percent safety to the stakeholder



Safety measures and Sign Boards in LCE, Chennai, TN.

2.20. Implementing Swachh Bharath Abhiyan Scheme under Clean India Mission

Swachh Bharath Abhiyan under Clean India Mission is the new initiative and a step towards sanitation, solid waste management and cleanliness to promote cleanliness across India. It is the country-wide campaign applied on a large scale in India for both the rural and urban place, producing needs for the bathrooms and providing hygienic atmosphere amongst the population by household members was the main purpose of this. This scheme is implemented by the Educational Institutions covering



Universities, Colleges and Schools, Government Departments, Companies and Public sectors across the country to give a safe pollution free environment, eliminate the open defecation, improve solid waste management and sanitation and refining drinking water quality to the stakeholders. The initiative is easily attainable by the support of Government employees, management representatives, staff members and students.



The students of Loyola College of Education conduct more awareness programmes on cleanliness, ill-effects of use of plastics, solid waste management and sanitation and importance of environment to the rural people, through NSS and Students Force units. The students collected and disposed of the wastes in the trash by using eco-friendly covers. They created awareness among the rural and urban people to keep the surroundings clean and hygiene. A sizable number of programmes and rallies are conducted periodically during the celebration of various events such as 'Independence Day', 'Republic Day', 'World Environmental Day' and 'Biodiversity Conservation Day' events. Professional implementation of all the Eco plans in the campus should be done through the Eco clubs, Nature clubs, Science clubs, Youth Red cross units, Fine Arts clubs, Women cell, Associations, Forums, SSL, NCC (National Cadet Corps) otherwise known as Students Force (SF) units and NSS (National Service Scheme) units. All the students, members of staff and employers should be mandatory members of the club and should do tree planting and maintenance of greenery in the campus periodically. Conducting frequent seminars, conferences, workshops, awareness rallies, etc. on topics relevant to the environment is necessary to educate and create awareness among the students and staff members.

In addition, student's associations, cells, clubs and forums should be the first-hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus. LCE has well developed NSS, Swachh Bharath Abhiyan under Clean India Mission. These bodies are actively involved in tree planting programmes and cleaning the surrounding areas of tribal, rural and urban people across Chennai. The Campus is conducting a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people. Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner. Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain.

Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses. The College has taken sufficient attempts to disseminate the green campus motto and green pledge as well as awareness programmes such as 'Don't cut trees', 'Don't use plastic bags', 'Don't waste waters', 'Plastic Free Zones' and 'Preserve the Natural Resources' etc. among the students and staff members in the campus. College is implemented the Government schemes (Swachh Bharath

Abhiyan under Clean India Mission) to provide pure and safe water to and teach the importance of cleanliness of toilets and restrooms to rural people living in nearby hills. These activities are very important in view of the immediate vicinity to undertake all developmental activities and conduct Participatory rural appraisal programmes which is associated with socioeconomic status of the inhabitants living nearby hills, natural resources, traditional knowledge systems, cropping patterns, etc. The College is also converging interest on the progressive development of women, youth, children and in particular, “dalits” and to identify the extension and training needs of the target group through the Department of Women Studies and Career Guidance.

The College provides the vocational training on (goat farming, mushroom cultivation, vermicomposting, bee keeping, ornamental fisheries, organic farming and medicinal plant cultivation) to marginal farmers in order to overcome seasonal employment the problem. The Campus helps to cultivate social commitment and to expose the students to get exposure to the social realities and to build a relation between student community and the other communities which in turn facilitate social interaction, inter-personal communication skills and develop emotional maturity of students. The College also supports the students to improve their personality. On the whole, the Institution accelerates the activity of preparing the students to face emerging tasks by developing qualities such as cooperation, team spirit, leadership, discipline and development of creative talents including to boost their self-confidence.

Conducted Eye Donation Awareness Camp at LCE Campus





23. Best Practices on Environment Audit Initiatives followed in the Organization

1. 'Eco Club' and 'Nature Club' along with NSS Units are functioning well and conducting a large number of awareness programmes related to nature conservation and environmental protection.
2. It is observed that the Organization is created massive facilities for solid waste management and wastewater treatment to purify the wastewaters using activated-sludge to manage both solid wastes and wastewaters effectively without harming the environment.
3. The dust bins and eco-friendly trashes are kept in different place across the campus to provide a dust free atmosphere to the stakeholders which are labelled properly for the indication of degradable and non-degradable items.
4. There is a Reverse Osmosis (RO) water unit to produce RO water which is periodically tested for the physio-chemical properties and all water parameters with water quality analysis meter designed by Loyola College of Education.
5. The management has created a very good campus ecosystem for making a coexisting and sustainable environment which includes natural and planted vegetation supporting a rich biodiversity of flora and fauna.
6. A well-established Rainwater harvesting system s to recharge ground water status by collecting rainwaters from the campus coinciding with the contour of the terrain and natural drains.
7. Swachh Bharath Abhiyan and National service schemes are implemented effectively towards sanitation, solid waste management and refining drinking water quality to promote cleanliness to rural and tribal people across the Chennai district.

8. In addition to Natural Ventilation and Exhaust fans are made available in all buildings to replace 'stale' air with 'fresh' air which helps to create favourable microclimate during the occupied periods.
9. The carbon footprint with respect to the concentration of CO₂ in the atmosphere is found to be low which did not exceed the critical limit of CO₂ coinciding with pure air circulation without any contaminants in the campus.
10. To ensure Miyawaki Forest system, one student one plant concern to enrich the campus Green which provide an eco-friendly campus to the stakeholders.

24. Recommendations for sustainable environment

- A proper step may be taken to minimize the environmental degradation by means of developing 'Sanitation and hygiene policy', 'Water conservation policy', 'Waste management policy' and 'Green campus and Environment policy' in collaboration with Governmental and Non-Governmental Organizations.
- Helpline numbers for waste collection may be made available in the Campus which may be useful for door-to-door collection of wastes thus avoiding improper disposal by individuals.
- The concept of eco-friendly culture and sensitize the students to minimize the use of plastics, non-biodegradable materials and exploitation of natural resources which pose the environmental hazards may be carried out.
- Policy on paper usage may be initiated with certain guidelines to reduce the number of papers that are being used by the students for assignments, mini-projects and final year projects which in turn to reduce 60% usage of paper as a commitment to curb the environmental damage.
- Waste disposal management for both dry and wet wastes should be proper in which from collection to disposal of the waste, together with monitoring and regulation of the same may be undertaken.
- Attempts may be made to segregate the wastes and to convert organic wastes into fertilizing material through recycling and composting processes which may be used for vegetation purpose.
- Students may be taken to some industrial areas including the waste management sites to teach about the recycling of wastewaters, solid wastes, natural ecosystem, pollution-free environment and environmental education.
- The College is providing bicycle for campus students to maintain eco-friendly atmosphere in the campus and to reduce carbon-di-oxide.

25. Conclusion

Loyola College of Education, Chennai, Tamil Nadu is a well-established College in India in terms of academic activities, efforts are continuously made in providing an eco-friendly atmosphere to the students, research scholars, parents and staff

members. The environmental protection initiatives are substantial by means of creating solid waste management, wastewater treatment, sanitation, rainwater harvesting system and natural vegetation in the Campus without harming the environment. Campus has 'solid waste management and wastewater treatment facility to recycle the solid wastes and wastewaters; respectively. The Campus has some Technology Missions related to Green Campus and Environment sustainability as well. A campus ecosystem is supported a rich biodiversity of flora and fauna which is making a sustainable environment and eco-friendly campus. Swachh Bharath Abhiyan is implemented effectively by the campus to promote sanitation and cleanliness to the rural/tribal people across the Chennai District, Tamil Nadu. Environmental audit is carried out to provide an indication to company management about how the environmental Organization system and equipment's are performing. As a result, the best practicable means can be applied to preserve air, water, soil, plant and animal life from the adverse effect.

To conclude an environment audit report, the College is an eco-friendly campus and providing pure atmosphere to the stakeholders and supports the nation as a whole in future generations. Further, we hope this will boost the new generation to take care of the environment and propagate these views for many generations to come by the Organization.

26. Acknowledgement

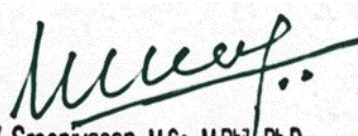
Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Principal, PRO and Management Committee members and IQAC Coordinator of Loyola College of Education, Chennai, Tamil Nadu for providing us necessary facilities and cooperation during the conduct of Environment Audit. This helped us in making the audit a magnificent success.


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 Chairman
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 No. 2669, LIG-II, Gandhi Managar,
 Peelamedu, Coimbatore - 641 004,
 Tamil Nadu, India.


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 Joint Director
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 Peelamedu, Coimbatore - 641 004
 Tamil Nadu, India.

**Certificates of
NATURE SCIENCE FOUNDATION
Coimbatore, Tamil Nadu.**

1. ISO Certificate (QMS 9001:2015)
2. ISO Certificate (EMS 14001:2015)
3. ISO Certificate (OHSMS 45001:2018)
4. ISO Certificate (EnMS 50001:2018)
5. MSME Certificate
6. NGO Darpan NITI Aayog Certificate
7. 12A Certificate
8. 80G Certificate
8. 10AC Certificate

Certificate of Registration



This is to Certify That The Quality Management System of



NATURE SCIENCE FOUNDATION

LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641004, TAMILNADU, INDIA.

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

PROVIDING ENVIRONMENT, ENERGY, GREEN AND HYGIENE AUDITS
TO ACADEMIC INSTITUTIONS AND ORGANISATIONS
AS PER THE OWN CHECKLIST AND AWARDS TO
MERITORIOUS CANDIDATES.

Certificate No	20DQHY90	Issuance Date	: 08/01/2021
Initial Registration Date	: 08/01/2021	Date of Expiry*	: 07/01/2024
1st Surve. Due	: 08/12/2021	2nd Surve. Due	: 08/12/2022

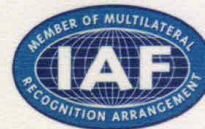
DIRECTOR

ROHS Certification Pvt. Ltd.

408, Madhuban Building, 55, Nefru Place, New Delhi - 110 019, India

phone : +91.11.41525522 | e-mail : info@rohscertification.co.in | website : www.rohscertification.co.in

The Registration is not a Product Quality Certificate, *Subject to successful completion of surveillance audits, Visit for verification on www.rohscertification.co.in
Certificate is the property of ROHS and return when demanded



Certificate of Registration



This is to Certify That The Environmental Management System of



NATURE SCIENCE FOUNDATION

LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,
TAMILNADU, INDIA.

has been assessed and found to conform to the requirements of

ISO 14001:2015

for the following scope :

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

Certificate No	22DEJI67	Issuance Date	: 21/05/2022
Initial Registration Date	: 21/05/2022	Date of Expiry*	: 20/05/2025
1st Surve. Due	: 21/04/2023	2nd Surve. Due	: 21/04/2024



[Signature]
DIRECTOR

ROHS Certification Pvt. Ltd.

D-7, 1st Floor, Sector-2, Noida, Gautam Buddha Nagar, UP-201301

e-mail : info@rohs-certification.com | web-site : www.rohs-certification.com

The registration is not a Product Quality Certificate. *Subject to successful completion of surveillance audits. Valid for registration as per ISO 14001:2015 and scope when demanded.



CB-EMS-035



QCS MANAGEMENT PVT. LTD.
MANAGEMENT SYSTEMS CERTIFICATION

Certificate of Registration

ISO 45001:2018 (Occupational Health & Safety Management System)

NATURE SCIENCE FOUNDATION

ADDRESS: NO. 2669, LIG-II, GANDHI MANAGAR PEELAMEDU COIMBATORE - 641 004 TAMIL NADU, INDIA.

Scope of Certification:

PROVIDING TRAINING AND AUDITING SERVICES IN THE FIELD OF GREEN CAMPUS, ENVIRONMENT, ENERGY, OCCUPATIONAL HEALTH AND SAFETY, HYGIENE AND WASTE MANAGEMENT AT EDUCATIONAL INSTITUTES AND INDUSTRIAL SECTOR.

Certificate Number : QCS/EUAS/OHS/002

Issue Date	: 03/08/2022	1 ST Surveillance Audit Within	: 02/07/2023
Expiration Date	: 02/08/2023	2 ND Surveillance Audit Within	: 02/07/2024
		Re-certification Due Date	: 02/08/2025



Partha Bagchi
(Managing Director)

Validity of this Certificate is subject to Surveillance Audits to be conducted before scheduled due dates of surveillance audits as mentioned on the certificate, failing which the certificate will stand to be withdrawn and need to be treated as an initial certification process to reactivate its continuity on the register of EUAS and QCS. This Certificate is valid when confirmed by data listed on the (Euro Universal Accreditation Systems) EUAS" www.euas-ac.org. The authenticity & validity of this certificate may be re-affirmed by referring to our company website - www.qcspl.com. Lack of fulfillment of conditions as set out on the 'Certification Contract' (Annex 13) may render this certificate invalid. Any alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of law. This certificate remains the property of QCS and to be returned on request.

REGISTERED OFFICE: 37E/1(310) 2ND STREET, MODERN PARK, GREENAGE APARTMENT - 2ND FLOOR,
SANTOSH PUR, KOLKATA - 700075, WEST BENGAL, INDIA.
Email: info@qcspl.com, Call: +91 8697724963, +91 8902447427. Website: www.qcspl.com



Certificate of Registration

This is to certify that

NATURE SCIENCE FOUNDATION

**LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,
TAMILNADU, INDIA.**

has been independently assessed by QRO
and is compliant with the requirement of:

ISO 5001:2018

Energy Management Systems

For the following scope of activities:

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

Date of Certification: 9th August 2022

2nd Surveillance Audit Due: 8th August 2024

1st Surveillance Audit Due: 8th August 2023

Certificate Expiry: 8th August 2025

Certificate Number: 305022080903EN



Chunant...

Head of Certification

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit.

(In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at www.qrocet.org

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : www.qrocet.org, E-mail : info@qrocet.org

UDYAM REGISTRATION NUMBER		UDYAM-TN-03-0073706				
NAME OF ENTERPRISE		M/S NATURE SCIENCE FOUNDATION				
TYPE OF ENTERPRISE *		MICRO				
MAJOR ACTIVITY		SERVICES				
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL				
NAME OF UNIT(S)		S.No. Name of Unit(s) 1 Green Campus, Energy and Environment Management Audits				
OFFICIAL ADDRESS OF ENTERPRISE		Flat/Door/Block No.	LIG-II,2669	Name of Premises/ Building	GANDHIMAA NAGAR	
		Village/Town	Gandhimaanagar S.O	Block	LIG-II	
		Road/Street/Lane	Peelamedu	City	Coimbatore South	
		State	TAMIL NADU	District	COIMBATORE , Pin 641004	
		Mobile	9566777255	Email:	chairmansnf@gmail.com	
DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE		28/11/2017				
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS		12/03/2020				
NATIONAL INDUSTRY CLASSIFICATION CODE(S)		S.No.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity
		1	69 - Legal and accounting activities	6920 - Accounting, bookkeeping and auditing activities; tax consultancy	69201 - Accounting, bookkeeping and auditing activities	Services
		2	85 - Education	8542 - Cultural education	85420 - Cultural education	Services
		3	85 - Education	8549 - Other education n.e.c.	85499 - Other educational services n.e.c.	Services
DATE OF UDYAM REGISTRATION		26/02/2022				

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the Mo MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from <https://udyamregistration.gov.in> & Date of printing:- 26/02/2022

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)

2. MSME-DI: CHENNAI (TAMIL NADU)

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NGO DARPAN

In order to strengthen services of the portal, Government has decided to make PAN Number of VOs/NGOs mandatory.

Please Update Your Profile

Welcome, Nature Science Foundation

Your Unique Id: TN/2018/0187711



PROCEEDINGS OF THE COMMISSIONER OF INCOMETAX (EXEMPTIONS),
III FLOOR, ANNEXE BLDG, NO.121, MAHATMA GANDHI SALAI, CHENNAI-34

Present : G.M.DOSS, I.R.S
Commissioner of Income Tax (Exemptions)

** URNo. AACTN7857J/05/18-19/T-1105

Dated:03/09/2018

Sub. Registration u/s. 12AA of the Income tax Act 1961 - in the case of

"Nature Science Foundation"
LIG-II, 2669, Gandhimaa Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 28/03/2018

ORDER UNDER SECTION 12AA OF THE INCOME TAX ACT 1961.

1. The above Trust/Society/Association/Company/others, bearing PAN AACTN7857J was constituted by Trust Deed / Memorandum of Association dated 29/11/2017 registered with Sub-Registrar's Office/Registrar of Societies/Registrar of Companies/others on 29/11/2017.

2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~

3. The above TRUST filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.

4. On going through the objects of the TRUST and its proposed activities as enumerated in the Trust Deed / Memorandum of Association, I am satisfied about the genuineness of the TRUST as on date.

5. The application has been entered at Sl.No.1105 maintained in this office. The above Trust is accordingly registered as a PUBLIC CHARITABLE TRUST u/s 12 AA of the Income Tax Act, 1961 with effect from 29/11/2017.

6. It is hereby clarified that the Registration so given to the Trust/Institution is not absolute. Subsequently, if it is found that the activities of the Trust/Institution are not genuine or are not being carried out in accordance with the objects and clauses of the Trust Deed / Memorandum of Association submitted at the time of registration or modified with the approval of the Commissioner of Income-tax (Exemptions), Chennai or there is a violation of the provisions of Section - 13, the Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the Trust/Society/Association/Company/Others complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961.

7. Granting of Registration u/s 12AA does not confer any automatic exemption of income from taxation. The Trust/Institution should conform to the parameters laid down in Sections 11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.

** This Unique Registration No. URNo. AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income-tax(Exemptions), Chennai.

Copy to:

1. The Assessee.
2. The ACIT(Exemptions), Coimbatore Circle.
3. Office Copy.

//CERTIFIED TRUE COPY//

(N SRINIVASA RAO)
Asst. Commissioner of Income-tax (H.Qrs)(Exemptions),
Chennai.



GOVERNMENT OF INDIA
INCOMETAX DEPARTMENT
OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
Aayakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URNNo. AACTN7857J/05/18-19/T-1105/80G

Date: 10.04.2019

Name of the Trust-/Society /Company/Institution : NATURE SCIENCE FOUNDATION
Address : LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004
PAN : AACTN7857J
Date of Application : 12.11.2018

Received
Rajy S. Ramesh
17/07/2019

APPROVAL UNDER SECTION 80G(5)(vi) OF THE INCOME TAX ACT, 1961

The aforesaid Trust-/Society/Company/Institution has been registered u/s.12AA of the Income Tax Act with effect from 29.11.2017 vide AACTN7857J/05/18-19/T-1105 dated 03.09.2018. It is certified that donation made to NATURE SCIENCE FOUNDATION at LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004 shall qualify for deduction u/s 80G(5)(vi) of the Income Tax Act, 1961, subject to the fulfillment of conditions laid down in clauses [i] to [v] of sub-section (5) of section 80G of the I.T Act, 1961.

2. This approval shall be valid in perpetuity with effect from **A.Y. 2019-20** unless specifically withdrawn. **The details and validity of the certificate is available @ office.incometaxindia.gov.in**
3. The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually to the Assessing Officer having jurisdiction over the case.
4. No change in the Trust Deed/Memorandum-of-Association shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai.**
5. Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. **URNNo. AACTN7857J/05/18-19/T-1105/80G** and date of this order i.e. **10.04.2019.**
6. Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.



Sd/-
(G.M.DOSS, I.R.5)
Commissioner of Income Tax (Exemptions)
Chennai.

Copy to:

1. The applicant
2. Guard File
3. The DCIT(Exemptions) Coimbatore Circle.

//Certified True Copy//

(Signature)
(N. SRINIVASA RAO)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

FORM NO. 10AC

(See rule 17A/11AA/2C)

Order for registration

1	PAN	AACTN7857J
2	Name	NATURE SCIENCE FOUNDATION
2a	Address	
	Flat/Door/Building	LIG-II, 2669
	Name of premises/Building/Village	GANDHIMAA NAGAR
	Road/Street/Post Office	Coimbatore South
	Area/Locality	COIMBATORE
	Town/City/District	Gandhimaanagar S.O
	State	Tamil Nadu
	Country	INDIA
	Pin Code/Zip Code	641004
3	Document Identification Number	AACTN7857JE2021501
4	Application Number	739995830271021
5	Unique Registration Number	AACTN7857JE20215
6	Section/sub-section/clause/sub-clause/proviso in which registration is being granted	01-Sub clause (i) of clause (ac) of sub -section (1) of section 12A
7	Date of registration	03-11-2021
8	Assessment year or years for which the trust or institution is registered	From AY 2022-23 to AY 2026-2027
9	Order for registration:	
	a. After considering the application of the applicant and the material available on record, the applicant is hereby granted registration with effect from the assessment year mentioned at serial no 8 above subject to the conditions mentioned in row number 10.	
	b. The taxability, or otherwise, of the income of the applicant would be separately considered as per the provisions of the Income Tax Act, 1961.	
	c. This order is liable to be withdrawn by the prescribed authority if it is subsequently found that the activities of the applicant are not genuine or if they are not carried out in accordance with all or any of the conditions subject to which it is granted, if it is found that the applicant has obtained the registration by fraud or misrepresentation of facts or it is found that the assessee has violated any condition prescribed in the Income Tax Act, 1961.	
10	Conditions subject to which registration is being granted	
	The registration is granted subject to the following conditions:-	

<p>o. This certificate cannot be used as a basis for claiming non-deduction of tax at source in respect of investments etc. relating to the Trust/ Institution.</p>	
<p>p. All the Public Money so received including for Corpus or any contribution shall be routed through a Bank Account whose number shall be communicated to Office of the Jurisdictional Commissioner of Income Tax.</p>	
<p>q. The applicant shall comply with the provisions of the Income Tax Act, 1961 read with the Income Tax Rules, 1962.</p>	
<p>r. The registration and the Unique registration number has been instantly granted and if, at any point of time, it is noticed that form for registration has not been duly filled in by not providing, fully or partly, or by providing false or incorrect information or documents required to be provided under sub-rule (1) or (2) of rule 17A or by not complying with the requirements of sub-rule (3) or (4) of the said rule, the registration and Unique Registration Number (URN), shall be cancelled and the registration and URN shall be deemed to have never been granted or issued.</p>	
<p>Name and Designation of the Registration Granting Authority</p>	<p>Principal Commissioner of Income Tax/ Commissioner of Income Tax (Digitally signed)</p>



Certificates of Environment Auditors

1. ISO Environment Management System (14001:2015) of Dr. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai.
5. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dineshkumar, Energy and Environment Auditor of NSF.
6. Tamil Nadu Fire and Rescue Service Certificate of Er. S. Srinivash, Energy Auditors of NSF.



Certificate of Training

TNV hereby certifies that

S. Rajalakshmi

has successfully completed the 5 days

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

ISO 14001:2015

Issue Date: 17th Jun. 2021

Training Date : 20th to 24th May. 2021

Certificate Number : 2106170721010105

Authorised Signatory
(Pragyaesh Singh)

This course is certified by Exemplar Global vide registration number TN006663

Note: The course conforms to the principles and practice of standards Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For certification of new candidate, please write to Mail: info@isoindia.com



**PR315: ISO 14001:2015 Lead Auditor
(Environmental Management Systems)
Training course**

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

A handwritten signature in black ink, appearing to be "G. Alagarsamy".

for TÜV NORD CERT GmbH

Essen, 2019-04-26

The course is certified by CQI and IRCA (Certification No. 18125). The learner meets the training requirements for those seeking certification under the IRCA EMS Auditor certification scheme.

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com









BUREAU OF ENERGY EFFICIENCY



Examination Registration No. : **EA-14056** Serial Number **9176**

Certificate Registration No. : **9176**

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. **Dinesh Kumar D** Son/Daughter of Mr./Mrs. **R M Dhanasekaran** who has passed the National Examination for certification of energy manager held in the month of **October 2011** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number **9176** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. **Dinesh Kumar D** is deemed to have qualified for appointment or designation as energy manager under clause (j) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this **7th** day of **February, 2013**

Secretary
Bureau of Energy Efficiency
New Delhi

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

Regn. No. EA-7391  Certificate No. 5093

National Productivity Council
(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. N. Balasubramaniam
son / daughter of Mr. M. Nanjukuttigounder
has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.


He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India
Date : 11th February 2010


Controller of Examination

 ENERGY IS LIFE
CONSERVE IT

ऊर्जा दक्षता ब्यूरो
BUREAU OF ENERGY EFFICIENCY
विद्युत मंत्रालय, भारत सरकार
MINISTRY OF POWER, GOVERNMENT OF INDIA

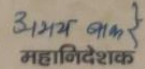
प्रमाणित किया जाता है कि

श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक एम्पनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।

This is to certify that

Shri/Smt. Dinesh Kumar has successfully completed the Master Trainer Certificate Programme conducted by MNIT / CEPT / IIIT from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 07 JUL 2017
New Delhi, _____


महाविदेशक
Director General



TECHNICAL REPORT OF GREEN CAMPUS AUDIT



Submitted to

**LOYOLA COLLEGE OF EDUCATION
LOYOLA COLLEGE CAMPUS, NUNGAMBAKKAM,
CHENNAI - 600 034, TAMIL NADU, INDIA**

Date of Audit: 31.01.2023

Valid till: 01.02.2025

Submitted by



NATURE SCIENCE FOUNDATION

*(A Unique Research and Development Centre for Society Improvement)
[ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) &
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1. Introduction

Green campus is an area of the Organisation or the Organisation as a whole itself contributing to have an infrastructure or development that is structured/planned to incur less energy, less water, less or no CO₂ emission and less or pollution free environment (Aparajita, 1995). Green Campus Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green campus audit constitutes the environmental friendly practices and education combined to promote sustenance of green environment adopting user-friendly technology within the campus. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs (APHA, 2017). It strengthen the concept of “Green building” and “Oxygenated building” which in turn provides a healthy atmosphere to the stakeholders.

Green Campus Audit ensures the Organization’s campus should be greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilisation and maintenance of natural topography and vegetation (Gowri and Harikrishnan, 2014, Aruninta *et al.*, 2017). The maintenance of an eco-friendly campus ensures a neat and clean environment. For the benefit of stakeholders, solid waste management, recycling of water, disposal of sewage and waste materials (electronic and biomedical wastes), ‘zero’ use of plastics, etc. should be followed consistently in the organization campus.

Green Campus Audit procedures includes the definition of green audit, methodology on how to conduct Green audit at Educational Institutions and Industrial sectors as per the checklist of Environment Management Systems and International Standards on ISO 14001:2015, Indian Green Building Council, Swachh Bharath Scheme under Clean India Mission to understand the principles and importance of various audits in the context of the organization and risk assessment at 360° views. Green campus audit helps the educational institutions/ industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings (Arora, 2017).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation’s growth and development which starts from maintenance of green campus without harming the environment. A clean and healthy environment in an Organization determine effective learning skills and offers a conducive learning environment to the students. Educational institutions are insisted by both Central and State Governments to offer eco-friendly atmosphere to the stakeholders. In addition, all the Educational institutions are asked to save the environment for future generations and to resolve the environmental problems (accumulating solid wastes and wastewaters/effluents and their careless disposal, enormous utility of plastics, uneconomical consumption of water, irresponsible in water harvesting and storage procedures, etc.) through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government thro’ the Educational institutions plays a major role in terms of giving neat and clean

environment to tribal, rural and urban people across the country, besides the regular and conventional activities carried out by NSS, NCC/Student Force, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, Youth Red cross unit, etc. Seminar, Conference, Workshop, training and awareness programmes on Biodiversity conservation education, environmental awareness programmes, etc. may be conducted periodically by the Management and Administrative people of an Organization to the stakeholders.

Green campus auditing is a systematic method whereby an organization's environmental performance is checked against its environmental strategies and compliances of the Government guidelines (Ribeiro *et al.*, 2017). This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including Management people. It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report. The green campus audit processes are being undertaken by World / Indian Green Building Council (IGBC), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Consideration of Indian Industry GreenCo Rating System (CII-GreenCo) and Associated Chambers of Commerce and Industry of India (ASSOCHAM) along with ISO EMS 14001:2015 criteria and the concept of Swachh Bharath Abhiyan under Clean India Mission.

3. Green Campus and Environment Policy

Green campus and environment policy aims to provide an education and awareness in a clean and green environment to the stakeholders with regard to environmental compliance. Scope of the policy applies to all employees and students of the Institution/organisation to provide an ecofriendly atmosphere. Green Campus Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes/pollutants (National Environmental Policy, 2006). The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes (Satean, 2017). Attempts are made to minimise the energy usage and substitute the non-renewable energy sources with renewable energy sources. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "Go Green" initiatives of the College/University and maintain a clean/green campus while each and every individual of the organisation should adhere to the policy.

4. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good drinking water facility to all the stakeholders (students and staff members). Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration/awareness programme on establishing plastic-free environment and

utility of organic alternatives for all incoming and current students, staff and faculty should be organised. Reduction of use of papers alternated with e-services, e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

5. Aims and Objectives of Green Campus Audit

- To recognise the initiatives taken towards establishing the green campus in terms of gardening.
- To grow a large number of oxygen releasing and carbon dioxide assimilating plants in the campus to give a pure atmosphere to the stakeholders.
- To identify and provide baseline information to assess threat and risk to the ecosystem due to Organization development.
- To recognise and resolve different environmental threats of the Organization.
- To ensure proper utilization of resources available in the surrounding areas towards future prosperity of the humanity.
- To fix a couple of norms for disposal of all varieties of wastes and use green cover as a carbon sink for pollution free air.
- To assess the greenish nature of an Organization campus in terms of trees, herbs, shrubs, climbers, twins, lianas, lawns and reflected in reducing the environmental pollution soil erosion, biodiversity conservation, landscape management, natural topography and vegetation.

6. Importance of Green Auditing

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage/follow all types of green activities. They should promote all kinds of green activities such as conduct of environment awareness programmes, in-campus farming, planting trees and maintenance of greening, irrigation, use of biofertilizers and avoidance of chemical fertilizers and agrochemicals, etc., prior to and after the green campus auditing (Suwartha and Sari, 2013). The administrative authorities should formulate 'Green and Environment Policies' based on technical report of green campus auditing. A clean and healthy environment will enhance an effective teaching/learning process and creates a favorable learning green environment to the scholars. They should create the awareness on the importance of greenish initiatives through environmental education among the student members and research scholars. Green Audit is the most effective, ecological approach to manage environmental complications.

Green campus audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. Green campus audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting a huge number of trees which is a duty of each and every individual who are the part of economical, financial, social, and environmental factors. It is necessary to conduct green audit frequently at least once in three years in campus because students and staff members should aware of the green audit and its beneficial effects in order to save planet by means of 'Go green concept' which in turn support the institution to set environmental models ('icon') for the community. Green audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can also be used to implement the alleviation measures at win-win situation for the

stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

7. Benefits of the Green Auditing

There are several benefits on conduct of green audit by the Organization which may be definitely useful to improve the campus significantly based on the audit report. The green campus audit contained methodology followed and both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in the campus. The natural and planted vegetation and their maintenance are also considered in the organization campus through topography, landscape management design and soil erosion control in environment sustainable development. The following are the major benefits of the green auditing.

- Know the status of development of internal and external Green campus audit procedures and implementation scenario in the Organization.
- Establishment of Green campus objectives and targets as on today as per the ‘Green and Environment Policy’, ‘Indian Biodiversity Act’ and ‘Wildlife Protection Act’ of the Ministry of Environment, Forests and Climate Change, New Delhi and World & Indian Green Building Council concepts in accordance with prevailing rules issued by the government/local authorities
- Assigning the roles and responsibilities to the Environmental Engineer and Agriculture Staff who are all responsible to improve green initiatives.
- Development of ownership, personal and social responsibility for the Organization and its environment and developing an environmental ethic and value systems to young generations.
- Enhancement of the Organization profile and reach the global standards in proving the green campus and eco-friendly atmosphere to the stakeholders
- Suggested of availability of Biogas plant to the management to restrict the usage of fossil fuel in cooking purposes.
- Implementing status of the rain harvesting system, water reservoirs, percolation pond, etc. in the campus to increase the ground water level.
- Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc. for enhancing teaching and learning and commercial exploitation.
- Treated water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use and etc. on water consumption and per capita water consumption per day calculation.
- Studying the campus flora by making a complete data on total number of both terrestrial and aquatic plants, herbs, shrubs, climbers, twins and grasses.
- Survey of campus fauna by conducting the number living and visiting animals, insects, flies, moths and worms in the campus.
- Documentation of the number of oxygen releasing and carbon dioxide assimilating plants planted in the campus to give pure atmosphere to the stakeholders.
- Operation of water irrigation, drip and sprinkler irrigation methods to improve the green campus.
- Studying the biodiversity conservation through Life Sciences and Biological Sciences people to conserve economically important, rare and endangered plant and animal species in the campus ecosystem.

- recommendation in use of biofertilizers, organic and green manures, cow dung manures and farmyard manures for the cultivation of plants to protect the environmental health
- Conduct of outreach programmes for dissemination of Green Campus motto and Green pledge initiatives to rural, tribal and urban people through Eco club, Nature club, Science club, Fine Arts club, Youth Red Cross unit, NCC/Student Force and NSS bodies.
- Academic credentials like major and minor Projects, Dissertations and Thesis work on green campus, environment protection and nature conservation by the students and staff members.
- The plants available in the campus must be tagged with their common name and Botanical name for the stakeholders to impart the knowledge on medicinal and ornamental, economic and food values of plant varieties.
- MoU may be signed with Government and non-Governmental Organizations (NGOs) to utilize the resources for nature conservation and environmental protection.
- Implementation of Government schemes (Swatch Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms.
- Conduction of awareness programmes and cultural activities on global warming, environmental changes and ecosystem maintenance to the stakeholders.
- Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods.
- Public transport, low-emitting vehicles and control of car smokes and exhaust towards carbon accumulation in the campus by carbon footprint studies.
- Implementation of advanced methods for watering plantations (Drip irrigation, Sprinkler irrigation, etc.) and use of metering for water utility, IoT based watering, automation, water device, remote water lines, etc.
- Percentage of Organization's budget for environment sustainability efforts and green campus initiatives planning and efforts.
- Campus facilities for disabled, special needs and/or maternity care including security, safety and health infrastructure facilities for stakeholder's wellbeing.
- High degree of resource management offers the basis for improved sustainable and creation of plastic free campus to evolve health consciousness among the stakeholders.
- Impart of knowledge on environment through systematic management approach and improving environmentally friendly standards by creating a benchmark for environmental protection initiatives
- Best practices followed on green campus initiatives in the Organization listed and disseminated among the stakeholders.
- Recommendations for improving the green initiatives, planning and efforts in the campus after audit report to improve further.

8. About the Organization

8.1 Loyola College of Education (LCE)

Loyola College of Education, a Jesuit Teacher Education Institution was established in June 2007. It is completely owned and administered by the Loyola College Society registered under the Society Registration Act of 1860 No.5228/1973. It is located in the wide campus of Loyola College of Arts & Science. It is recognized by National Council for Teacher Education (NCTE) and affiliated to Tamil Nadu Teachers Education University (TNTEU). It is accredited at `A` grade with CGPA – 3.79 by NAAC (National Assessment and Accreditation Council) in the 1st cycle which is the highest among the colleges of education in India. In the second cycle it was re-accredited at `A` grade with CGPA–3.48 by NAAC.

The sole aim of Jesuit education is to form compassionate, committed, competent, conscientious and creative men and women for others. The mission of the Jesuits is crystallized in their preferential option for a large number of Catholics, Dalit Catholics, first generation learners, orphans, semi-orphans, differently-abled students, neighbourhood children, refugees, migrants, gypsy children and economically poor and vulnerable students. Thus, Jesuits in the education apostolate pay undivided attention to the empowerment of the marginalised and the oppressed.

Since its inception, Loyola College of Education (LCE) has been focussing on the formation of intellectual capacity, training of the will and formation of character of the student-teachers, thus ensuring the integral formation of the prospective teachers. LCE is committed to inculcating desirable social and human values and moral principles that would make the student-teachers self-disciplined, value-oriented and responsible teachers. LCE provides also a wide range of opportunities and experiences for student-teachers to discover their potentialities both physical and intellectual and cultivate their artistic and aesthetic sense through cultural extravaganza and nurture their social responsibility through rural / slum exposure camp.

Motto

- " Let your light shine"

Vision

- "Holistic formation of human engineers with techno-pedagogical skills to develop a humane society"

Mission

- Forming compassionate, competent, conscientious, creative and committed teachers with techno-pedagogical skills using education as the key to empower the youth to bring about a desirable social transformation.
- Train and form responsible socially committed teachers who promote the fundamental rights and duties, values of liberty, equality and fraternity, uphold the constitution and affirm the ideas of secularism, social justice and sustainable development.

8.2. About Nature Science Foundation (NSF)

NSF is an ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) Certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore - 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12AA, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is to “Save the Nature to Save the Future” and “Go Green to Save the Planet”. NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the ‘Go Green Concept’ in a big way. NSF family is wide spread across India with over 115 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment Day celebration, Ozone day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation. NSF is being released ‘Magazine’ and ‘Newsletter’ biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India.

In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies across the world, NSF tributes the deserved meritorious candidates with various awards and honours such as ‘Best Faculty Award’, ‘Best Women Faculty’, ‘Best Scientist Award’, ‘Best Student Award’, ‘Best Research Scholar Award’, ‘Best Social Worker Award’, ‘Young Scientist Award’, ‘Life-Time Achievement Award’ and ‘Fellow of NSF’. These award and honours will be given to the deserved meritorious candidates during the ‘Annual Meet and Award Distribution Ceremony’ which will be conducted every year during the first week of January.

NSF has introduced various types of Audits such as ‘Eco Audit’, ‘Green Audit’, ‘Energy Audit’, ‘Hygienic Audit’ Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Checklist prepared by the NSF ISO Criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, Energy Policy, MoU, International Eco Club Student Chapter.

Audit processes are being conducted through the certified Auditors as per the following by the NSF

Audit	Certified Auditors	Certified Auditors
Green Audit	<ul style="list-style-type: none"> • IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan
Energy Audit	<ul style="list-style-type: none"> • BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator 	<ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam ➤ Dr. P. Thirumoorthi ➤ Dr. G. Murugananth
Environment Audit	<ul style="list-style-type: none"> • IGBC -Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. Ashutosh Kumar Srivastava ➤ Er. N. Shanmugapriyan
Hygiene Audit	<ul style="list-style-type: none"> • FSMS – Food Safety Management System & Occupational Safety & Health (ISO 22000:2018) • SBICM - Swachh Bharath under India Clean Mission 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R. Sudhakaran ➤ Dr. N. Saranya

Waste Management Audits	<ul style="list-style-type: none"> • Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R. Sudhakaran ➤ Er. N. Shanmugapriyan
ISO Certification	<ul style="list-style-type: none"> • QMS (9001:2015), • EMS (14001:2015), • OHS (45001: 2018), • ISMS (27001:2018), • FSMS (22000:2018), • QMSMD (13485: 2016), • EnMS (50001: 2018) 	<ul style="list-style-type: none"> ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R. Mary Josephine

Table 1. The LCE facility details

S.No.	Details of Area	Total area
1.	Total Campus area	4866.26 Sq. m
2.	Total Built up area	2877.13 Sq. m
3.	Covered Car parking area	-
4.	Air-conditioned area	231.13 Sq. m
5.	Non-Airconditioned area	-
6.	Gross Floor area	2648.98 Sq. m
7.	Public area	-
8.	Service area	-
9.	Forest vegetation	30%
10.	Planted vegetation	55%

9. Audit Details

Date / Day of Audit	: 31.01.2023
Venue of Audit	: Loyola College of Education (LCE) Loyola College Campus, Nungambakkam Chennai- 600 034, Tamil Nadu, India
Audited by	: Nature Science Foundation Coimbatore, Tamil Nadu, India.
Audit type	: Green Campus Audit
Name of Auditing Chairman	: Dr. S. Rajalakshmi Jayaseelan

Name of IGBC AP Auditor	: Dr. B. Mythili Gnanamangai Chairman of NSF & ISO QMS, EMS, OHSMS, EnMS Auditor. Vice Chairman of NSF & Indian Green Building Council Accredited Professional.
Name of Lead Green Auditor	: Dr. R. Mary Josephine Plant Taxonomist & Principal, St Joseph College for Women, Tiruppur, TN.
Name of Subject Expert-I	: Dr. D. Vinoth Kumar Joint Director of NSF & ISO EnMS Auditor.
Name of Subject Expert-II	: Mr. B.S.C. Naveen Kumar Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of Subject Expert-III	: Er. D. Dinesh Kumar Certified Lead Auditor, IGBC, ASSOCHEM, GRIHA & LEED
Name of the Energy Auditor	: Dr. N. Balasubramanian Certified Bureau of Energy Efficiency Auditor of NSF.
Name of Eco & Green Officer	: Ms. E. Sivaranjani Environment, Energy & Green Council Programme Officer, NSF.

10. Procedures followed in Green Campus Audit

Green campus audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducing the environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. It is a kind of a professional tool for assessing the green campus. Green audit projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organisation has a central role in building the green campus, in order to validate the same (Adeniji, 2018).

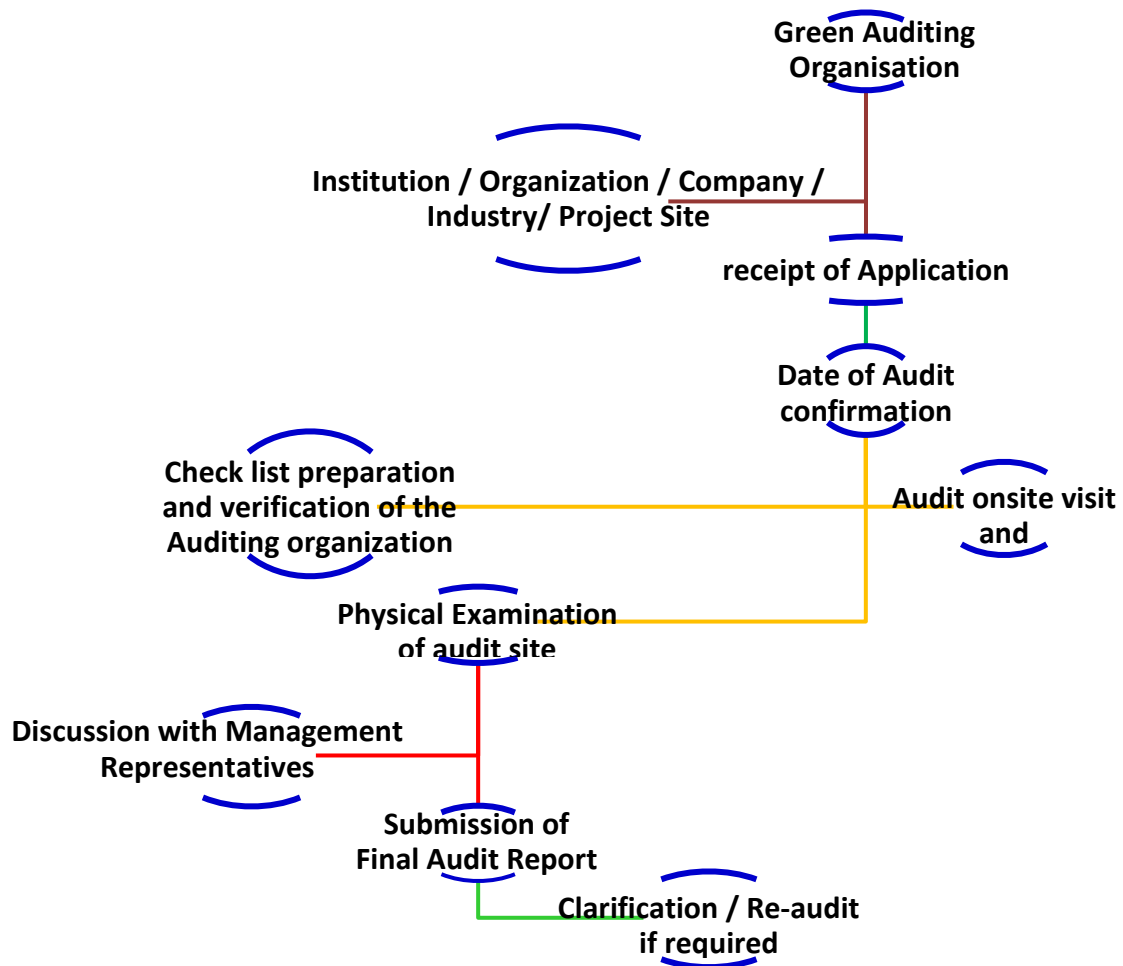
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green campus audit has been conducted as per the checklist of Nature Science Foundation, Coimbatore, Tamil Nadu, India (www.nsfonline.org.in) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices (Staniskis and Katiliute, 2016, SCSR, 2018). Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of Green campus Lead Auditors and Botanists /

Zoologists / Biotechnologists were selected to conduct the Green campus audit process.

During the audit, the nature of plants and animals / birds species thriving within the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal garden / aquarium and aquatic (hydrophytes) plants in the campus were recorded. Labelling of common names and Botanical names of plants were observed. The operation of the water irrigation system, drip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted.

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering for plantations in the campus were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto were recorded (Venkataraman, 2009). Conduct of outreach programmes for dissemination of Green campus motto to the students and staff members including public domain and signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities for future generation were noted (Lauder *et al.*, 2015; Brindusa *et al.*, 2007). Technology driven solutions initiated by the Green campus organization can also be disseminated and documented successively for propagating the attitude of the Green campus in wider masses.

Projects, Dissertations and Thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches towards the green campus. These should be disseminated through presentations and publications in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. These efforts taken by the students and staff were deliberated while conducting the Green campus audit. Green audit processes are taking place as per the following flow-chart starting from the Seipt of application forms from the auditee (organization) and ending upon the submission of final report to the concerned organization (Leal Filho *et al.*, 2015). During the audit process, the best environmental / greenery practices followed and new initiatives undertaken in the organisation to reduce the environmental pollution and steps taken for nature conservation that brings added value to the organisation in maintaining the eco-friendly campus were assessed. In addition, supporting activities of the scholars and staff with regard to “Vision and Mission” of the greenery activities of the Organization is also evaluated.



Flow-chart of Green Campus Audit Procedures

10.1. Onsite Green Campus Audit activities

1. Opening meeting is the first step between the audit team and auditee along the Management Representatives where the purpose of the audit, procedures to be adopted for the conduct of the audit, verification of the documents and the time schedules were discussed, in brief.
2. Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the Audit team members visited different sites in the LCE campus and required photographs were taken then and there for preparing the audit report.
3. During the onsite phase of visit, it is vivid how the various facilities made by the LCE campus and management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.
4. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders. The assessment reveals the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in creating Green campus facilities.

5. Collecting audit proofs *ie*, data collection and information from the auditee as per the audit protocol were carried out.
6. An exit meeting was conducted to describe the findings of the audit with Management Representatives and staff members along with the audit team in brief.

10.2. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of Energy and Environment audit process, wherein, audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al.*, 2018). Pre-audit stage activities are an essential prerequisite for the green audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al.*, 2019). Audit team was selected by the Nature Science Foundation as per the checklist comprised of Lead Auditor of ISO (EMS 14001:2015), Botanist, Agriculture and Horticulture Scientists from Conventional and Technical Universities across India, Accredited Professionals from Indian Green Building Council, Hyderabad and Associated Chambers of Commerce and Industry of India, New Delhi.



Opening meeting with the Principal, PRO, IQAC Coordinator and Management responsibilities of the LCE, Chennai, Tamil Nadu and Audit Team of the Nature Science Foundation

Green, Energy, Eco and Waste Management Audits Activity at the LCE Campus by the NSF Audit team



10.3. Target Areas of Green Auditing

Green campus audit is nothing but a professional tool to assess the greenery activities in the educational institutions and give a value addition to the campus and considered as a resource management process. Eco-campus concept mainly concentrate on the efficient use of energy and water; Minimize waste generation or pollution and also improve the economic efficiency. Green campus audit process may be undertaken at frequent intervals and their results can demonstrate improvement or change over time. Eco-campus focuses on the reduction of carbon emissions, water consumption, wastes to landfill and enhance energy use conservation to integrate environmental considerations into all contracts and services considered to have significant environmental impacts (Choy and Karudan, 2016).

There are several target listed in the Green audit process in which a few are taken into consideration as per the Indian scenario is concerned. They are water use efficiency, energy use efficiency, solid, e-waste biomedical, food, sewage waste management and reuse methods, planting of oxygen releasing and carbon dioxide assimilating plants, landscape management, topology, vegetation, soil erosion control, carbon footprint due to use of vehicles, electricity and fossil fuels (León-Fernández and Domínguez-Vilches, 2015; www.carbonfootprint.com). drinking water quality supply, Biogas plant, rain harvesting system, water reservoirs, percolation pond, establishment of various herbal, terrace and ornamental, gardens, campus and flora fauna, water irrigation, implementation of Government schemes, conduction of awareness programmes management, public transport, low-emitting vehicles and control of car smokes and exhaust, Organization's budget for greenery activities, campus facilities for disabled, persons needs special attention and or maternity care, security, safety and health infrastructure facilities for stakeholder's wellbeing (Nunes *et al.*, 2018; Report of Green Audit, 2018).

10.4. Flora and Fauna diversity of study area



The LCE is situated in Loyola College Campus, Chennai district, Tamil Nadu, India. It is located about 31 min (7 km) from the Chennai Central Station to Loyola college campus. At present, the campus is quite clean, green and with much less pollution when compared to the rest of the city. Study/documentation of biodiversity

provides a useful measure of the quality of the environment and the ecological studies are important aspects of environment, in view of the consideration of environmental quality and natural flora and fauna conservation.

10.4.1. Topography

The LCE consists of an environment of Sandy and Loam type, located at an altitude of 14m above mean sea level, 80°16'42" E of longitude and 13°05'16" N latitude.

10.4.2. Geology and Soil condition

The geology of Chennai comprises mostly clay, shale and sandstone. The city is classified into three regions based on geology, sandy areas, clayey areas and hard-rock areas. Sandy areas are found along the river banks and the coasts. Clayey regions cover most of the city. Hard rock areas are Guindy, Velachery, Adambakkam and a part of Saidapet. In sandy areas such as Tiruvanmiyur, Adyar, Kottivakkam, Santhome, George Town, Tondiarpet and the rest of coastal Chennai, rainwater run-off percolates very quickly. In clayey and hard rock areas, rainwater percolates slowly, but it is held by the soil for a longer time. The city's clayey areas include T. Nagar, West Mambalam, Anna Nagar, Perambur and Virugambakkam. Chennai's soil is mostly clay, shale and sandstone.

10.4.3. Climatic conditions

Chennai has a tropical wet and dry climate. The city lies on the thermal equator and is also on the coast, which prevents extreme variation in seasonal temperature. The weather is hot and humid for most of the year. The average annual rainfall is about 140 cm. The city gets most of its seasonal rainfall from the north-east monsoon winds, from mid-October to mid-December. Cyclones in the Bay of Bengal sometimes hit the city.

Table 2. Soil edaphic and environmental parameters of the LCE campus

S.No	Details of Parameters	Data collected
Soil edaphic parameters		
1.	Soil pH	8
2.	Soil types	Alluvial, Clayey Soil
3.	Total organic carbon	11%
4.	Electrical conductivity	8 dSm-1
5.	Water holding capacity	80%
6.	Total Nitrogen	8 ppm
7.	Available Phosphorous	7 ppm
8.	Exchangeable Potassium	3 ppm
Environmental parameters		
1.	Minimum Temperature	21°C
2.	Maximum Temperature	35°C
3.	Minimum Relative humidity	63%
4.	Maximum Relative humidity	80%
5.	Annual Average Rainfall	1014 mm/avg.year
6.	Annual Average Sunshine	7.5 hrs/day
7.	Wind speed	9 -12 miles/h

11. Identification of Plant Species

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across the LCE campus and subjected to botanical identification (botanical name, family, habitat, and economic importance) and anthropogenic disturbances to the natural vegetation in campus. Plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using taxonomic literatures (Gamble and Fischer, 1972; Matthew, 1983; Nair and Henry, 1983; Henry *et al.*, 1989; Chandrabose and Nair, 1988). Further, their identification was confirmed by matching with authentic specimens in the Madras Herbarium (MH), Botanical Survey of India (BSI), Southern Circle, Coimbatore, Tamil Nadu, India.

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

Lichen specimens were collected from the LCE campus and then identified based on the lichen identification key of Awasthi (2007). Representative lichen specimens were identified based on thalli morphology such as rhizine, cilia and pseudocephellae and reproductive structures (fruiting bodies) such as apothecia, perithecia, soredia, soralia, conidia and isidia embedding on the thalli surface using a stereo microscope (CZM4, Labomed, India). In the present study, Anatomy of the thallus were carried out in order to document micro morphological features such as medulla thickness, upper and lower surface of thallus, lobes, size and shape of spores. Thin section of apothecia and perithecia was made to observe the nature ascus spores and the arrangement of the algal and fungal layers in the thallus; respectively. Spot tests featured the use of chemical reagents to detect lichen substances by appearances of the characterized colour changes on lichen thallus was noted. The lichen chemistry was analyzed according to Culberson and Kristinson (1970) methods. The colour spot test was done on medulla of lichen thallus using test reagents of potassium hydroxide (K), calcium hypochlorite (C) and paraphenylene di amine (PD). Lichen was identified based on colour spot test using the procedure defined by Orange *et al.* (2001).

To authenticate the identified lichen samples, the representative samples were compared with the voucher specimens at the Lichen Herbarium Centre of National Botanical Research Institute (NBRI), Lucknow, Uttar Pradesh, India and Department of Botany, Bharathiar University, Coimbatore, Tamil Nadu. The lichen species might be confused with other species unless their morphological, biochemical and anatomical features were closely monitored. Therefore, apart from microscopic observation, spot tests, chemical profiling and TLC tests, attempts were made to compare the representative samples with voucher specimens.

11.2.3. Identification of Algae Genera

Algae are the members of a group of predominantly aquatic photosynthetic organisms of the kingdom *Protista* followed by terrestrial algae found in freshwater and slump areas. Algae are non-flowering and lower group of plants which are green in colour because of presence of chlorophyll pigments in the body called thallus. Algae adopt diverse life cycles, and by size, they range from microscopic *Micromonas* to giant kelps that reach 60 metres (200 feet) in length. Their photosynthetic pigments highly varied when compared to that of higher plants; their cells have features not found among plants and animals. In addition to their ecological roles as oxygen producers,

they serve as food base for almost all aquatic life; algae are economically important as a source of crude oil and as sources of food and a number of pharmaceutical and industrial products for humans. Algae are defined as eukaryotic (nucleus-bearing) organisms that photosynthesize. They lack specialized multicellular reproductive structures of plants, but they always contain fertile gamete-generating cells surrounded by sterile cells. Algae also lack true roots, stems, and leaves features they share with the avascular lower plants (e.g., mosses, liverworts, and hornworts). Algae identification key consists of couplets of characteristics using algal description of the specimen based on morphological characterization from 58 Genera to species level identification as per the comprehensive key.

12. Identification of Mammals, Birds, Reptiles, Amphibians and Termites

Birds were observed by visual sightings and by calls also the avifaunal data were observed through the Nikon 8 x 40 binoculars and photographs were taken by Canon 600 D camera (55 – 250 mm). The recorded data was noted in the field work note. Later, the birds were identified with the help of field guide- "Birds of Indian subcontinent" by Richard Grimmett, and the IUCN category of the birds were also noted with the same. The point count and transect line methods were used to record the number of bird species in the study area in which regular visits and personal visits were carried out (Ferenc *et al.*, 2014). The surveys were conducted to understand the distribution of bird species in relation to habitats and nesting behaviour of birds in the study area. Based on survey richness and abundance of bird species were calculated using Shannon-weaver diversity index. Based on available data and species were selected for nest site selection study. Selected species of birds was analysed for its nest site characteristics between the habitats and also plant species preference was enumerated and assessed. The number of breeding bird species and nests found in different habitats as depend variables such as biotic and abiotic factors as the independent variable (Jayson and Mathew, 2000).

Reptiles and Amphibians are identified based on colouration, markings on the skin, background colour generally brown, Males often have a flecked pattern on back. Occasionally they are in green, leading to mistaken identification as sand lizard, Males have thicker base to tail and brighter, speckled underside. Newborn young are dark in colour, almost black. A rare species, almost entirely confined to heathland sites in Dorset, Hampshire and Surrey, and sand dunes on the Mersey and Welsh Coast. The most common reptile found in a variety of habitats, including gardens. Spends most of its time underground or in vegetation litter. Most likely to be found underneath objects lying on the ground, or in compost heaps. Snakes are identified based on cream, yellow or white collar behind the head, bordered to the rear by black marks. Body colour ranges from bright green to dark olive, but mostly the latter. Darker specimens can appear black from a distance. Truly black grass snakes are rare. Males are predominately brown, females are grey. Dark butterfly shape on top of head may be noted. Pairs of spots, sometimes fused as bars, running along back with black line running through eye are recorded. Males typically grey with a black zigzag stripe, females generally brown with a dark brown zigzag stripe (Beebee and Griffiths, 2000).

13. Green Campus Audit Observations

It covers both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in natural and planted vegetation and their maintenance. Topography,

landscape management design and soil erosion control are playing important role in environment sustainable development in the campus (Pradip and Patil, 2014). An account of a large number of Oxygen releasing and Carbon dioxide assimilating plants planted in the Campus are taken into consideration to give pure atmosphere to the stakeholders. Establishment of different types of gardens in the campus, rainwater harvesting system, operation of water irrigation, drip and sprinkler irrigation methods may be adopted to improve the green campus. Similarly, biodiversity conservation strategies are very essential to conserve a variety of plant and animal species in the campus ecosystem. Biofertilizers, organic and green manures, cow dung manures and farmyard manures may be used for the cultivation of plants which may be protected the environmental health that will not cause any air, water and soil pollution. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC/Student Force and NSS bodies may be involved in green campus initiatives, planning and efforts among stakeholders. Outreach programmes may be conducted for dissemination of Green Campus motto and Green pledge initiatives to rural, tribal and urban people. Academic credentials like taking up major and minor Projects, Dissertations and Thesis work by the students and staff members may be taken into account towards green campus initiatives, planning and efforts. Best practices followed on green campus initiatives in the Organization and recommendations for greening are illustrated in the audit report as well.

13.1. Table 3. Qualitative Measurements of Green Auditing

S.No	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have internal Green campus audit procedures been developed and implemented in the Organization?		✓	
2.	Have programmes for the achievement of Green campus objectives and targets been established and implemented as on today?	✓		
3.	Whether Green campus audit and Environment audit are simultaneously carried out or separately carried out?		✓	
4.	Whether Indian Biodiversity Act as per the Ministry of Environment, Forests and Climate Change, New Delhi, Wildlife protection act and World & Indian Green Building Council concepts followed?		✓	
5.	Have responsibilities been assigned for programmes at each appropriate function and level? (Environmental Engineer & Agriculture Staff working for environment monitoring)		✓	
6.	Are the following environmental aspects considered in sufficient detail?			
	a. Drinking water / RO water / Borewell water / Open well water / Pond water / Municipal or Corporation water use and to check quality of water through Physico-chemical properties analysis	✓		

	b. Wastewater treatment facility	✓		
	c. Sufficient number of trees, shrubs, herbs and lawns	✓		
	d. Solid waste management facility	✓		
	e. Availability of Biogas plant		✓	
	f. Rain harvesting system, water reservoirs, etc.	✓		
	g. Aquarium and aquatic (hydrophytes) plants		✓	
	h. Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc.	✓		
	i. Natural Topography or Forest, Planted vegetation	✓		
	j. Water well, Bore well, lake, water reservoir facility	✓		
	k. Water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use	✓		
	l. Treated water consumption towards plant cultivation, machinery cleaning, transport, toilet use and etc.	✓		
	m. Per capita water consumption per day calculated (45L/P/C/D)	✓		
7.	Whether plants are tagged properly with their common name and Botanical name for stakeholders?		✓	
8.	Signing of MoU with Govt. and NGOs to disseminate Green campus motto and pledge			NA
9.	Biodiversity conservation of plants, animals and wildlife, genetic resources (Endangered and endemic species) at each appropriate function and level?	✓		
10.	Are any biofertilizers, organic manures, farmyard manures, vermicompost, green manures and chemical fertilizers used for maintaining plants?	✓		
11.	Establishment of herbal garden, zodiac garden, medicinal garden, kitchen garden, terrace garden and ornamental plants garden in the campus	✓		
12.	Implementation of Government schemes (Swatch Bharath Abhiyan under Clean India Mission)		✓	
13.	Functioning of Nature club, Eco club, Cell, Forum, Association, NCC/Student Force, NSS bodies and Social Service League for students and staff members on biodiversity conservation, green campus development, etc.	✓		
14.	Conduction of awareness programmes and cultural activities on global warming, environmental changes and ecosystem maintenance to the stakeholders	✓		
15.	Conduction of outreach programmes for dissemination of green campus initiatives, natural resources, environmental pollution and biodiversity conservation to rural, tribal and urban people		✓	

16.	Implementation of composting pits, vermicompost unit, recycling of kitchen wastes collected from Hostels, Canteens, Cafeteria, Food court and other places		✓	
17.	Maintenance of plantations in the campus and steps taken for water scarcity during summer season to maintain plants	✓		
18.	Steps taken for organic, inorganic, toxic, e-waste, biomedical, food, sewage waste management, segregation of wastes and reuse methods	✓		
19.	Public transport, low-emitting vehicles and control of car smokes and exhaust towards environment monitoring			NA
20.	Observation on the site preservation, soil erosion control and landscape management		✓	
21.	Projects and Dissertation works and Scholarly publications on environmental science and management carried out by students and staff members			NA
22.	Implementation of advanced methods for watering plantations (Drip irrigation, Sprinkler irrigation, etc.)	✓		
23.	Use of metering for water utility, IoT based watering, automation, water device, remote water lines, etc.			NA
24.	Percentage of Organization's budget for environment sustainability efforts	✓		
25.	Campus facilities for disabled, special needs and or maternity care including security, safety and health infrastructure facilities for stakeholder's wellbeing	✓		

13.2. Table 4. Quantitative Measurements of Green Auditing

S.No.	Details of Plant and animal species	Numbers / Percentage
1.	Total number of Flowering plant species inside the Campus	60 species belonging to 43 Genera under 25 families
2.	Total number of Non-Flowering plant species inside the Campus	12 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora
3.	Total number of living Mammals inside the Campus	5 such as Cats, Mice and Dog
4.	Total number of visiting Mammals inside the Campus	10 Species belonging Rabbit, Squirrel and Monkey
5.	Total number of living Birds inside the Campus	22 species belonging Common Myna, House Sparrow, King-crow, House Crow, Jungle Babbler, Honey bird

6.	Total number of visiting Birds inside the Campus	4 species belonging Mangrove heron, Common Wood shrike, Peacock.
7.	Total number of Aquarium	-
8.	Total number of Aquatic (hydrophytes) plant species	-
9.	Total number of Grasshopper and Termites	Grasshopper: 3 species Termites: 2 species
10.	Total number of Amphibians and Reptiles	Amphibians: 3 species Reptiles: 3 species
11.	Total number of Butterflies and Mosquitos	Butterflies: 22 species Mosquitos: 03 species
12.	Percentage of Forest Vegetation	30%
13.	Percentage of Planted Vegetation	70%
14.	Percentage of Water consumption to total human population	-
15.	Percentage of Water consumption to total flora and fauna	-
16.	Per capita water consumption per day	-

13.3 Flora and Fauna diversity in the LCE campus

13.3.1. Flora diversity in the LCE campus

13.3.1.1. Flowering plants diversity in the LCE campus

Ensuring the rich biodiversity in the green campus is an important parameter which reflects the real-time ecosystem. Plants are indicators for assessing the varying levels of environmental quality. In general, plants improve the outdoor air quality with increased oxygen levels and reduced temperature and carbon dioxide. The green and varying colour of the flowering plants improve the ambience of the Organization environment. The record on maintenance of the plant biomass and its management are important with respect to green campus initiatives. The existence of such plants and birds in the green campus may be recorded for the rich flora and fauna which are being considered as a value addition to the campus.

The observations indicated that the LCE campus has more than 30-50% of wild, 50-60% native plant species and the other 20-25% plant species are ornamental in nature coming under the planted vegetation. Native plant traits promote the indigenous fauna at the site area. Hence, the accountancy of 35% of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of LCE campus is the moist deciduous type. The remnants of this past vegetation are found in the campus. The most plants LCE Campus recorded are *Azadirachta indica* A. Juss., *Tamarindus indica*, *Pongamia pinnata*, *Cassia fistula*, which are dominant trees species characteristic to the vegetation within the campus. Some of the shrub species like

Nerium oleander L., *Punica granatum* are also rather common in the campus.

Ground flora is comparatively sparse, but fairly rich in undistributed areas. Some of the common weeds like *Euphorbia hirta* L., is found to be predominant. Species such as *Catharanthus roseus*, *Cynodon dactylon* are some common herbs in the campus.

Certain common climbers found among the shrubs are *Abutilon indicum* L., *Adhatoda vasica*, *Coccinia grandis* L., *Cardiospermum halicacabum*, *Tinospora cordifolia* (wild.), *Toddalia asiatica* L., and *Citrullus landaus* (Thumb.) This campus is rich in grass species like *Andropogon pumilis*, *Apluda mutica*, *Cenchrus ciliaris*, *Asparagus racemosus* (Wild.) and *Commelina benghalensis* L.

Most of the species found are common in the campus, some of the species *Cucumis dipsaceus* Ehrenb, *Hybanthus*, *Bothriochloa compressa* (Hook.F.), and *Caralluma bicolor* Ramach., is the rare species. Some endemic grass species like *Andropogon pumilus* Roxb., *Panicum psilopodium* Trin., and *Perotis indica* (L.) Kuntze are also occurring in the campus. Number of above species decreased in number and a few face the danger of going extinct due to anthropogenic activities (regular clearing and construction activities). Hence in terms of conserving the available floral biodiversity, it is pertinent to set up a botanical garden within the campus and cultivate them while protect the ones that grow naturally on the grounds upon the vegetation maintenance.

Invasive species

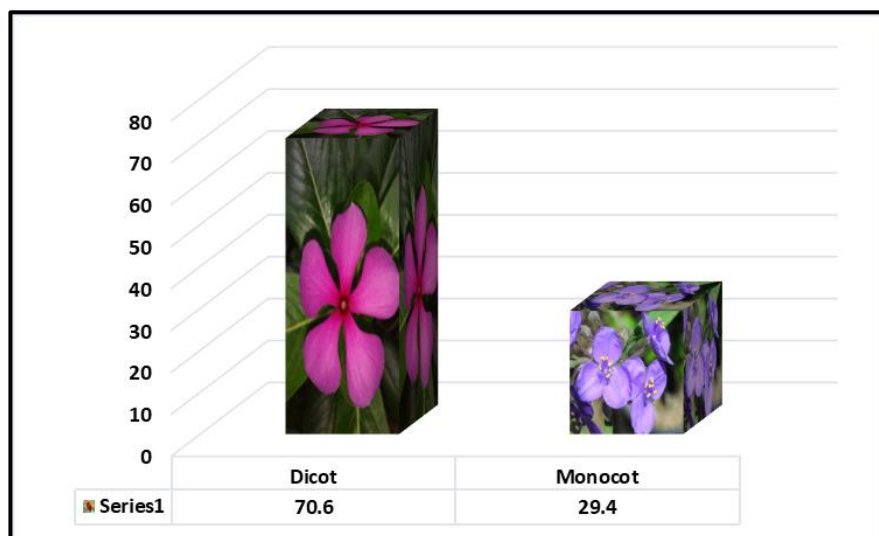
The campus has invasive species such as *Leucaena leucocephala* L., (Wild Tamarind). This is clearly indicated disturbances to the natural setting in the vegetated areas.

The alien / exotic species viz., *Plumeria*, *Anthurium* and *Tecoma stans* (L.) Kunth are occur in the campus.

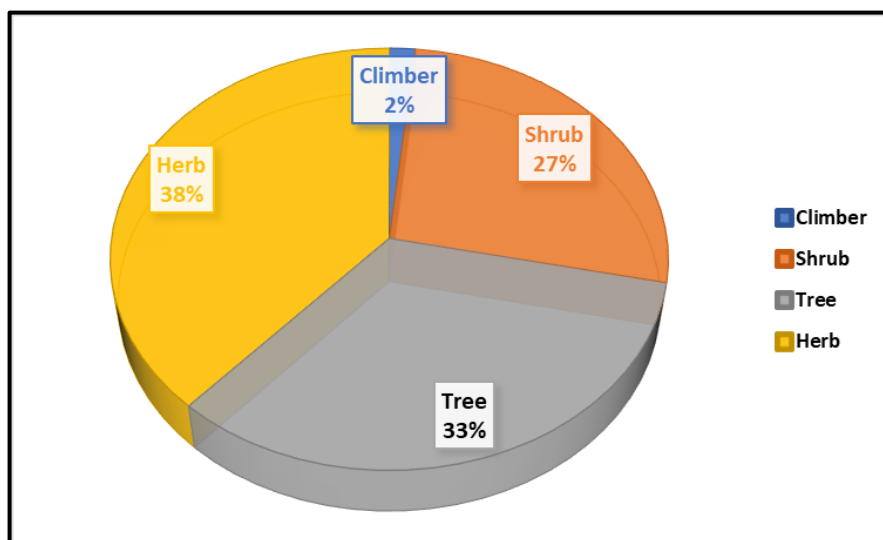
Some of the species are utilized as fruit yielding like *Mangifera indica* L. (Maa), *Psidium guajava* L., *Moringa pterygosperma* Gaertn., *Phyllanthus emblica* L., *Artocarpus heterophyllus* (Jack fruit), *Phyllanthus acidus* (Amla) and Species such as *Bougainvillea glabra*, *Ixora coccinea* are exploited for their attractive flowers.

Distribution of flowering Plants

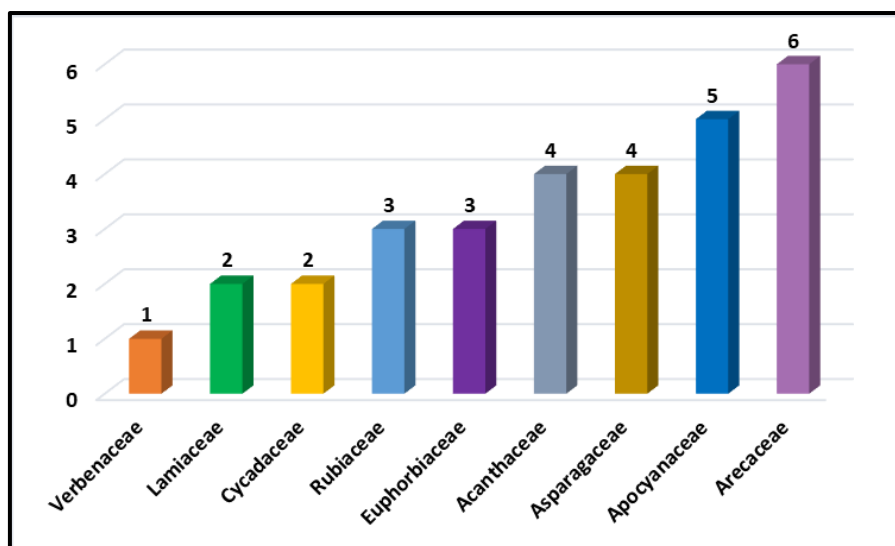
The biodiversity of LCE campus comprises a sum of 60 species belonging to 43 genera under 25 families besides the lichens, mycoflora, pteridophytes and bryophytes. Among the documented higher plants, Dicots are dominating with 70.6% families followed by monocots (29.4% families). Over all analysis revealed that herbs were dominating flora (38%) followed by trees, shrubs and climbers which accounts 33%, 27% and 2%, respectively. Among the documented dicots, Polypetalae formed a major proposition with 9 families, 15 genera and 20 species; Gamopetalae with 6 families, 12 genera and 18 species while Monochlamydeae with 7 families, 10 genera and 13 species. In monocots 3 families are spreading over 6 genera belonging to 9 species. Arecaceae is first dominant family and followed, Apocyanaceae, Asparagaceae, Acanthaceae, Euphorbiaceae, Rubiaceae, Cycadaceae, Lamiaceae and Verbenaceae with 6, 5, 4, 4, 3, 3, 2, 2 and 1 species respectively. At the time of green campus audit at LCE Campus, a total of 2 invasive floral species were recorded. This clearly specified the disturbances to the natural setting in the vegetated sector.



Systematic groups of the plants in the LCE Campus



Analysis of habit-wise distribution of plant species in the LCE campus



Plant families with higher number of species in the LCE campus area

Table 5. List of Flowering plants in the LCE Campus

S.No	Common Name	Scientific Name	Family	Habitat
1.	Almond	<i>Treminalia catappa</i> L.	Combretaceae	Tree
2.	Aloe Vera	<i>Aloe barbadensis</i> miller	Asphodelaceae	Shrub
3.	Annual Sedge	<i>Cyperus Compresses</i>	Cyperaceae	Herb
4.	Arali	<i>Nerium oleander</i> L.	Apocyanaceae	Shrub
5.	Areca Palm	<i>Dypsis Lutescens</i>	Arecaceae	Tree
6.	Asthma Weed	<i>Euphorbia Hirta</i> L.	Euphorbiaceae	Herb
7.	Bamboo	<i>Bambusa vulgaris</i>	Bambusoideae	Tree
8.	Banya tree	<i>Ficus bengalensis</i> L.	Moraceae	Tree
9.	Beard Grass	<i>Andropogon pumilus</i>	Acanthaceae	Herb
10.	Bottle Palm	<i>Hyophorbe Lagenicaulis</i>	Arecaceae	Tree
11.	Broadleaf Lady Palm	<i>Rhapis Excelsa</i>	Arecaceae	Shrub
12.	Broadleaf palm-lily	<i>Cordyline fruticosa</i>	Asparagaceae	Shrub
13.	Chay Root	<i>Oldenlandia Umbellata</i>	Rubiaceae	Herb
14.	Chinese ixora	<i>Ixora chinensis</i>	Rubiaceae	Shrub
15.	Coco-Grass	<i>Cyperus Rotundus</i>	Cyperaceae	Herb
16.	Coconut tree	<i>Cocos nucifera</i> L.	Arecaceae	Tree
17.	Common Basil	<i>Ocimum tenuiflorum</i>	Lamiaceae	Herb
18.	Common needle grass	<i>Aristida pinnata</i>	Poaceae	Herb
19.	Crown of thorns	<i>Euphorbia milii</i>	Euphorbiaceae	Shrub
20.	Cycas	<i>Cycas indica</i>	Cycadaceae	Tree
21.	Dinnerplate-Aralia	<i>Polyscias Scutellaria</i>	Araliaceae	Tree
22.	Donkey Ears	<i>Kalanchoe gastonis</i>	Crassulaceae	Herb
23.	Dumb Cane	<i>Dieffenbachia Seguine</i>	Araceae	Herb
24.	Dwarf White Orchid	<i>Bauhinia acuminata</i>	Fabaceae	Shrub
25.	Eastern red cedar	<i>Juniperus virginiana</i>	Cupressaceae	Tree
26.	Fasle Daisy	<i>Eclipta prostrata</i>	Asteraceae	Herb
27.	Ganges Primrose	<i>Asystasia gangetica</i>	Acanthaceae	Herb
28.	Golden Cane Palm	<i>Dypsis Lutescens</i>	Arecaceae	Tree
29.	Golden dewdrops	<i>Duranta erecta</i> L.	Verbenaceae	Shrub
30.	Guava	<i>Psidium guajava</i>	Myrtaceae	Tree
31.	Hardy hibiscus	<i>Hibiscus moscheutos</i>	Malvaceae	Shrub
32.	Hibiscus	<i>Hibiscus rosa-sinensis</i>	Malvaceae	Shrub
33.	India rubber plant	<i>Ficus elastica</i>	Moraceae	Tree
34.	Indian Almond	<i>Terminalia Catappa</i>	Combretaceae	Tree
35.	Indian borage	<i>Plectranthus amboinicus</i>	Lamiaceae	Herb
36.	Indian Oleander	<i>Nerium Indicum</i>	Apocynaceae	Shrub
37.	Indian tulip tree	<i>Thespesia populnea</i> Cav.	Malvaceae	Tree
38.	King of Bitters	<i>Andrographis paniculata</i>	Acanthaceae	Herb
39.	King sago	<i>Cycas revoluta</i>	Cycadaceae	Tree
40.	King's Mantle	<i>Thunbergia erecta</i>	Acanthaceae	Herb

41.	Knot Grass	<i>Aerva lanata</i>	Amaranthaceae	Herb
42.	Madagascar	<i>Catharanthus roseus</i>	Apocynaceae	Herb
43.	Maize	<i>Zea mays</i>	Andropogoneae	Herb
44.	Money Plant	<i>Epipremnum aureum</i>	Araceae	Climber
45.	Monkey Bush	<i>Abutilon indicum</i>	Malvaceae	Herb
46.	Neem tree	<i>Azadirachta indica</i> A. Juss	Meliaceae	Tree
47.	Pagoda-tree	<i>Plumeria alba</i>	Apocynaceae	Tree
48.	Peacock flower	<i>Caesalpinia pulcherima</i>	Caesalpiaceae	Shrub
49.	Rainbow Tree	<i>Dracaena reflexa</i>	Asparagaceae	Tree
50.	Royal palm	<i>Roystonea regia</i>	Arecaceae	Tree
51.	Scarlet jungle flame	<i>Ixora coccinea</i> L	Rubiaceae	Shrub
52.	Snake Plant	<i>Dracaena trifasciata</i>	Asparagaceae	Shrub
53.	Spider plant	<i>Chlorophytum comosum</i>	Asparagaceae	Herb
54.	Spiny amaranth	<i>Amaranthus spinosus</i>	Amaranthaceae	Herb
55.	Swollen finger grass	<i>Chloris barbata</i>	Poaceae	Herb
56.	Tridax Daisy	<i>Tridax procumbens</i>	Asteraceae	Herb
57.	Trumpet bush	<i>Tecoma stans</i>	Bignoniaceae	Tree
58.	Variegated Croton	<i>Codiaeum variegatum</i>	Euphorbiaceae	Shrub
59.	White Frangipani	<i>Plumeria Obtusa</i> L.	Apocynaceae	Shrub
60.	Yard-Grass	<i>Eleusine Indica</i>	Poaceae	Herb



Hibiscus rosa-sinensis



Thunbergia erecta



Cordyline fruticosa



Azadirachta indica



Zea mays



Aloe barbadensis miller



Plectranthus amboinicus



Ocimum tenuiflorum



Chlorophytum comosum



Roystonea regia



Ixora coccinea L.



Bauhinia acuminata



Catharanthus roseus



Juniperus virginiana



Euphorbia milii



Cycas revoluta



Ficus elastica



Psidium guajava



Epipremnum aureum



Plumeria obtusa



Tecoma stans



Kalanchoe gastonis



Hibiscus moscheutos

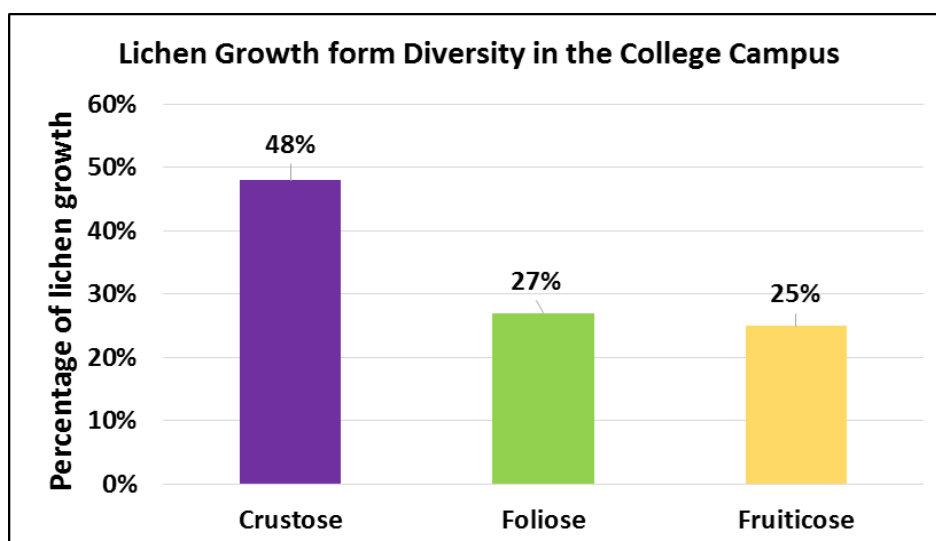


Dracaena reflexa

13.3.1.2. Lichen diversity in the LCE campus

Lichens are one of the most fascinating symbiotic organisms found worldwide. The lichens species are ubiquitous and common inhabitants of the bark of the tree, rock surface, soil etc. They are a lower group of plants coming under non-flowering plants that live in a variety of substrates under a wide range of environmental conditions with or without causing harm to the hosts. Ecologically, lichen plays important roles in soil formation; re-establishes life on earth; fixes atmospheric nitrogen; plant's health, ecology distribution, and in the formation of organic matter of habitat which in turn benefitting mosses in nutrient availability. A unique synergetic association between a fungal and an algal species result in lichens and occupied in plant kingdom. In this relationship both the organisms are mutually benefited. The algal partner may be cyanobacteria or the blue green algae and this is responsible for the process of photosynthesis. The algae thus provide food or nutrition for the fungi too. The fungal partner in turn provides space and protection for the algae. The lichen is an autotrophic organism in the sense that they can produce their own food by the process of photosynthesis. Even though the lichen is made up of two different organisms, the characteristics of the lichen are entirely different from the original characteristics of the algal and the fungal partner. Lichens are classified as micro lichens and macro lichens in which the microlichens cover the substrate on which they grow in the form of a crust whereas macro lichens grow in the form of a bush or a leaf like structure. The major forms of lichens are a) Foliose lichens exhibit a flat leaf like thallus, b) Fruticose lichens exhibit erect, pendulous and bushy thallus c) Squamulose lichens exhibit thallus with minute, scale like squamules and d) Crustose lichens exhibit flat crust shaped thallus.

Lichen diversity reorded in the LCE campus showed a total of 5 different lichens species representing 2 genera and 2 families. Three species accounted for 5% of total available lichen diversity and identified up to species level while 52 were LCE recognized to genus level. The observation on lichen diversity revealed that two types of lichens growth forms belonging to the genus, *Parmotrema* and *Lecanora* were accounted 5% diversity coming under crustose lichens and three types of foliose lichens belonging too the genus, *Dimeralla*, *Graphis* and *Pertusaria* were accounted. About 2% lichens were found to be one single species in each genus of fruticose lichens.



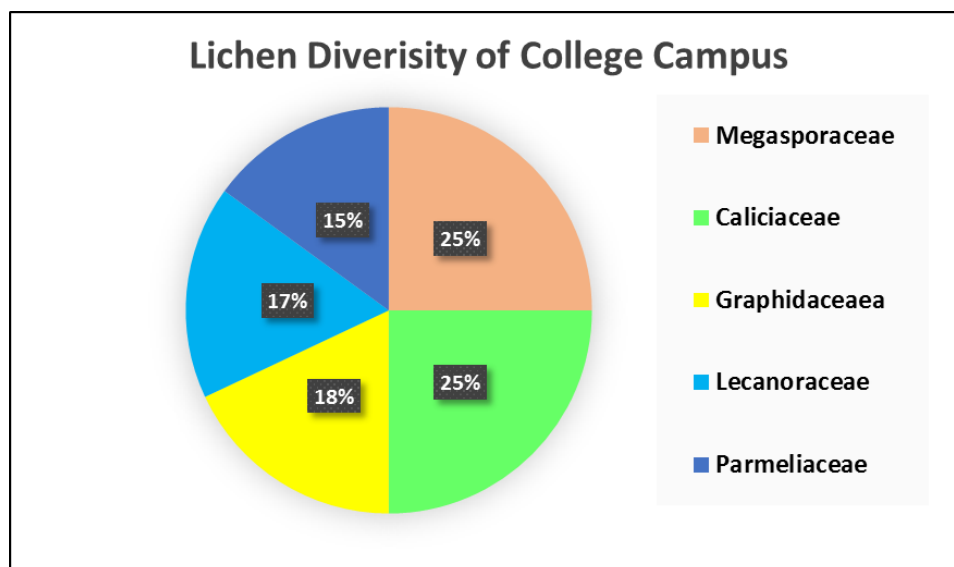


Table 6. Lichen diversity of the LCE Campus with respect to family, substratum and growth forms in genus and family wise classification

S.No	Lichen diversity of the KEC campus	Family	Growth forms
1.	<i>Aspicilia cuprea</i> Owe-Larss. & A.Nordin	Megasporaceae	Crustose
2.	<i>Buellia pullata</i> Tuck	Caliciaceae	Crustose
3.	<i>Graphis glauconigra</i> Vainio	Graphidaceaea	Furticose
4.	<i>Lecanora perplexa</i>	Lecanoraceae	Foliose
5.	<i>Usnea coralline</i> Mot	Parmeliaceae	Furticose

13.3.3. Algal diversity in the LCE Campus

Oscillatoria, *Chara*, *Oedogonium*, *Spirogyra*, *Volvox*, *Chlamydomonas*, *Scytonema* and *Cladophora spp.* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae are the predominant species found in the campus. The families Chlorellaceae, Closteriaceae, Desmidiaceae, Radiococcaceae, Ulotrichaceae, Uronemataceae and Oedogoniaceae were represented by single genus and species. Chlorophyceae plays an important role in both terrestrial and aquatic ecosystem as most of the members are found to be ecologically important. The highest diversity of Chlorophyceae indicated relatively good health of atmosphere. The presence of these algal species in abundance can be concluded that the LCE Campus ecosystem has high amount of organic nutrients in soil and rock. Generally, occurrence of abundant algal flora at a place indicates the availability of abundant nutrients along with conducive favourable environmental conditions.

13.3.1.3. Mushrooms diversity in the LCE Campus

Mushrooms, edible basidiomycete, represent white rot fungi which contained higher amount of proteins, rich in minerals with medicinal properties. At present three mushroom varieties (white mushroom, the paddy-straw mushroom and the oyster mushroom) are being cultivated in India. These are most popular, economically sound to grow and is extensively cultivated throughout the world. Due to moderate

temperature requirement for luxuriant growth, its cultivation are restricted to the cool malgrowth yield is influenced by the type of compost, spawn, temperature, percentage of moisture and also affected by the pests and disease-causing agents. There has been extensive discussed in recent years, as far as the production of fungal protein from domestic, agricultural and industrial wastes. Since mushrooms have a very short life span, it should reach to consumers within a short time or immediately canned. Mushroom growth is determined by means of carbohydrate content in the substrates like paddy straw, sugarcane molasses, saw wood dust and other plant waste materials.

The LCE campus has various mushroom types covering poisonous, edible and medicinal varieties such as white mushroom (*Agaricus bisporus*), the paddy-straw mushroom (*Volvariella volvacea*), oyster mushroom (*Pleurotus sajor-caju*), button mushroom (*Omphalotus olearius*) and other mushroom types such as *Amauroderma conjunctum*, *Ganoderma applanatum*, *Laccaria laccata* and *Volvariella bombycina*.

13.3.2. Fauna Diversity in the LCE Campus

13.3.2.1. Birds Diversity in the LCE Campus

The observations on fauna diversity indicated that the LCE campus has a large number of living as well as visiting animals, birds, reptiles and insects including termites. A total number of 20 birds belonging to the 2 species were recorded from different habitats during winter and summer, of them one of which were endemic to the deccan plateau like purple rumped sunbird. Totally 11 species of birds representing 2 families and 2 orders were observed during this study, passeiformes constituted the predominated group representing 15. Total number of 6 bird species, out of them 3 species were migrant, 3 species were local migrant during winter and summer season because of unfavourable environment and low availability of food resources. Migratory bird species like Mangrove heron, Common Wood shrike, Black-rumped flameback and Peacock.

Table 7. Birds Diversity in the LCE Campus

S.no	Scientific name	Common Name
1.	<i>Accipiter</i>	Shikra
2.	<i>Acridotheres tristis</i>	Common Myna
3.	<i>Anthusrufulus</i>	Black Kite-
4.	<i>Athenebrama</i>	Spotted Owlet
5.	<i>Bubulcus ibis</i>	Cattle Egret
6.	<i>Centropusparroti</i>	Barn Owl-Tylo Alba
7.	<i>Coraciasbenghanlensis</i>	Indian Roller
8.	<i>Corvus splendens</i>	House Crow
9.	<i>Dendrocitta vagabunda</i>	Rufous Tree Pie
10.	<i>Dicruridaemacrocerus</i>	Black Drongo
11.	<i>Egretta garzetta</i>	Little Egret
12.	<i>Elanusaxillaris</i>	Black-Shouldered Kite
13.	<i>Eudynamysscolopaceus</i>	Asian Koel-
14.	<i>Halcyon smyrnensis</i>	White-Throated Kingfisher
15.	<i>Haliasturindus</i>	Brahminy Kite-
16.	<i>Leptocoma zeylonica</i>	Purple-Rumped Sunbird
17.	<i>Megalaima zeylanica</i>	Brown-Headed Barbet

18.	<i>Merops orientalis</i>	Green Bee-Eater
19.	<i>Milvus migrans</i>	Shikra-Accipiter Badius
20.	<i>Motacilla</i>	Indian Robin
21.	<i>Psittaciformes</i>	Parrot
22.	<i>Columbidae</i>	Dove

Table 8. Total number of visiting birds in the LCE Campus

S.No	Common Name	Scientific Name
1.	Koel	<i>Eudynamys scolopaceus</i>
2.	Rose-ringed	<i>Psittacula krameri</i>
3.	Mangrove heron	<i>Butorides striata</i>
4.	Wood shrike	<i>Tephrodornis Pondicerianus</i>

13.3.2.2. Butterflies diversity in the LCE Campus

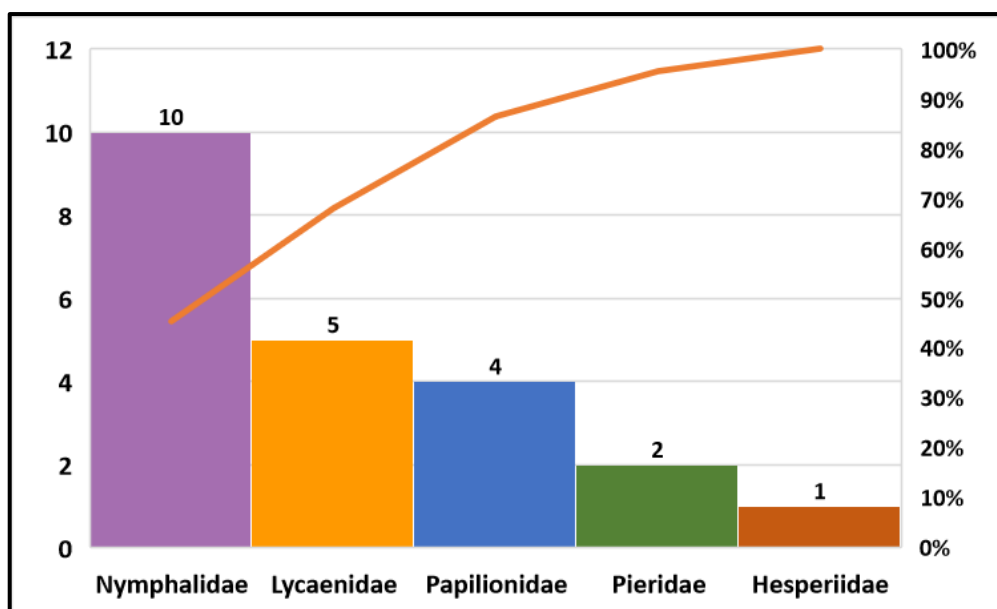
LCE Campus has five family level diversities such as Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperidae in which Common butterflies species such as Mormon, Rose, Birdwing, Emigrant, Grass yellow, Gull Wanderer, Emigrant, Small Orange Tip, Plain Orange Tip, White Orange Tip, Yellow Orange Tip, Pioneer Chocolate, Pansy, Baron, Palmfly, Bush, Brown, Eggfly, Leopard, Sailer, Evening, Brown, Eggfly, Pansy, Grey and Pansy are commonly found.

Table 9. List of Butterflies recorded in the LCE Campus

S.No.	Common Name	Scientific Name	Family
1.	Common hedge	<i>Actolepis puspa</i>	Lycaenidae
2.	Common Hedge Blue	<i>Acytolepis puspa</i>	Lycaenidae
3.	Pioneer	<i>Belenois aurota</i>	Pieridae
4.	Common mpierrot	<i>Castalius rosimon</i>	Lycaenidae
5.	Tamil yeoman	<i>Cirrochroa thais</i>	Nymphalidae
6.	Rustic	<i>Cupha erymanthis</i>	Nymphalidae
7.	Plain tiger	<i>Danaus chrysippus</i>	Lycaenidae
8.	Common crow butterfly	<i>Euploea core</i>	Papilionidae
9.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperidae
10.	Tailed jay	<i>Graphium agamemnon</i>	Papilionidae
11.	Yellow Orange Tip	<i>Ixias pyrene</i>	Pieridae
12.	Common cerulean	<i>Jamides celeno</i>	Lycaenidae
13.	Lemon pansy	<i>Junonia lemonias</i>	Papilionidae
14.	Blueokleaf	<i>Kallima horsfieldi</i>	Nymphalidae
15.	Bamboo treebrown	<i>Ithysia letheeopa</i>	Nymphalidae
16.	Gladeye bushbrown	<i>Mycalesis patina</i>	Nymphalidae
17.	Whitebar bushbrown	<i>Mycalesis anaxias</i>	Nymphalidae

18.	Common bushbrown	<i>Mycalesis perseus</i>	Nymphalidae
19.	Common sailor	<i>Neptis hylas</i>	Nymphalidae
20.	Crimson rose	<i>Pachliopta hector</i>	Nymphalidae
21.	Common Lascar	<i>Pantoporia hordonia</i>	Nymphalidae
22.	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae

Butterfly Diversity in the LCE Campus



13.3.2.3. Mammals diversity in the LCE Campus

Mammals, a group of vertebrate animals (class: Mammalia), characterized by the presence of mammary glands (where females produce milk for feeding/nursing their young), a neocortex (a region of brain), fur or hair and three middle ear bones. These characteristic features differentiate them from reptiles and birds. Observation on diversity of mammals in the LCE Campus indicated that around 5 Mammal species are commonly distributed. The commonly found mammals are Black-naped Hare, Three-striped Palm Squirrel, Common or Grey Mongoose, Indian Flying Fox, Short-nosed Fruit Bat, House Rat and Indian Mole-rat.

Table10. List of Mammals diversity in the LCE Campus

S.No.	Common Name	Scientific Name	Common Name
1.	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>	Anil
2.	Indian Flying Fox	<i>Pteropus giganteus</i>	Periya Vowaal
3.	House Rat	<i>Rattus rattus</i>	Sundeli
4.	Indian Mole-rat	<i>Bandicota bengalensis</i>	Peruchali
5.	Greater short-nosed fruit bat	<i>Cynopterus brachyotis</i>	Bat

13.3.2.4. Amphibians diversity in the LCE Campus

Amphibians (class: Amphibia) are ectothermic, tetrapod vertebrates. All living amphibians represent the group Lissamphibia and they inhabit a wide variety of habitats. Most of them living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Amphibians naturally start out as larvae living in water, but some species bypass this by developed behavioural adaptations. Observation made on diversity of Amphibians in the LCE Campus indicated that around 6 species are Amphibians are commonly distributed.

Generally, amphibians undergo metamorphosis from larva with gills to air-breathing adult with lungs. Skin of the Amphibians served as a secondary respiratory organ while very few terrestrial salamanders and frogs lack lungs and they rely entirely on their skin for respiration. With their complex reproductive needs and permeable skins, amphibians are often ecological indicators. In recent decades, there has been a drastic decline in populations of many amphibian species around the globe.

Historically, amphibians evolved in the Devonian period from sarcopterygian fish with lungs and bony-limbed fins, which were helpful them to adapt to dry land conditions. Their spread was higher and predominant during Carboniferous and Permian periods and they were later displaced by reptiles and other vertebrates. Over a period, amphibians shrank in size and their diversity decreased drastically, leaving only the modern subclass Lissamphibia. Modern amphibian orders include Anura (the frogs), Urodela (the salamanders) and Apoda (the caecilians). Number of known amphibian species is nearly 60% are frogs. Observation made in the LCE Campus on diversity of Amphibians revealed that around 3 species of Amphibians are commonly disseminated. The commonly found amphibians are listed hereuner.

13.3.2.5. Grasshopper diversity in the LCE Campus

Grasshoppers, a group of insects belonging to the suborder Caelifera and they are probably most ancient living group of chewing herbivorous insects. They are typically ground-dwelling insects with powerful hind legs which allow them to escape from threats by leaping dynamically. As a hemimetabolous insects, they do not undergo complete cycle of metamorphosis. In other word, they hatch from an egg into a nymph or "hopper" which undergoes five moults, to become identical to that of an adult. Grasshoppers hear through the tympanal organ which can be found in the first segment of the abdomen attached to the thorax; its sense of vision is compound eyes. Under certain environmental conditions, some grasshopper species at high population densities can change colour and behaviour besides form swarms. Grasshoppers are plant-eaters; few species at times become as a serious pest of cereals, vegetables and pasture, especially when they swarm to destroy the crops over huge contiguous areas. Surveillance audit at LCE Campus on diversity of Grasshoppers demonstrated that 4 species are Amphibians are commonly distributed which includes *Eyprepocnemis alacris*, *Cyrtacanthacris tartarica*, *Crucinotacris decisa* and *Aulacobothrus luteipes*.

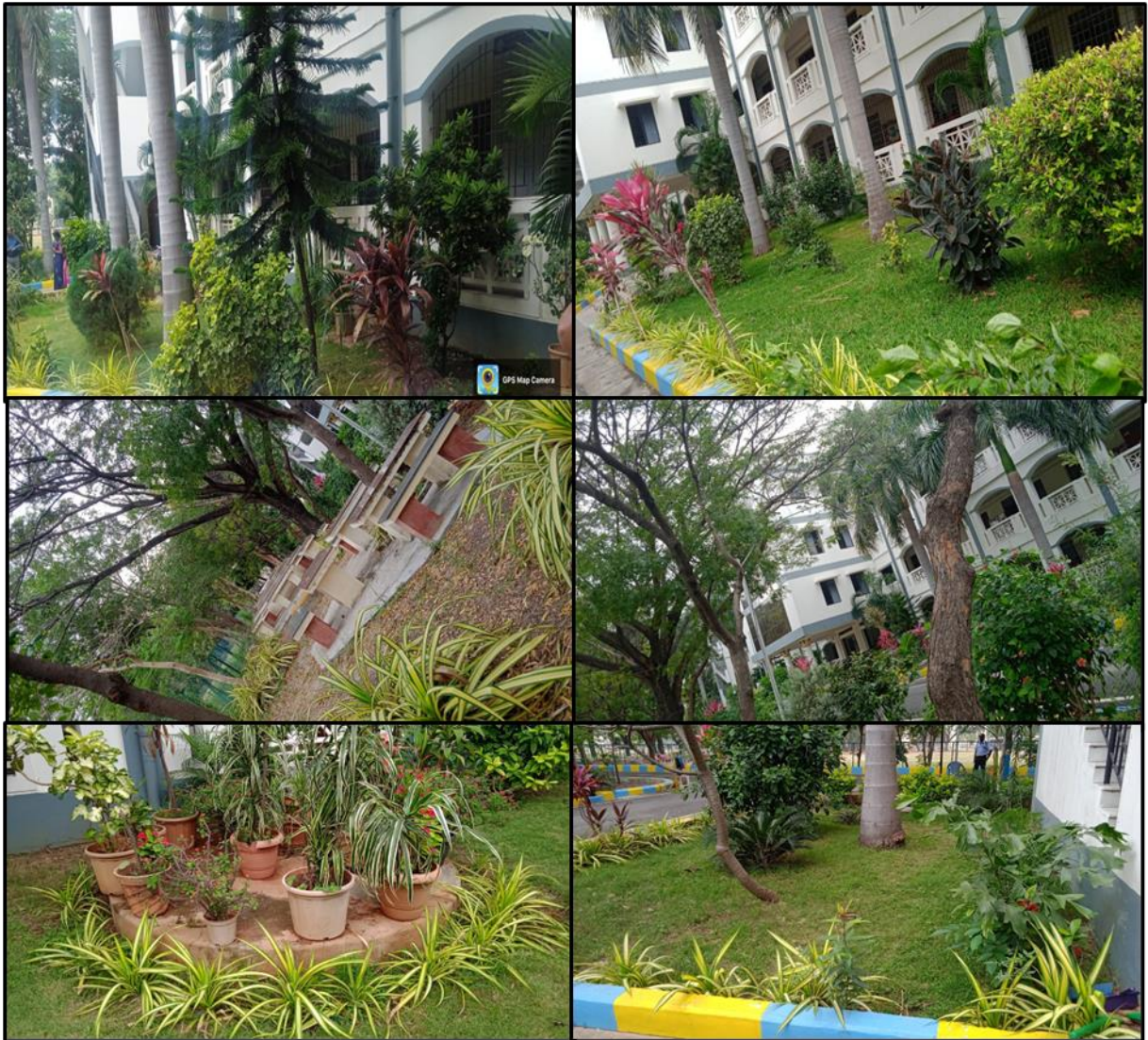
13.3.2.6. Termites Diversity in the LCE Campus

Termites are most successful groups of insects on earth, colonising most landmasses. Their colonies range in size from a few hundred individuals to enormous societies with several million individuals. Eusocial insects, commonly Termites, are taxonomically ranking as infraorder. Isoptera, or alternatively as epifamily Termitoidae, within the order Blattodea (along with cockroaches). Although Termites are habitually known as "white ants", they are not ants and they are not closely related with them. Earlier, Termites were classified as a separate order from cockroaches. Recent phylogenetic studies revealed that they evolved from cockroaches, as they are deeply nested within the group and the sister group found to wood eating cockroaches of the genus *Cryptocercus*. More recent estimates suggest that they have originated during the Late Jurassic period evidenced with the first fossil records in the Early Cretaceous. Termites mostly nourish on cellulose based dead plant material (wood, leaf litter), soil and animal dung. Two species of Termites (*Odontotermes anamallensis*, *Trivitermes fletcheri*) recorded during on-site Green Campus audit at LCE Campus and they are belonging to the Genera *Odontotermes*, *Trivitermes* and *Nasutitermes*.

13.4. An account of more Oxygen releasing and Carbon dioxide assimilating plants in the LCE Campus

There are some plants which are being considered highly efficient in oxygen releasing and carbon dioxide assimilating (Carbon sinks) which in turn reflected the quality of the green campus. If more oxygen is made available in the campus naturally, the stakeholders may be free from various cardiovascular and pulmonary problems and breathing troubles. *Sansevieria zeylanica* (commonly known as snake plant or the mother-in-law's tongue plant) is unique for oxygen release during night time and it is able to purify the atmospheric air in terms of removal of toxic gases. Although options are available to enhance the level of oxygen by reducing CO₂ with the aid of oxygenators and air purifiers, there are certain alternatives to improve the air quality which is beneficial for both body and mind. Green campus audit at LCE campus revealed that the campus is well distributed with more oxygen releasing and CO₂ assimilating plants such as *Money plant*, *Neem tree*, *Tamarind tree*, *arali*, and *Pongam* trees. There are 6 plant species which are able create an eco-friendly atmosphere in terms of reducing erosion, moderating the climate, improving air quality and supporting wildlife besides they are economically important and valued for different medicinal aspects.

The ornamental plants such as Java Plum / Jamun (*Syzygium cumini*), Yellow Trumpetbush / Yellow Bells (*Tecoma stans*) are made available. In addition, medicinal plant such as *Tinospora cordifolia* available in the campus.



Oxygen releasing and Carbon dioxide assimilating plants in the LCE Campus

Table 11. List of Oxygen releasing and Carbon dioxide assimilating, Ornamental / Medicinal plants in the LCE Campus

S.No	Plant Name (Tamil Name)	Plant Name (English)	Scientific Name	Grouping Nature	Characteristic Features of the plant
1.	Kaatu panai	Areca Palm	<i>Dypsis lutescens</i>	Monocots	O ₂ releasing Plant
2.	karpooravalli	Cuban Oregano	<i>Coleus amboinicus</i>	Monocots	O ₂ releasing Plant
3.	Kattralai	Aloe Vera	<i>Aloe barbadensis miller</i>	Dicots	O ₂ releasing Plant
4.	Kuppaimeni	Copper leaf	<i>Acalypha wilkesiabna</i>	Dicots	O ₂ releasing Plant
5.	Money Plant	Money Plant	<i>Epipremnum aureum</i>	Monocots	O ₂ releasing Plant
6.	Munkil	Bamboo	<i>Bambusa vulgaris</i>	Monocots	O ₂ releasing Plant
7.	Sembaruthi	Hibiscus	<i>Hibiscus rosa-sinensis</i>	Dicots	O ₂ releasing Plant
8.	Spiritual	Skyblue Clustervine	<i>Jacquemontia Pentanthos</i>	Dicots	O ₂ releasing Plant
9.	Thulasi	Tulsi	<i>Ocimum tenuiflorum</i>	Dicots	O ₂ releasing Plant
10.	Vembu	Neem	<i>Azadirachta indica</i>	Dicots	O ₂ releasing Plant

13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the LCE campus

Lawns are gazing features of unutilized land made to cover the soil with green grass for the ambience of the place to have a greenish look. Lawn provides a hollow space among the building structures. The shaded trees in between the grass lawn, pathways and garden benches are meaningful lineaments to the green campus. The advantage of lawn is that it prevents the unintended weeds growth in the unutilized landscape areas. Trees that are native to land with medicinal value, ethnicity and environmental value add an advantage to green building. Purpose of trees is to provide shade, atmospheric CO₂ sequestration and supply of oxygen that serves the purpose of a green campus. Herbs are small plants with medicinal values and shrubs are small plants with thick stems and can hold soil to some extent than the herbs and serve the purpose of soil erosion. Climbers can grow with the support of wall structures and the climbers can enhance the wall value with greeneries.

The LCE campus has a huge number of trees, herbal plants, bushes, climbers, lianas, twiners and lawns. It is further observed that all the plants are growing profusely and showing healthier free from pests and diseases attack. The commonly available native as well as wild shrub species in the LCE campus are *Bougainvillea spectabilis*, *Cycas revolute*, *Hibiscus rosa-sinensis*, *Ixora coccinea*, *Jasminum sambac* and *Nerium odorum*.

Similar to that of shrubs, there are 3 kinds of herbs available in the LCE campus. The predominant species of herbs available in the LCE campus are, (Croton) *Tradescantia spathaceae* and (Bright eyes) *Vinca rosea*.

The existence of climber, creepers, twiners and lianas species available which accounted more than seven species in the LCE Campus is Amirtaval (*Tinospora cordifolia*). The major grasses are Arugam Pillu (*Cynodon dactylon*), Korai Pollu (*Cyperus rotundus*) and Crowfoot grass (*Dactyloctenium aegyptium*). Weak stemmed creeper plants grow alongside the ground, depends another plant support, or climb up a wall by means of extending stems or branches. Climbers, include herbs or shrubs, whose stems are weak, which needs support to grow, where it climb up trees and walls and grow vigorously without any pest and disease attach which are observed in the LCE.



13.6. Establishment of different Gardens in LCE Campus

Growing many types of herbal plants having medicinal importance in the campus becomes more attractive and useful if concept gardens are maintained. Medicinal plant gardens can contain the locally available medicinal plants, RET (Rare Endangered Threatened) listed plants and those plants are most useful in terms of economic importance. The tree garden / arborea can be planted based on the zodiac signs which would attract the public and students, faculties, staff members, employees and educate them based on their uses. In the tree gardens, trees as linings all over the campus can act as oxygen corridors. Native trees along with trees like *Azadirachta*, *Pongamia* and *Ficus* species can be cultivated at the maximum as these plants are used to remove the dust particles and carbon lead from the air and purifies the air considerably. Similarly, the ornamental plants with beautiful flowers can be maintained in the frontage gardens of campus for attraction and good ambience. This will give an overall aesthetic look and also provide fresh air for healthy respiration to the stakeholders.

In LCE, they are planted ornamental plants for the display of appealing characteristic features including: varying types of leaves and their texture, flowers and their fragrance, fruit, stem and bark. In some places, plants unusual features also planted to be of interest, such as the prominent thorns of cactus and snake cactus. There are many varieties of ornamentals plants we are maintaining surrounding of our college campus. In front of principal's room, cafeteria, college grounds and many places planted ornamentals plants. Nearly 100 plants in different places. These plants are making the college campus pleasantly and decoratively. Every year they try to plant new varieties with help of Environmental department. Once in three months the unwanted barks of the plants are cut it down, to make the beautification of their campus. No plant is cut unless it becomes dead. Not only can visitors enjoy seeing the ornamentals plants and also humming birds, butterflies shelter in that. This environment makes campus greenish and pleasant.



13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 60-65% of the organization should have the natural features like rocks, water resources, slopes, landscape, pathways, etc. and the altered topography can be accounted for, it is facilitated. The vegetation in the land alone is considered as they are part of the natural topography. The vegetation in the artificially created structures are also accounted for when it is reported more than 70% of the claimed green campus audit site. Vegetation is the cultivation of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. Natural topography is better appreciated with wild vegetation than the artificially created topography like pathways and parking areas. The observation at the campus indicated that more than 70% natural topography and vegetation have been maintained properly. Further, there was no anthropogenic activity in some of the interior side of the campus.

13.8. Rainwater Harvesting System and Percolation Pond

Rainwater harvesting system is a traditional old practice not only in drought prone areas and also in areas having seasonal rainfall. The Indian traditional rainwater harvesting is being practiced in various parts of the country to improve the ground water status. Now the threatening features of the lower ground level of water has created a revamp of newly featured rainwater harvesting systems. Indian traditional rainwater harvesting systems are constructed based on three modes either direct pumped, indirect pumped or by gravity alone in the campus. In addition, lakes, bonds, water channels and any other water reservoir methods are considered as the rainwater harvesting system. The green campus should have adopted any of the above said modes of rainwater harvesting or any new methods that has the benefit of conserving the water resource as well. A small square shaped pit containing gravels and sands constructed near the building for rainwater harvesting and connected with pipes from the roof of the building to pit. During the audit, there having well developed rain harvesting systems such as pond like setup which surrounds the trees were observed with the LCE campus. Rainwater harvesting structures have been commissioned in the campus at different locations.



13.9. Landscape design and Soil Erosion control

Landscape management is the maintenance of land to make sure that backgrounds can fulfil the needs and objectives in an effective and sustainable manner for current and future members. It is an action that forms a perception of viable expansion, to ensure the preservation of a panorama, in order to help and harmonize alterations which are supplemented through social, monetary and environmental methods. Landscape design is an important feature for any disasters to control especially with respect to the soil erosion. In general, soil erosion occurs if the design of the land is not altered so as to prevent the slope features by strong vegetation and use of a plant buffer zone as safe for escape of nutrients or fertilizers entering the streams. When the slope features are altered, adequate vegetation can alone be enough to prevent soil erosion. The observation revealed that the LCE Campus has very good landscape design without disturbing the natural vegetation. Contour ploughing is being done at right angles to the slope wherever possible and ridges and furrows are properly maintained to break the flow of water down to the empty land. These activities are widely adopted to control soil erosion in the campus.

13.10. Operation of Water irrigation, Drip and Sprinkler Irrigation methods

Maintaining the green campus and water conservation mechanisms should be applied efficiently in the campus. Well planned water irrigation systems like sprinklers and drip should be implemented in the entire green area of the campus for an effective water management system. This can be implemented only when the plantations are well planned. The tree growing areas can be connected with drip irrigation and medicinal plants growing areas and flower gardens can be connected with sprinkler irrigation. The LCE campus has taken sufficient efforts to maintain the plants greenish and



frequency of watering to the plants. A register is maintained to note down the timing of watering the plants and quantity of water poured every time. Internal auditing of time of plantation, number of times the plants are watered and growth parameters of the plants in the campus is being carried out.

13.11. Importance of Biodiversity Conservation

The campus should be a mini biodiversity conservation area, wherein, more greenery due to native plant species, medicinal plant garden, concept gardens, flowering plants that attract bees, birds, beetles and other animals like squirrels should be monitored as ecosystems. Shade giving trees in the paths, flowering trees in the avenues and fruit trees at the back yards also would attract birds, bees, butterflies and squirrels. The LCE Campus is free of exotic plants that cause threat to the natural vegetation. It is like mini bio-reserve rich in native species and endemic plants. A complete data on the soil type, water holding capacity and soil nutrition in the campus is being thoroughly studied internally or with the Government agriculture departments. It is useful for cultivation of various native and wild plant species and also helps in choosing the proper irrigation system.



13.12. Pedestrian Path facility at the LCE campus

The concept of pedestrian path is to give safe space to walk freely by the pedestrian. It is very important in the green campus in terms of freely walk pedestrians or people going on foot without any obstacles. The pedestrian path is otherwise called as zebra crossing by the combination of black and white stripes remained to characterize the zebra. This path is specially designed space to the stakeholders to walk freely without any disturbance. It is useful for cross walk and easy to recognize to walk by means of wide black and white colour combination of lines and authorize to walk while crossing and walking on the foot. In addition, pedestrian path are created in the green campus along with road side which meant for walking only using special cement bricks and stones. The pedestrian path aims to end circulation not only cars, buses, vans, trucks and other vehicles but also giving safe space to the pedestrians, where cross and pass through blocks and also forcing vehicles to comply with it. The LCE Campus is having very good facility in creating pedestrian path for stakeholders.



13.13. Use of Biofertilizers, Organic and Green manures

Natural or eco-friendly methods should be used to grow plants vigorously in the campus which could reduce the environmental pollution. Use of biofertilizers, organic manures (cow dung, vermicompost and plant wastes and litters) and green manures to grow healthy plants in the medicinal plant garden, kitchen garden and terrace garden should be ensured to keep the campus organic. The plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts should be used to make green manures. A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but nil use of chemical fertilizers is highly appreciable and also helps to keep the campus more of an organic ecosystem. The soil, air, water and sunlight are the four major natural resources any campus gets. Proper use and conservation of these resources are mandatory in green campus audit sites. The available resources and their utilization should be accounted for from time to time. Management of the right way of utilization of these resources with the vision of sustainability should be carried out by framing a committee led by the Head of the Institution concerned. Biofertilizers such as Nitrogen fixing bacteria, Potassium and Phosphorus solubilizing bacteria, Potassium mobilizing fungi (VAM), farm yard manure, dried cow dung manure, vermicompost manures and biofungicides and biopesticides are extensively used in the LCE Campus to cultivate plants. Agrochemicals, chemical fertilizers (urea, murate of potash, sulphate of potash, rock phosphate, etc.), pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which in turn to improve the soil health significantly.

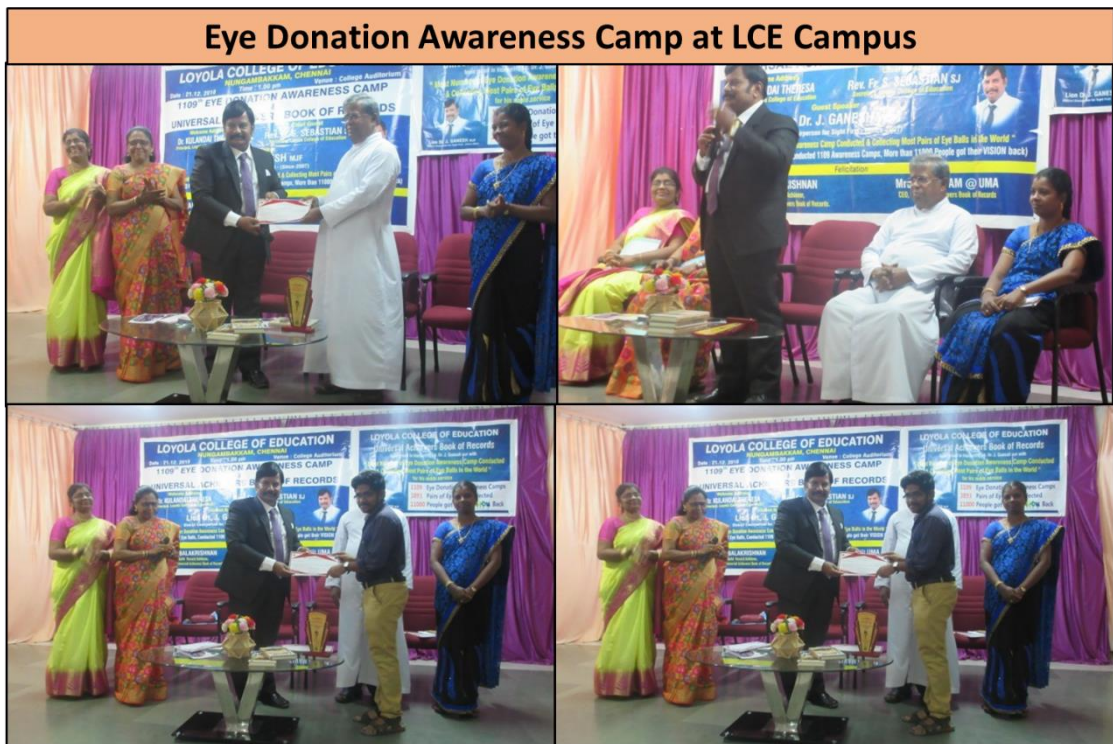
13.14. Conduct of Outreach programmes for dissemination of Green Campus motto and Green pledge initiatives by Eco club, Nature club, Associations, Cells, Forums, NCC/Student Force and NSS bodies in Green Campus initiative

Professional implementation of all the Eco plans in the campus should be done through the Eco clubs, Nature clubs, Science clubs, Youth Red cross units, Fine Arts clubs, Women cell, Associations, Forums, SSL, NCC (National Cadet Corps) and NSS (National Service Scheme). All the students, members of staff and employers should be mandatory members of the club and should do tree planting and maintenance of greenery in the campus periodically. Conducting frequent seminars, conferences, workshops, awareness rallies, etc. on topics relevant to the



environment is necessary to educate and create awareness among the students and staff members. In addition, student's associations, cells, clubs and forums should be the first hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus. The LCE Campus has well developed NCC/Student Force, NSS, Swachh Bharath Abhiyan under Clean India Mission. These bodies are actively involved in tree planting programmes and cleaning the surrounding areas of tribal, rural and

urban people. The LCE Campus is running many clubs such as Orators Club (Presentation Skills), Scholastic Tutelage (Writing Skills), Leading-Edge Rivulets (Literature Review), Photography Club, Mathematics Club, Energy Club, LSB Management Club, Blockchain Club, Robotics Club, Technology Club, Ek-Kahani Club, Social Club, Women Entrepreneurs Club, Talkspiration Club, Landscaping Club and a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people.



Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner. Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain. Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses. The LCE Campus has taken sufficient attempts to disseminate the green campus motto and green pledge such as 'Don't cut trees', 'Don't use plastic bags', 'Don't waste waters', 'Plastic Free Zones' and 'Preserve the Natural Resources' and etc. among the students and staff members in the campus.

The LCE Campus is implemented the Government schemes (Swatch Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms to people living in chennai city. These activities are very important in view of the instantaneous vicinity to undertake progressive programmes and conducted Participatory rural appraisal programmes. It is involving the socioeconomic position of the inhabitants, natural resources, traditional knowledge systems, cropping patterns, etc. of the rural and tribal people. The LCE Campus is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of the target group through the Department of Women Studies and Career Guidance. It provides the vocational training to marginal farmers to overcome the problem of seasonal employment. Some of areas identified are goat farming, mushroom cultivation, vermicomposting, bee keeping, ornamental fisheries, organic farming and medicinal plant cultivation.

The LCE Campus helps to develop social commitment and to expose the students to get sensitized to social realities and to build a link between the student community and the wider community. It enhances the social interaction, inter-personal communication skills and develop emotional maturity of students. It also helps students in total and integrated personality development. The LCE Campus facilitates to prepare the students for future life, by developing qualities such as cooperation, teamspirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

13.15. Establishment of Aquarium and Aquatic plant

Growing fishes in the small ponds will keep the environment pleasant. In the closed environment like corridors and the front offices, auditoriums and gallery classes placing the fish aquarium as well as plant aquarium will improve the scenic value of the place bringing peace to the people. The fish water waste also can be used as manure for growing potted indoor plants. Growing *Lotus*, *Lilly*, *Hydrilla* and other water plants will give a pleasant and calm environment and growing fishes like *Guppies* can keep the water clean and neat. The fountains and small ponds can be built in the frontages to give an aesthetic look and also growing water plants in these ponds will help to maintain the aesthetic sense of the environment in greenish. The LCE campus has initiated to create a good aquatic site in which aquatic plants, Fishes and birds are living generously.

13.16. Academic credentials: Projects, Dissertations and Thesis work

Project, Dissertation and Thesis works are academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches. Applied research work of the faculties, staff and student members should be implemented within the campus owing to the credential of the research. Those works indicating the significance of empowering the green campus can be implemented or adopted in other organizations. If the innovation is capable of developing into entrepreneurship, then it is highly appreciable. The Report of projects and dissertations which are productive in methodologies should be disseminated through presentation and publication in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. The LCE campus faculty members and students from various subject domains are doing extensive project work related to nature conservation, environmental pollution, soil and water analysis.

14. Best practices followed on Green Campus initiatives in the Organization

1. It is observed that the LCE campus is maintaining more than 75% of the green cover area after building construction as per the guidelines of World Green Building Council and Indian Green Building Council to provide a healthy environment and ecofriendly atmosphere to the stakeholders. It is calculated that the natural vegetation was 30% and planted vegetation was 55%.
2. The LCE campus is belonging to Chennai which provides a pure atmosphere to the stakeholders under natural environment, topology, landscape and soil erosion. The campus is established without disturbing the natural vegetation along with the artificially created topography like pathways and parking areas.
3. In view of floral biodiversity in the LCE campus, a sum 60 species belonging to 43 Genera under 25 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 12 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora like Mushrooms were recorded. It is observed that all the plants are growing profusely and showing healthier free from pests and diseases.
4. In view of faunal biodiversity in the LCE campus a total of 5 living Mammals representing two Genera under two families, visiting Mammal species (4), 22 species of birds, 3 species of Grasshopper, 2 species of Termites, 3 species of Amphibians, 3 species of Reptiles, 22 species of Butterflies and Three species Mosquitos were recorded and documented.
5. The LCE campus has established rainwater harvesting models, percolation pond to recharge the borewells by collecting rainwaters from the building roofs, open areas and playgrounds including unexplored areas which are channelized to flow of rainwaters to increase the ground water level.
6. Eco club student chapters, forums, cells, etc., established among the students from which a large number of programmes conducted on nature conservation and environmental protection to rural, tribal and urban people.
7. Gardens inside the college premises are found well maintained.

8. Nature Conservation is well maintained.
9. The campus has a maximum number of more oxygen releasing and carbon dioxide assimilating plants such as *Areca* Palm, Money plant, Neem including some of the shrub and herbal plants.

15. Recommendations for Greening

- Honey Bee hives may be kept in the campus which is free from student's mobilization. Honeybees are natural pollinators help to increase the yield potential of plants (flowers, fruits and vegetables) upto 33%.
- A complete data on the soil parameters such as pH, electrical conductivity (EC), water holding capacity (WHC), total organic carbon, available nitrogen, exchangeable potassium, available phosphorus in the campus may be studied which may be useful for the cultivation of various native and wild type plant species.
- A complete data on the water quality parameters such as pH, TSS, BOD, COD, dissolved oxygen and dissolved carbon dioxide and macro and micro elements like iron, nickel, chromium, ferric and ferrous ion concentrations may be studied for which bore well, open well, corporations, municipal RO, Aquaquad, Millipore. Distilled water rain water and may be used. It may be analysed which may be useful for the plant growth as well as to the stakeholders.
- It is recommended to develop 'Green Campus Policy', 'Energy and Environment Policy' and 'Purchase Policy' for not allowing the non-degradable plastic covers during the paking of goods with respect to nature conservation and environmental protection.
- Creating 'Medicinal Garden' and 'Vertical Garden' for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together with a minimum distance covering fruits, nuts and timber yielding plants are planted. It will be establishing by following the method of 'Miyawaki Concept' that helps build dense, native forests and to restore the natural potential vegetation, landscape management and control soil erosion.
- LCE campushas to take smart initiatives towards creating a Green Campus in the areas of green computing and waste management. The desktop infrastructure is virtualized through VMW virtualization technology.
- Use of fossil fuels has to be reduced for the sake of community health.
- Exotic grassland can be replaced by growing native grasses which yield revenue.
- The matured trees may be subjected to do white wash upto 3 feet height with limestone and neem oil mix to prevent the pests and diseases attack.
- Name Board should be kept for each tree in the Campus.

16. Conclusion

After the establishment of Loyola College of Education (LCE), Loyola College Campus, Nungambakkam, Tamil Nadu, it 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*. The LCE campus is a well-established Private Institution in which imparts quality education to rural, tribal and urban people across the Nation. This Organization is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders. The Organization has taken enormous efforts to maintain green campus to the students, research scholars, staff members and parents in a sustainable manner which reflects the importance of the environment and stakeholders. It is conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment, topology, landscape management and vegetation. The LCE campus is maintaining more than 70% of the green cover area after building construction along with 30% of natural vegetation and 55% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the LCE campus. A maximum number of more oxygen releasing and carbon dioxide assimilating plants are being maintained to provide pure atmosphere to the stakeholders. The installation of a rainwater harvesting system, percolation ponds and drip irrigation system to conserve rainwater and ground water are noteworthy in the campus. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation planting 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.

17. Acknowledgements

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Principal, PRO and IQAC coordinator of the Loyola College of Education, Loyola College Campus, Nungambakkam, Chennai- 600 034, Tamil Nadu for providing necessary facilities and co-operation extends during the Green Campus Audit. This helped us in making the audit a magnificent success. Further, we hope concept of establishing and maintenance of Green Campus proposed by the LCE Management will create Clean and Green Environment and this will be taken care of by up coming generation and propagate further.

Methodology for Flora and Fauna Identification

I. Identification of Flowering Plant Species

Various vascular plant species were identified based on the following identification key by adopting the polyphasic taxonomic approach

Key to Plant Families Identification

1a. Seeds enclosed in fruit wall, Perianth Present.....	2
b. Seeds not enclosed in fruit wall, perianth absent.....	Gymnosperm
2a. Leaves usually net veined seeds-2.....	3
b. Leaves parallel veined, seeds-1.....	66
3a. Petals free.....	4
b. petals connate.....	41
4a. Corolla and calyx present.....	5
b. Corolla and calyx absent.....	24
5a. calyx of united sepals; ovary inferior.....	31
b. Calyx of distinct or unit sepals; ovary syncarpous.....	6
6a. Sepals imbricate in bud.....	7
b. Sepals valvate in bud.....	24
7a. Sepals more or less united at the base.....	19
b. Sepals free.....	8
8a. Stamens more than 12.....	9
b. Stamens 10 or fewer.....	13
9a. Sepals 2-3.....	11
b. Sepals 4 or more.....	10
10a. Stamens inserted on the disk.....	Cleomaceae
b. Stamens inserted of the gynophore.....	Capparaceae
11a. Trees, Petals more or like the sepals; carpels free.....	Magnoliaceae
b. Herbs, petals coloured unlike the sepals; carpels united.....	12
12a. Plants with yellow sap, Flowers pedicelled.....	Papaveraceae
b. Plants with watery sap, Flowers sessile.....	Portulacaceae
13a. Flowers unisexual, gynoecium apocarpous.....	Menispermaceae
b. Flowers bisexual, gynoecium Syncarpous.....	14
14a. Petals 4, Stamens 6.....	Brassicaceae
b. Petals 5, Stamens ∞	15
15a. Ovary 1, loculated.....	16
b. Ovary 2-more loculated.....	17
16a. Flowers actinomorphic, placentas free- central.....	Caryophyllaceae
b. Flowers zygomorphic, placentas parietal.....	Viloiaceae
17a. Filaments of anthers more or less united.....	Polygalaceae
b. Filaments of anthers more or less united.....	18
18a. Leaves stipulate; stamens 5 or 10.....	19
b. Leaves exstipulate; stamens usually 8.....	Sapindaceae
19a. Style 5; stamen 5.....	Oxalidaceae
b. Style many; stamens 10.....	Zygophyllaceae

- 20a. Leaves pellucid-gland dotted Rutaceae
 b. Leaves not gland dotted21
- 21a. Placentas parietal; Fruit elongatedMoringaceae
 b. Placentas axile; Fruits not elongated22
- 22a. Ovules and seeds pendulous; sometimes horizontal.....Meliaceae
 b. Ovules and seeds erect or ascending23
- 23a. Stamens alternate with the petals..... Anacardiaceae
 b. Stamens opposite the petalsVitaceae
- 24a. Leaves simple; Flowers 3-merous.....Annonaceae
 b. Leaves compound; Flowers 4-6 merous 25
- 25a. Filaments of anther united into a columnar toothed cup.....26
 b. Filaments of anther free; rarely connate at the base in ring28
- 26a. Stamens 15; anther unitedStericuliaceae
 b. Stamens 2; anther free.....27
- 27a. Anther unilocular; pollen muricateMalvaceae
 b. Anther bilocular; pollen smoothBombacaceae
- 28a. Stamens 4-5; usually embraced and adnate to the base of the petal.....29
 b. Stamen many; atleast twice as many as and free from the petals30
- 29a. ShrubLythraceae
 b. StragglerRhamnaceae
- 30a. Anther dehisce by slits; fruits capsuleTiliaceae
 b. Anther dehisce by spores; fruits drupeElaeocarpaceae
- 31a. Ovary syncarpous; placentas 3-5, parietal.....32
 b. Ovary 1 or more free, placentas basal.....33
- 32a. Climbing herbs tendril.....Passifloraceae
 b. Erect shrubs or trees with tendril.....Turneraceae
- 33a. Ovules arising from the inner angles or from base of the carpels or loculi.....34
 b. Ovules pendulous form the apex of the carpels or locules.....Combretaceae
- 34a. Carpels solitary; fruits legume.....35
 b. Carpels more than 1; fruits otherwise.....37
- 35a. Flowers zygomorphic; petals imbricate.....36
 b. Flowers actinomorphic; petals valvate.....Mimosaceae
- 36a. Upper petals outermost stamens monodelphous or diadelphous.....Fabaceae
 b. Upper petals innermost stamens always freeCaesalpiniaceae
- 37a. Flowers unisexual.....Cucurbitaceae
 b. Flowers bisexual.....38
- 38a. Ovary 1-celled.....Cactaceae
 b. Ovary more than 1 celled.....39
- 39a. Carpels free if ultimately united the styles distinct.....40
 b. Carpels and styles united throughout.....Myrtaceae
- 40a. Flowers in dichasial – polychasial cyme.....Molluginaceae
 b. Flowers in clustered, cymes or solitary.....Aizoaceae
- 41a. Ovary inferior, stamens as many as the corolla lobes.....42
 b. Ovary superior, stamens numerous.....43
- 42a. Anther free; ovary 2-loculed; stipulate.....Rubiaceae
 b. Anther syngenesious; ovary 1-loculed, exstipulate.....Asteraceae
- 43a. Ovary 1-loculed; placentation free central.....Plumbaginaceae

b. Ovary 2-many loculed; placentation axile or parietal.....	44
44a. Ovary 3 or more carpelled.....	Sapotaceae
b. Ovary 2-carpelled.....	45
45a. Corolla actinomorphic.....	46
b. Corolla zygomorphic.....	50
46a. Plants leafless; parasitic.....	Cuscutaceae
b. Plants leafy ; not parasitic	47
47a. Leaves opposite; stamens 2.....	--48
b. Leaves alternate; stamens 4 or more	49
48a. Leaves not scabrid, corolla tube white: fruits berry	Oleaceae
b. Leaves scabrid; corolla tube orange; fruits capsules	Nyctanthaceae
49.a. Anther inseperatable; corona present	Asclepidiaceae
b. Anther seperatable; corona absent	Apocyanaceae
50a. Corolla lobes imbricate ;fruit drupe	Boraginaceae
b. Corolla lobes plicate; fruit capsule	Convolvulaceae
51.a Ovary cells many ovulated	Solanaceae
b. Ovary cells 1-4 ovuled.....	52
52.a Carpels 2 or more ovulated ; fruits dehiscent	53
b. Carpels 1 –ovulated ; fruits indehiscent	57
53.a Fruits dehiscent; seeds supported on reticulae.....	Acanthaceae
b. Fruits indehiscent; seeds not supported on reticulae.....	54
54.a. Leaves compound; fruits elongated; seeds winged	Bignoniaceae
b. Leaves simple;fruits not elongated, seeds not winged.....	55
55.a. Ovules many on swollen placentas; seeds albuminous.....	Scropulariaceae
b. Ovules 2 lobed placenta ; seeds not albuminous.....	56
56.a Flowers solitary; axile placentation	Pedaliaceae
b. Flowers raceme; axile placentation.....	Marytiniaceae
57.a Ovary entire, style terminal	Verbinaceae
b. Ovary 4 –lobed, style gynobasic.....	Lamiaceae
58.a Flower bisexual	59
b. Flower unisexual	62
59.a. Ovary inferior	60
b. Ovary superior	61
60.a Ovary 4-6 loculated; ovules many	Aristolochiaceae
b. Ovary 1-loculated; ovules 1-4	Santalaceae
61.a Perianth not tubular	Amarathaceae
b. Perianth trubular	Nyctaginaceae
62a. Leafless trees; brachlets ribbed and joined at the nodes.....	Casuarinaceae
b. Leaves well developed ; brachlets not ribbed and not joined at the nodes.....	63
63 a. Ovary 1- loculed; ovules 1-2 in each loule.....	64
b. Ovary 2 or more loculed;ovules 1 or 2 in each locule.....	65
64a. Leaves glandular.....	Euphorbiaceae
b. Leaves eglandular.....	Urticaceae
65a. Filaments inflexed in bud with reversed anther.....	Moraceae
b. Filaments not inflexed in bud, not with reversed anther.....	Ulmaceae
66a. Terrestrial or epiphytic.....	67
b. Aquatic, marsh or riparian.....	Cyperaceae

- 67a. Arborescent woody; leaf blade many nerved articulate with sheath...Bambusaceae
 b. Herbs with herbaceous culms; leaf blade sessile not articulate with sheath.....68
- 68a. Perianth 0 or reduced to scale.....Araceae
 b. Perianth present.....69
- 70a. Plant armed.....71
 b. Plant unarmed.....72
- 71a. Plants Xerophytic; leaves fibrous.....Agavaceae
 b. Plants not xerophytic; leaves nor fibrous.....Liliaceae
- 72 a. Perianth segments connate.....Amaryllidaceae
 b. Perianth segments free.....73
- 73a. Outer perianth calycine; inner coroline.....Commelinaceae
 b. Outer and inner perianth.....74

II. Identification of Non-Flowering Plant Species

Lichen samples were identified based morphological, biochemical and anatomical features and representative samples were compared with the voucher specimens at the Lichen Herbarium Centre of National Botanical Research Institute (NBRI), Lucknow, Uttar Pradesh, India.

Key to identify the Lichen Genera

Key to Genera

- 1 a. Photobiont cyanobacterium*Leptogium cyanascens*.
 1 b. Photobiont green alga2
2. Thallus leprose, crustose.....Group I
3. Thallus foliose.....Group II
4. Thallus fruticose.....Group III

Group I

- 1 a. Thallus leprose,.....*Chrysothrix chlorina*
 1 b. Thallus crustose.....*Graphis* sp

Group II

- 1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc*Pseudocyphellaria*
 1 b. Thallus lacking pseudocyphellae2
- 2 a. Upper cortex thick walled longitudinally oriented, conglutinate hyphae.....3
 2 b. Upper cortex otherwise.....4
- 3 a. Thallus lower side canaliculated zeorin, norstictic and salazinic acids, and unknown pigments and triterpenoids present.....*Heterodermia leucomelos*
 3 b. Thallus lower side no canaliculated only in medulla.....*Heterodermia diademata*
- 4 a. Cilia bulbate at the base, thallus grey to grey brown*Bulbothrix*
 4 b. Cilia present or absent, not bulbate.....5
- 5 a. Rhizines dichotomously branched present throughout the margins....*Hypotrachyna*
 5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining.....6
- 6 a. Lobes narrow, long, dichotomously branched, canaliculate.....*Everniastrum*
 6 b. Lobes otherwise.....7
- 7 a. Lobe margins ciliate.....8
 7 b. Lobe margins eciliate.....9

8 a. Salazinic acid present K ⁺ Red cortex.....	10
8 b. Salazinic acid absent	11
9 a. Thallus with isidia.....	<i>Parmotrema tinctorum</i>
9b Thallus with soredia.....	12
10 a. thallus emaculate.....	<i>P.stuppeum</i>
10 b. thallus maculate.....	<i>P.reticulatum</i>
11 a. Protolichesternic acid in medulla	<i>P.grayanam</i>
11 b. Alecoronic acid in medulla.....	<i>P. nilgherrense</i>
12 a. Thallus large lobed, loosely attached, mainly corticolous	<i>P. austrosinense</i>
12 b. Thallus smaller, closely to strongly attached, saxicolous.....	<i>P.defectum</i>

Group III

1 a. Squamules in thallus.....	<i>Cladonia</i> sp
1 b. Squamules absent in thallus	2
2 a. Thallus flat, strap shaped or palmately lobed.....	<i>Ramalina</i>
2 b. Thallus round to angular in section	3
3 a. Thallus bright yellow to orange, K ⁺ purple... ..	<i>Teloschistes</i>
3 b. Thallus greenish grey or yellowish grey pendent or erect.....	4
4 a. Medulla K ⁺ red Stictic acid present	<i>Usnea stigmatoides</i>
4 b. Medulla K ⁻ norstictic psoromic acid present.....	<i>Usnea dasaea</i>

III. Identificayion of Algae Genera

Algae identification key consists of couplets of characteristics using algal description of the specimen based on morphological characterization from 58 Genera to species level identification as per the comprehensive key.

Key to identify the Algae species

1A. Plant pigments contained in chromatophores or chloroplasts	10
1B. Plant pigments not contained, but diffused through protoplast	2
2A. Plants filamentous; cells arranged in trichomes	4
2B. Plants colonial, not filamentous	3
3A. Cells in regular rows, in multiples of four;	<i>Agmenellum</i>
3B. Cells somewhat evenly arranged toward periphery of spherical colony; barely visible gelatinous strands radiate from center of colony to cells	<i>Gomphosphaeria</i>
3C. Colony asymmetrical; cells very dense and unevenly distributed	<i>Anacystis</i>
4A. Filaments straight or slightly flexed	6
4B. Filaments curved, twisted, or spiralled	5
5A. Heterocysts and akinetes present	<i>Anabaena</i>
5B. Heterocysts absent	<i>Raphidiopsis</i>
6A. Heterocysts present	9
6B. Heterocysts absent	7
7A. Filaments without a sheath; cells discoid	<i>Oscillatoria</i>
7B. Filaments with distinct sheath	8
8A. Trichomes tangled; sheaths confluent	<i>Phormidiwn</i>
8B. Trichomes separate; sheaths not confluent	<i>Lyngbya</i>
9A. Heterocysts terminal	<i>Cylindrospermum</i>
9B. Heterocysts intercalary	<i>Aphanizomenon</i>

10A. Cell walls without punctae or striae -----	31
10B. Cell walls rigid, ornamented with punctae or striae -----	11
11A. Frustules adiametric, two or more times longer than wide, elongate -----	15
11B. Frustules isodiametric, generally shorter in length than in diameter, round or elliptical or ovoid or nearly so -----	12
12A. Frustules elliptical or ovoid or nearly so -----	14
12B. Frustules discoid or nearly so -----	13
13A. Valves radially punctate -----	<i>Stephanodiscus</i>
13B. Valves with two concentric regions, the inner being smooth -----	<i>Cydotella</i>
14A. Frustules with marginal keel containing a raphe -----	<i>Surirella</i>
14B. Frustules with a pseudoraphe or with a raphe not in a marginal keel ---	<i>Cocconeis</i>
15A. Frustules cylindrical arranged end to end into filament -----	<i>Melosira</i>
15B. Frustules not arranged into filaments -----	16
16A. Frustules with a raphe in at least one valve -----	21
16B. Frustules without a raphe in either valve, pseudoraphe evident -----	17
17A. Frustules united in zigzag chains -----	<i>Tabellaria</i>
17B. Frustules not in zigzag chains -----	<i>Pseudoraphe</i>
18A. Frustules united laterally -----	<i>Fragilaria</i>
18B. Frustules not united laterally -----	19
19A. Frustules united apically forming spokelike colony -----	<i>Asterionella</i>
19B. Frustules not forming spokelike colony -----	20
20A. Frustules needle shaped without costae -----	<i>Synedra</i>
20B. Frustules with prominent costae -----	<i>Diatom</i>
21A. Frustules sigmoid or "S" shaped -----	<i>Gyrosigma</i>
21B. Frustules not sigmoid -----	22
22A. Frustules longitudinally symmetrical, other than lunate in valve view -----	25
22B. Frustules with raphe in both valves, longitudinally asymmetrical, lunate -----	23
23A. Valves with transverse costae -----	<i>Epithemia</i>
23B. Valves without transverse costae -----	24
24A. Raphe a smooth curve with well defined central and polar nodules ----	<i>Cymbella</i>
24B. Raphe not a smooth curve, gibbose with marginal central nodule -----	<i>Amphora</i>
25A. Frustules with raphe in both valves -----	27
25B. Frustules with pseudoraphe in one valve and raphe in other valve -----	26
26A. Frustules wedge-shaped in girdle view and cuneate in valve -----	<i>Rhoicosphenia</i>
26B. Frustules shaped otherwise -----	<i>Achnanthes</i>
27A. Raphe extended length of valve; polar nodules; central nodules lacking -	<i>Eunotia</i>
27B. Raphe restricted to polar regions -----	28
28A. Raphe located in a canal -----	<i>Nitzschia</i>
28B. Raphe not located in a canal -----	29
29A. Frustules with symmetrical valves -----	30
29B. Frustules with valves symmetrical but asymmetrical -----	<i>Gomphonema</i>
30A. Valves with transverse costae -----	<i>Pinnularia</i>
30B. Valves with transverse punctae -----	<i>Navicula</i>
31A. Cells solitary -----	45
31B. Cells colonial or grouped -----	32
32A. Cells enclosed in conical to cylindrical lorica; joined lorica have treelike appearance -----	<i>Dinobryon</i>

32B. Cells and lorica without treelike appearance -----	33
33A. Colony discoid, one cell in thickness; cells in concentric rings -----	<i>Pediastrum</i>
33B. Colony not discoid -----	34
34A. Colonies spherical or globose -----	40
34B. Colonies not spherical -----	35
35A. Colony with elongate cells radiating from common center -----	<i>Actinastrum</i>
35B. Colony with cells not radiating from common center -----	36
36A. Colony with four to eight cells positioned in linear series -----	<i>Scenedesmus</i>
36B. Colony with cells not in linear series -----	37
37A. Colony with arcuate to lunate cells with apices acutely -----	<i>Selenastrum</i>
37B. Colony with spherical to broadly ellipsoidal cells -----	38
38A. Cells without spines or setae -----	<i>Crucigenia</i>
38B. Cells with spines or setae -----	39
39A. Cells quadrate, closely apposed; free face of each cell with spines ----	<i>Tetrastrum</i>
39B. Cells quadrate and united; free face cell with long delicate setae ---	<i>Micractinium</i>
40A. Colony with biflagellated cells -----	<i>Pandorina</i>
40B. Colony with nonflagellated cells -----	41
41A. Cells lunate to sickle shaped -----	<i>Kirchneriella</i>
41B. Cells spherical or nearly so -----	42
42A. Cells borne terminally on dichotomously branched threads ----	<i>Dictyosphaerium</i>
42B. Cells not on dichotomously branched threads -----	43
43A. Colony a hollow sphere -----	<i>Coelastrum</i>
43B. Colony not a hollow sphere -----	44
44A. Colony surrounded by gelatinized and expanded parent cell wall -----	<i>Oocystis</i>
44B. Colony with cells equidistant and toward periphery -----	<i>Sphaerocystis</i>
45A. Cells with median constriction dividing cell into two distinct halves -	<i>Cosmarium</i>
45B. Cells without pronounced median constriction -----	46
46A. Cells nonflagellated -----	53
46B. Cells flagellated -----	47
47A. Cell walls without polygonal plates -----	49
47B. Cell walls with polygonal plates -----	48
48A. Cells walls of thick plates with distinct sutures -----	<i>Peridinium</i>
48B. Cells walls with faintly distinct plates and sutures -----	<i>Glenodinium</i>
49A. Cells uniflagellate -----	52
49B. Cells biflagellate -----	50
50A. Cells with two flagella of equal length -----	<i>Chlamydomonas</i>
50B. Cells with two flagella of unequal length -----	51
51A. Cells with single chromatophore -----	<i>Chroomonas</i>
51B. Cells with 2 large chromatophores -----	<i>Cryptomonas</i>
52A. Cells surrounded by distinct lorica -----	<i>Trachelomonas</i>
52B. Cells without lorica; fusiform to acicular shaped; posterior end -----	<i>Euglena</i>
53A. Cells acicular to fusiform with ends tapering into long spines -----	<i>Schroederia</i>
53B. Cells without ends tapering into long spines -----	54
54A. Cells without setae -----	56
54B. Cells with setae -----	55
55A Cells with subpolar or both subpolar and equatorial long setae -----	<i>Chodatella</i>
55B Cells with multiple peripheral long delicate setae -----	<i>Golenkinia</i>

- 56A Cells long, slender, and tapered at both ends -----*Ankistrodesmus*
 56B Cells flattened or isodiametric, triangular, quadrangular -----*Tetraedron*

IV. Identification of Major Groups of Mushrooms

Mushrooms are belonging to fungal kingdom which are edible and non-edible in nature. They represented in various colours starting from white, black, brown, red and pale yellow rot fungi. They are identified based on the following characterization key

Key to identify the Mushrooms species

1. Mushroom growing on other mushrooms or the decayed remains ----- *Mycotrophs*
2. Growing shelflike on wood (or, if not, then gills *concentric* rather than radial); mushroom *very* tough and leathery, corky, or woody (try tearing it in half); gills tough and hard, sometimes maze-like; cap frequently (but not always) with concentric zones of colour -----*Polypores*
3. Gills running down the stem, not platelike and thus not easily separable from the cap and stem (try removing an entire "gill" with your fingers or a sharp object); mushroom usually *not* growing on wood -----*Chanterelles and Trumpets*
4. Gills not as above; mushroom growing on wood or elsewhere ----*Gilled Mushrooms*
5. Stem absent--or, if present, lateral, Flesh in stem tough----- *Polypores*
6. Raphe a smooth curve with well defined central and polar nodules -----*Cymbella*
7. Raphe not a smooth curve, gibbose with marginal central nodule -----*Amphora*
8. Frustules with raphe in both valves -----27
9. Frustules with pseudoraphe in one valve and raphe in other valve -----26
10. Colony with cells not radiating from common center -----36
11. Colony with four to eight cells positioned in linear series -----*Scenedesmus*
12. Colony with cells not in linear series -----37
13. Colony with arcuate to lunate cells with apices acutely-----*Selenastrum*
14. Cells acicular to fusiform with ends tapering into long spines -----*Schroederia*
15. Cells without ends tapering into long spines -----54
16. Cells without setae -----56
17. Cells with setae -----55
- 18 Cells with subpolar or both subpolar and equatorial long setae -----*Chodatella*
19. Raphe extended length of valve; polar nodules; central nodules lacking ----*Eunotia*
20. Raphe restricted to polar regions -----28
21. Raphe located in a canal -----*Nitzschia*
22. Filaments with distinct sheath -----8
23. Trichomes tangled; sheaths confluent -----*Phormidiwn*
24. Trichomes separate; sheaths not confluent -----*Lynngbya*
25. Heterocysts terminal -----*Cylindrospermum*
26. Heterocysts intercalary -----*Ahphanizomenon*
27. Cell walls without punctae or striae -----31
28. Cell walls rigid, ornamented with punctae or striae ----- 11
29. Frustules adiametric, two or more times longer than wide, elongate -----15
30. Frustules isodiametric, generally shorter than round or elliptical or ovoid ----- 12
31. Frustules elliptical or ovoid or nearly so -----14
32. Frustules discoid or nearly so -----13
33. Valves radially punctate -----*Stephanodiscus*

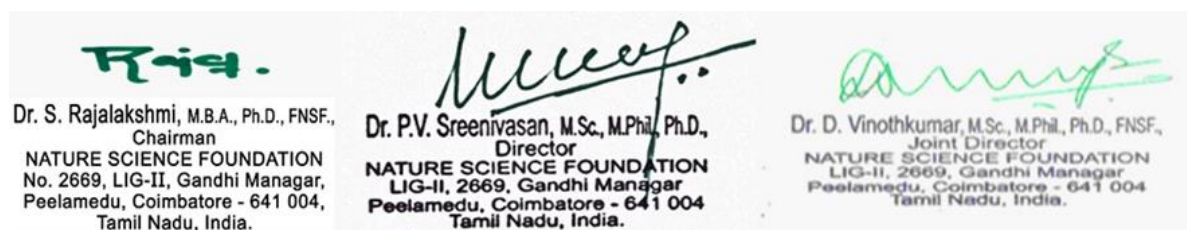
34. Valves with two concentric regions, the inner being smooth -----*Cydotella*
 35. Frustules with marginal keel containing a raphe -----*Surirella*
 36. Frustules with a pseudoraphe or with a raphe not in a marginal keel ----*Cocconeis*
 37. Cap round in outline; pore surface not running down the stem, or only slightly running down the stem; spore print not white -----*Boletes*
 38. Mushroom with spines or "teeth"--either on the underside of a cap, or hanging from a branched structure, or clumped in an indistinct mass -----*Toothed Mushrooms*
 39. Mushroom covered in some part with a foul-smelling slime; arising from a soft underground "egg"; variously shaped (like a club or stick, like crab claws, like a lantern, like a Wiffle ball, etc.); frequently found in woods----- *Stinkhorns*
 40. Mushroom more or less shaped like a ball, or like a ball raised up on a stem, or like a ball set on a starfish----- *Puffballs*
 41. Cap shape convex to centrally depressed or vase-shaped; undersurface, smooth, wrinkled, or gill-like; fruiting embedded -----*Chanterelles*
 42. Cap shape oval, pointed, lobed, saddle-shaped, irregular, or thimble-like (never vase-shaped or convex); undersurface absent, or hard to see or define; many (but definitely not all) species fruiting----- *Trumpets*
 43. Stem completely hollow, or hollow with cottony fibers inside; cap with pits and ridges, or longitudinally wrinkled, or fairly smooth (never lobed or convoluted); without reddish or reddish brown shades; found in spring----- *Morels & Verpas*
 44. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black; stem surface ribbed or "pocketed" in some species -----*Saddles*
 45. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black -----*Oddballs & Misfits*

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MAJOR ACTIVITY		SERVICES	
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL	
NAME OF UNIT(S)		S.No. Name of Unit(s) 1 Green Campus, Energy and Environment Management Audits	
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DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE		28/11/2017	
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS		12/03/2020	
NATIONAL INDUSTRY CLASSIFICATION CODE(S)		S.No. NIC 2 Digit NIC 4 Digit NIC 5 Digit Activity 1 69 - Legal and accounting activities 6920 - Accounting, bookkeeping and auditing activities; tax consultancy 69201 - Accounting, bookkeeping and auditing activities Services 2 85 - Education 8542 - Cultural education 85420 - Cultural education Services 3 85 - Education 8549 - Other education n.e.c. 85499 - Other educational services n.e.c. Services	
DATE OF UDYAM REGISTRATION		26/02/2022	

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PROCEEDINGS OF THE COMMISSIONER OF INCOMETAX (EXEMPTIONS),
III FLOOR, ANNEXE BLDG, NO.121, MAHATMA GANDHI SALAI, CHENNAI-34

Present : G.M.DOSS, I.R.S
Commissioner of Income Tax (Exemptions)

** URNo. AACTN7857J/05/18-19/T-1105

Dated:03/09/2018

Sub: Registration u/s. 12AA of the Income tax Act 1961 - in the case of

“Nature Science Foundation”

LIG-II, 2669, Gandhima Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 28/03/2018

ORDER UNDER SECTION 12AA OF THE INCOME TAX ACT 1961.

1. The above Trust/Society/Association/ Company/ others/, bearing PAN AACTN7857J was constituted by Trust Deed / Memorandum of Association dated 29/11/2017 registered with Sub-Registrar's Office/ Registrar of Societies/Registrar of Companies/others on 29/11/2017.
2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~
3. The above TRUST filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.
4. On going through the objects of the TRUST and its proposed activities as enumerated in the Trust Deed / Memorandum of Association, I am satisfied about the genuineness of the TRUST as on date.
5. The application has been entered at Sl.No.1105 maintained in this office. The above Trust is accordingly registered as a PUBLIC CHARITABLE TRUST u/s 12 AA of the Income Tax Act, 1961 with effect from 29/11/2017.
6. It is hereby clarified that the Registration so given to the Trust/Institution is not absolute. Subsequently, if it is found that the activities of the Trust/Institution are not genuine or are not being carried out in accordance with the objects and clauses of the Trust Deed / Memorandum of Association submitted at the time of registration or modified with the approval of the Commissioner of Income-tax (Exemptions), Chennai or there is a violation of the provisions of Section – 13, the Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the Trust/Society/Association/Company/ Others/ complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961.
7. Granting of Registration u/s 12AA does not confer any automatic exemption of income from taxation. The Trust/Institution should conform to the parameters laid down in Sections 11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.

** This Unique Registration No. URNo. AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income-tax(Exemptions), Chennai.

Copy to:

1. The Assessee.
2. The ACIT(Exemptions), Coimbatore Circle.
3. Office Copy.

//CERTIFIED TRUE COPY//

(N SRINIVASA RAO)
Asst. Commissioner of Income-tax (H.Qrs)(Exemptions),
Chennai.

GOVERNMENT OF INDIA
INCOMETAX DEPARTMENT

OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
Aayakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URNo. AACTN7857J/05/18-19/T-1105/80G

Date: 10.04.2019

Name of the Trust-/Society /Company/Institution : NATURE SCIENCE FOUNDATION
Address : LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004
PAN : AACTN7857J
Date of Application : 12.11.2018

Received
Rajiv S. Ponnudurai
17/07/2019

APPROVAL UNDER SECTION 80G(5)(vi) OF THE INCOME TAX ACT, 1961

The aforesaid Trust-/Society/Company/Institution has been registered u/s.12AA of the Income Tax Act with effect from 29.11.2017 vide AACTN7857J/05/18-19/T-1105 dated 03.09.2018. It is certified that donation made to NATURE SCIENCE FOUNDATION at LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004 shall qualify for deduction u/s 80G(5)(vi) of the Income Tax Act, 1961, subject to the fulfillment of conditions laid down in clauses [i] to [v] of sub-section (5) of section 80G of the I.T Act, 1961.

- This approval shall be valid in perpetuity with effect from A.Y. 2019-20 unless specifically withdrawn. The details and validity of the certificate is available @ office.incometaxindia.gov.in
- The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually to the Assessing Officer having jurisdiction over the case.
- No change in the Trust Deed/Memorandum of Association shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai**.
- Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. **URNo. AACTN7857J/05/18-19/T-1105/80G** and date of this order i.e. **10.04.2019**.
- Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income Tax (Exemptions)
Chennai.

Copy to:

- The applicant
- Guard File
- The DCIT(Exemptions) Coimbatore Circle.

//Certified True Copy//

(N. SRINIVASA RAO)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

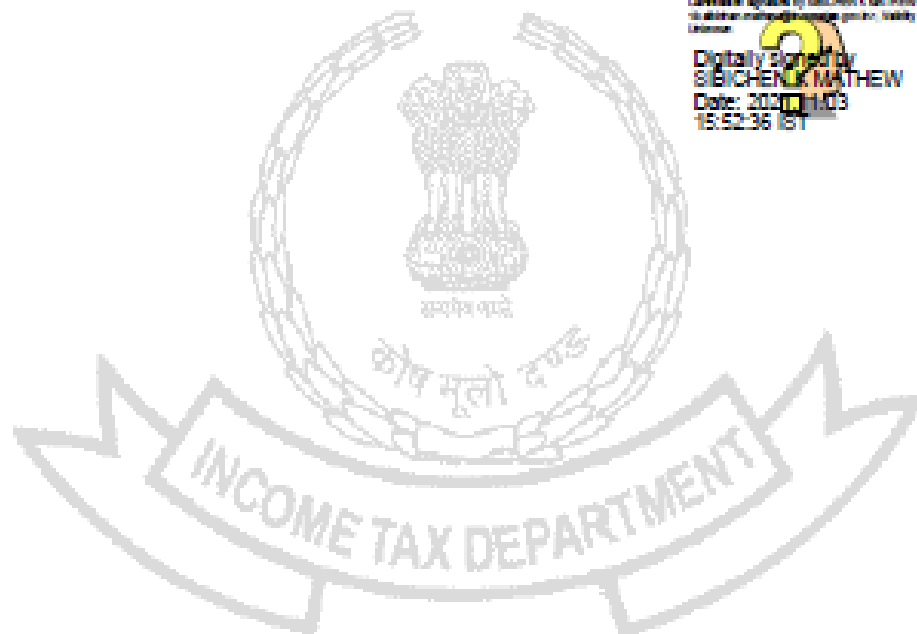
FORM NO. 10AC

(See rule 17A/11AA/2C)

Order for registration

1	PAN	AACTN7857J
2	Name	NATURE SCIENCE FOUNDATION
2a	Address	
	Flat/Door/Building	LIG-II, 2669
	Name of premises/Building/Village	GANDHIMAA NAGAR.
	Road/Street/Post Office	Coimbatore South
	Area/Locality	COIMBATORE
	Town/City/District	Gandhimasnagar S.O
	State	Tamil Nadu
	Country	INDIA
	Pin Code/Zip Code	641004
3	Document Identification Number	AACTN7857JE2021501
4	Application Number	739995830271021
5	Unique Registration Number	AACTN7857JE20215
6	Section/sub-section/clause/sub-clause/proviso in which registration is being granted	01-Sub clause (i) of clause (ac) of sub-section (1) of section 12A
7	Date of registration	03-11-2021
8	Assessment year or years for which the trust or institution is registered	From AY 2022-23 to AY 2026-2027
9	Order for registration:	
	a. After considering the application of the applicant and the material available on record, the applicant is hereby granted registration with effect from the assessment year mentioned at serial no 8 above subject to the conditions mentioned in row number 10.	
	b. The taxability, or otherwise, of the income of the applicant would be separately considered as per the provisions of the Income Tax Act, 1961.	
	c. This order is liable to be withdrawn by the prescribed authority if it is subsequently found that the activities of the applicant are not genuine or if they are not carried out in accordance with all or any of the conditions subject to which it is granted, if it is found that the applicant has obtained the registration by fraud or misrepresentation of facts or it is found that the assessee has violated any condition prescribed in the Income Tax Act, 1961.	
10	Conditions subject to which registration is being granted	
	The registration is granted subject to the following conditions:-	

	o. This certificate cannot be used as a basis for claiming non-deduction of tax at source in respect of investments etc. relating to the Trust/ Institution.
	p. All the Public Money so received including for Corpus or any contribution shall be routed through a Bank Account whose number shall be communicated to Office of the Jurisdictional Commissioner of Income Tax.
	q. The applicant shall comply with the provisions of the Income Tax Act, 1961 read with the Income Tax Rules, 1962.
	r. The registration and the Unique registration number has been instantly granted and if, at any point of time, it is noticed that form for registration has not been duly filled in by not providing, fully or partly, or by providing false or incorrect information or documents required to be provided under sub-rule (1) or (2) of rule 17A or by not complying with the requirements of sub- rule (3) or (4) of the said rule, the registration and Unique Registration Number (URN), shall be cancelled and the registration and URN shall be deemed to have never been granted or issued.
Name and Designation of the Registration Granting Authority	Principal Commissioner of Income Tax/ Commissioner of Income Tax (Digitally signed)



Certificates of Green Campus Auditors

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.
6. Botanist and Subject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
7. Bureau of Energy Efficiency (BEE) and National Productivity Council of Er. N. Dineshkumar and Dr. N. Balasubramanian, Energy Auditors of NSF.



Certificate of Training

TNV hereby certifies that

S. Rajalakshmi

has successfully completed the 5 days

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

ISO 14001:2015

Issue Date: 17th Jun. 2021

Training Date : 20th to 24th May. 2021

Certificate Number : 2106170721010105

Authorised Signatory
(Pragyesh Singh)

This course is certified by Exemplar Global vide registration number TN006669

Note: The course conforms to the principles and practice of audits of Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For verification of this certificate, please write to Mail: info@isoindia.org



**PR315: ISO 14001:2015 Lead Auditor
(Environmental Management Systems)
Training course**

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

A handwritten signature in black ink, appearing to be "G. Alagarsamy".

for TÜV NORD CERT GmbH

Essen, 2019-04-26

The course is certified by CQI and IRCA (Certification No. 18125). The learner meets the training requirements for those seeking certification under the IRCA EMS Auditor certification scheme.

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com







Medicinal Plants Farmes 1999-2000
Kuppayee Thottam, Vadugampalayam Privu,
Gobi.

ATTENDANCE CERTIFICATE
FOR INSITUTIONAL TRAINING

This is to Certify that Mr. D. VINOTHKUMAR
of B.Sc., BOTANY FINAL YEAR of
Chikkaiah Naicker College, Erode-4. Has undergone institutional training in Plantation, Cultivation
and Collection of medicinal plants for 14 days from 18.12.99 to
31.12.99 at Gobi.

Station : GOBI
Date : 31.12.99

M. R. SARAVANAN, SCIENTIST
HERBAL
GOBI-638476

m. m. r. saravanan
SIGNATURE OF THE CONCERNED AUTHORITY
M. R. SARVANAN, GOBI



BUREAU OF ENERGY EFFICIENCY



Examination Registration No. : **EA-14056** Serial Number **9176**

Certificate Registration No. : **9176**

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. **Dinesh Kumar D** Son/Daughter of Mr./Mrs. **R M Dhanasekaran** who has passed the National Examination for certification of energy manager held in the month of **October 2011** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number **9176** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. **Dinesh Kumar D** is deemed to have qualified for appointment or designation as energy manager under clause (f) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).


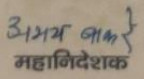
Given under the seal of the Bureau of Energy Efficiency, this **7th** day of **February, 2013**


Secretary
Bureau of Energy Efficiency
New Delhi

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

Regn. No. EA-7391		Certificate No. 5093
National Productivity Council (National Certifying Agency)		
<u>PROVISIONAL CERTIFICATE</u>		
This is to certify that Mr. / Ms. <u>N. Balasubramaniam</u> son / daughter of Mr. <u>M. Nanjukkuttigounder</u> has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.		
He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.		
He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.		
This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.		
Place : Chennai, India		
Date : 11 th February 2010		Controller of Examination

	
ऊर्जा दक्षता ब्यूरो BUREAU OF ENERGY EFFICIENCY विद्युत मंत्रालय, भारत सरकार MINISTRY OF POWER, GOVERNMENT OF INDIA	
प्रमाणित किया जाता है कि	
श्री/श्रीमती <u>दिनेश कुमार</u> ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए <u>7 दिसंबर '16</u> से <u>8 दिसंबर '16</u> तक एमएनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।	
This is to certify that	
Shri/Smt. <u>Dinesh Kumar</u> has successfully completed the Master Trainer Certificate Programme conducted by MNIT / CEPT / IIT from <u>7 December '16</u> to <u>8 December '16</u> for the Energy Conservation Building Code.	
New Delhi, <u>07 JUL 2017</u>	 महानिदेशक Director General

	<p>GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT</p> <p>DINESH KUMAR D</p> <p>HAS ATTAINED THE DESIGNATION OF</p> <p>LEED AP[®] Building Design + Construction</p> <p>by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED[®] green building program.</p>
<p>10531234-AP-BD+C</p> <hr/> <p>CREDENTIAL ID</p> <p>26 DEC 2016</p> <hr/> <p>ISSUED</p> <p>25 DEC 2022</p> <hr/> <p>VALID THROUGH</p>	<p><i>Mahesh Ramaniyam</i></p> <hr/> <p>MAHESH RAMANU JAM PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.</p>

	
<p>GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT</p>	
<p>GRIHA CERTIFIED PROFESSIONAL CERTIFICATE</p>	
<p>This is to certify that</p>	
<p><u><i>Dinesh Kumar Dhanasekaran</i></u></p>	
<p>has qualified as a GRIHA Certified Professional For V. 2015</p>	
<p>Date of issue: 19th June 2020 Note : This certification is valid only for GRIHA version 2015.</p>	<p><i>[Signature]</i> Chief Executive Officer GRIHA Council</p>

TECHNICAL REPORT OF WASTE MANAGEMENT AUDIT



Submitted to

**LOYOLA COLLEGE OF EDUCATION,
LOYOLA COLLEGE CAMPUS, NUNGAMBAKKAM
CHENNAI – 600 034, TAMIL NADU**

Date of Audit: 31.01.2023

Valid till: 01.02.2025

Submitted by



NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)

**ISO 9001:2015, 14001:2015, 45001:2018 & 50001:2018 Certified and Ministry of
MSME Registered Organization**

**No. 2669, LIG-II, , Gandhi Managar, Peelamedu
Coimbatore - 641 004, Tamil Nadu, India.**

Phone: 0422 2510006, Mobile: 9566777255, 9566777258

Email: director@nsfonline.org.in, directornsf@gmail.com

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1. Introduction

Waste management audit is all about the “Waste control or waste disposal is all the behaviours and acts necessary to handle the waste from its inception to its final disposal. This involves, but is not limited to, storage, transport, management and recycling of waste along with control and enforcement. It also covers the legislative and regulatory system for waste control, including recycling guidelines. Wastes are generated from several sources such as domestic, industries, agriculture and commercial activities which in turn to cause environmental pollution. Domestic waste include kitchen wastes like vegetables, fruits, and other food waste, Sewage-human excreta and waste from bathrooms and kitchens, Garbage-newspapers, rags, hair, house dust and others wastes like plastic bags, bottles, tins and etc. In general, domestic waste is referred to as refuse (Amasuomo and Baird, 2016). About 90% of domestic wastes are directly dumped on land thereby increasing land or soil pollution. All Industries generate waste materials either directly or indirectly. The wastes typically include ashes, rubbish, building material wastes, toxic wastes, metal containers, plastic containers, paints, oils, and other complex synthetic materials. The industrial wastes include (i) Mining operations leave tailings (rocks of little or no value) as waste, (ii) Metallurgical industries release waste like slag and scrap metal, (iii) Paper and pulp mills release effluents containing wood chips, bits of bark, cellulose fibres, and a number of chemicals, (iv) Oil refineries and petrochemical units release a mixture of wastes containing hydrocarbons, organic acids, and sulphur compounds and (v) Food processing units such as dairy, breweries, and meatpacking units release organic wastes.

Modern techniques employed in agriculture and the use of a variety of chemicals have contributed to the production of large quantities of agricultural waste. The agricultural waste includes (i) Agricultural wastes include crop residues like husk and straws, farm animal waste, and chemicals like pesticides, rodenticides, fungicides, herbicides, and fertilizers, (ii) These wastes can enter the water table as runoff from agricultural fields and (iii) Chemicals used in agriculture are toxic in nature. A lot of wastes is generated from commercial establishments such as restaurants, hotels, markets, offices, printing shops, auto repair shops, medical institutions, and hospitals. Nuclear reactors produce toxic, radioactive substances, such as heavy water or spent nuclear fuel. Radioactive waste is hazardous to all life forms as well as to the environment. These are the substances that have characteristics of ignitability or corrosivity or reactivity or toxicity. All waste generated from different sources can be grouped into biodegradable waste and non-biodegradable wastes. Biodegradable waste can be decomposed by the action of microorganisms. Domestic sewage, newspaper, and vegetable matter are biodegradable and under rotting. Non-biodegradable waste cannot be decomposed easily by microorganisms due to complex chemical constituents. Polythene bags, plastics, glass, aluminium cans, iron nails and DDT are some of the non-biodegradable waste materials (Aye and Widjaya, 2006).

Due to the increasing population and subsequent urbanization, production and consumption processes have increased because of which waste generation has increased rapidly in India. As a result of industrialization and the shifting of people from rural to urban areas in search of jobs, there has been an increase in the urban population, as a result of which waste generation has also increased tremendously. Industrialization has

brought both positive as well as negative impacts on the world. And, solid waste generation and its improper management is one of the negative consequences of industrialization. Unscientifically, disposal of solid waste in open dumps and landfills creates problems for public health and the environment. Hence, safe disposal with effective waste management is necessary. Waste management is concerned with how solid waste can be transformed and turned into a useful resource. Currently, India's population is around 1.50 billion, or 140 crores, which is showing an increase of 0.91 billion during 2020. As per an estimate, a total of 1,30,000 to 1,50,000 metric tonnes (MT) of municipal solid waste is being generated in India every day. That means around 330-550 grams of waste is generated per urban inhabitant per day. In this way, it adds up to roughly 50 million MT per year, and if it is calculated considering the current rates, this will increase to ~125 million MT per year by 2031 (Kumar *et al.*, 2020).

As per a recently published study, around 62 million tonnes of waste are currently being generated in our country which may increase by up to 165 million tonnes by 2030 (Kumar *et al.*, 2020). Of the total generated solid waste, only 75-80% of the municipal waste gets collected and only 22–28% of this waste is processed and treated. So, the rest of the waste (approx. 72–78%) is left untreated and dumped in open areas, which is leading to environmental and health hazards. Therefore, it is necessary that every household, including business owners all around the world, adopt solid waste management (Bioswas *et al.*, 2017; Vinothkumar *et al.*, 2021).

Waste Management Audit procedures includes the definition of Waste Management audit, methodology on how to conduct Waste Management audit at Educational Institutions and Industrial sectors as per the checklist of Environment Management Systems and International Standards on ISO 14001:2015, World Green Building Council, Swachh Bharath Scheme under Clean India Mission to understand the principles and importance of various audits in the context of the organization and risk assessment at 360° views (Gnanamangai *et al.*, 2021). Waste Management audit helps the educational institutions/ industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings (Arora, 2017; Demirbas, 2021).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation's growth and development which starts from maintenance of Different wastes without harming the environment (Chan and Lam, 2018). A clean and healthy environment in an Organization determine effective learning skills and offers a conducive learning environment to the students. Educational institutions are insisted by both Central and State Governments to offer eco-friendly atmosphere to the stakeholders (Rajalakshmi *et al.*, 2021). In addition, all the Educational institutions are asked to save the environment for future generations and to resolve the environmental problems (accumulating solid wastes and wastewaters/effluents and their careless disposal, enormous utility of plastics, uneconomical consumption of water, irresponsible in water harvesting and storage procedures, etc.) through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government

thro' the Educational institutions plays a major role in terms of giving neat and clean environment to tribal, rural and urban people across the country, besides the regular and conventional activities carried out by NSS, NCC/Student Force, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, Youth Red cross unit, etc. Seminar, Conference, Workshop, training and awareness programmes on environmental Waste Management awareness programmes may be conducted periodically by the Management and Administrative people of an Organization to the stakeholders.

Waste Management auditing is a systematic method whereby an organization's environmental performance is checked against its environmental strategies and compliances of the Government guidelines. This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including management people (Vergara and Tchobanoglous, 2012). It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report. The Waste Management processes are being undertaken by ISO EMS 14001:2015 criteria and the concept of Swachh Bharath Abhiyan under Clean India Mission (Gnanamangai *et al.*, 2021).

3. Waste Management and Environment Policy

Waste management and environment policy aims to provide an education and awareness in a clean environment to the stakeholders with regard to environmental compliance. Scope of the policy applies to all employees and students of the Institution/organisation to provide an ecofriendly atmosphere (Ghani *et al.*, 2014). Waste Management Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes /pollutants (Cardenas and Halman, 2016). The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "waste management" initiatives of the College / University and maintain a clean campus while each and every individuals of the organisation should adhere to the policy.

4. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with waste management facility to all the stakeholders (students and staff members). All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration/awareness programme on establishing plastic-free environment and utility of organic alternatives for all incoming and current students, staff and faculty should be organised. Reduction of use of papers alternated with e-services, e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus. Environment Friendly Campus is playing an important role in terms of imposing waste management scheme which in turn useful to maintain the soil health and increased productivity (Sridhar and Adeoye, 2015).

5. Importance of Waste Management Auditing

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making ecofriendly atmosphere through the Waste Management and ready to encourage/follow all types of waste management activities. They should promote all kinds of waste management activities such as conduct of environment awareness programmes, usage of segregation bins, avoiding of single use plastics, utility of organic alternatives prior to and after the Waste Management (Suwartha and Sari, 2013). The administrative authorities should formulate 'Waste Management Policies' based on technical report of Waste Management auditing. A clean and healthy environment will enhance an effective teaching/learning process and creates a favourable learning clean environment to the scholars. They should create the awareness on the importance of waste management through environmental education among the student members and research scholars. Waste Management is the most effective, ecological approach to manage environmental complications.

Waste Management may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. It is necessary to conduct Waste Management audit frequently at least once in three years in campus because students and staff members should aware of the Waste Management and its beneficial effects in order to save planet by means of 'Go green concept' which in turn support the institution to set environmental models ('icon') for the community. Waste Management is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner (Kaseva and Gupta, 1996). It can also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

6. Broad Categories of Waste

6.1. Municipal Solid Waste (MSW): It is commonly known as garbage collected by the municipality and/or disposed of at the municipal waste disposal site. Based on the sources of waste generation, it is further categorised into residential, commercial, institutional, and municipal services. MSW include food items, packaging materials, newspapers, clothes, containers, bottles, batteries, and durable goods like furniture, etc., generated by households, offices, hotels, shops, schools, and other institutions (USEPA, 2020). Some fractions of demolition and construction debris, hazardous waste materials such as used electric light bulbs, batteries, automotive parts, and a very small quantity of biomedical waste such as discarded medicines and used syringes, are often found in collected municipal solid waste. Once collected, they are sorted and treated for recycling and reuse before their final disposal.

6.2. Biomedical waste: Biomedical waste or hospital waste is the waste created by healthcare activities such as diagnosis, treatment, immunization, or any kind of research activity or in the production or testing of biologicals. It contains hazardous materials such as needles and syringes, chemicals, pharmaceuticals, medical devices, and radioactive materials and infectious materials such as unwanted microbiological cultures and stocks, bandages and soiled dressings, body parts, other human or animal tissue, diagnostic samples, discarded blood, etc.

6.3. Plastic waste: Plastic wastes are the discarded products made of plastic, such as packaging material, carry bags, pouches, etc. whose life is over and are of no use as prescribed in the Plastic Waste Management Rules, 2016. They are recyclable materials. It is necessary to manage plastic waste properly because the accumulation of plastic discarded objects causes adverse effects on wildlife, the marine environment, and human beings. Plastic waste can be easily seen everywhere on land and in oceans, lakes, rivers, ice, and air, which causes damage to humans and the whole environment.

6.4. Electronic waste: Electronic waste, also known as "E-waste," refers to unwanted or useless electronic or electrical products that are non-working, broken, rejected, or have reached the end of their useful life. Some examples of electronic waste are computers, cell phones, tablets, televisions, photocopiers, fax machines, etc. They are dangerous in nature due to toxic chemicals they release and can harm the environment. Although they can be refurbished, reused, or recycled.

6.5. Bio-waste: Bio-waste is biodegradable waste, which consists of mainly organic waste. It includes green waste generated from paper waste, gardens and parks, food and kitchen waste from households, restaurants, and food processing waste from food processing plants. In the landfill directives, it is defined as 'waste capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and cardboard. Bio-waste is a fuel resource that may be used to produce heat and electricity.

6.6. Construction and demolition (C&D) waste: C&D waste comprising of building materials, construction debris and rubble generated during the redevelopment, construction, repair and demolition of any civil structure. Though it is kept as a separate category, some of the fraction of C&D waste is also found in municipal solid waste. The waste was disposed of at the disposal facilities which contains high proportion of recyclable materials, which are used to make construction materials. The C&D waste may have some hazardous substances which should be disposed of separately.

6.7. Industrial waste: Industrial waste is generated as a result of industrial processes. They are categorized mainly as hazardous waste and non-hazardous waste. Though industrial waste is not considered as municipal solid waste and is not mixed with it, in some places, non-hazardous waste is disposed of with municipal waste. In this case, the industries arrange for waste transportation to the disposal site and may be responsible for disposal fees. According to the legislation and current practises, the municipality should explicitly define its responsibility for industrial waste management. This would assist in the quantity and classification of hazardous and non-hazardous industrial wastes, as well as municipal and non-municipal wastes.

6.7. Food waste: It refers to the decrease in mass (quantitative) or nutritional value (qualitative) of food - edible parts - throughout the supply chain that was intended for human consumption. It also refers to food that gets spilled, spoilt or otherwise lost, or incurs reduction of quality and value during its process in the food supply chain before it reaches its final product stage. It is typically taking place at production, post-harvest, processing, and distribution stages in the food supply chain.

7. Scope of Waste Management Audit

Waste management audit is sought to examine whether the institution / industries / pharmaceutical / hospitals had identified waste as a risk to environment and health, accurately assessed the amount of different kinds of waste being generated in the institution/industries/pharmaceutical/hospitals and drafted a policy on waste management which focused on waste minimisation and waste reduction, as compared to waste disposal, as the more effective ways to manage waste (Rajeshwari *et al.*, 2015; Trung and Kumar, 2015). In addition, the waste management audit sought to examine whether all kinds of waste had been covered under legislation for safe disposal and whether agencies had been allocated responsibility and accountability for the management of waste.

8. Benefits of the Waste Management Auditing

There are several benefits on conduct of Waste Management by the Organization which may be definitely useful to improve the campus significantly based on the audit report. The Waste Management contained methodology followed and both qualitative and quantitative measurements including physical observation of availability of adequate dust bins, usage of personnel protected materials, separate transportation trolley and method of disposal of waste. The waste management scheme is essential to impose the soil health and increased productivity in an organization (Brunner and Rechberger, 2014). The following are the major benefits of the waste management process.

- Availability of adequate number of user-friendly dust bins as per Guidelines (Red, Yellow, Blue, and Black & Green Bins) in the campus for various wastes' collection, segregation and disposal.
- Maintenance of 'Record Register' for waste disposal and puncture proof containers for sharps / blue bags in the campus.
- Availability and usage of personal protected materials like Gloves, Caps, Masks, Aprons & Gum boots etc. as per the Guidelines in the campus.
- Availability of 1% fresh Sodium hypochlorite or Bleaching Powder solution as per guidelines for maintaining the pest and disease free hygiene environment.
- Proof of Licensed companies signed MoU with the organization for wastes collection and disposal as per the Central and State Government regulation.
- Norms are being followed by the Organization as per the Central and State Government Pollution Control Board.
- Different Forms, Formats, Annual Report, etc. are available for waste collection and mode of transportation.
- Availability of a trained dedicated with skilled personals for waste management in each campus in department / sector wise.
- Checking whether e-wastes, bio (wood) wastes, construction wastes, plastic wastes, hazardous wastes and biomedical wastes mixed at the source of generation.
- Checking whether the waste collected in covered bins and is the bins filled up to more than $\frac{3}{4}$ th level.
- Checking whether the bins are cleaned with soap and disinfectant regularly and is the stored waste kept beyond 48- 72 hrs.
- Checking whether the waste transported in closed containers or open bags and are

the waste collection bins/Trolleys/wheel barrow used for transporting wastes.

- Checking whether the concept of E-Waste, Plastic Waste, Biomedical waste management is followed in the campus.
- Whether E-Waste management practices included in the purchase policy of electronic items and observe the E-waste refurbished and used again in the institution.
- Whether the importance waste and their implications on environmental and personal hygiene through awareness programmes are conducted for stakeholders.
- Signing MOU with Government and NGOs ensure proper handling of waste materials and reuse of construction and wood wastes in the same campus.

9. About the Organization

9.1. Loyola College of Education

Loyola College of Education, a Jesuit Teacher Education Institution was established in June 2007. It is completely owned and administered by the Loyola College Society registered under the Society Registration Act of 1860 No.5228/1973. It is located in the wide campus of Loyola College of Arts & Science. It is recognized by National Council for Teacher Education (NCTE) and affiliated to Tamil Nadu Teachers Education University (TNTEU). It is accredited at `A` grade with CGPA – 3.79 by NAAC (National Assessment and Accreditation Council) in the 1st cycle which is the highest among the colleges of education in India. In the second cycle it was re-accredited at `A` grade with CGPA–3.48 by NAAC.

The sole aim of Jesuit education is to form compassionate, committed, competent, conscientious and creative men and women for others. The mission of the Jesuits is crystallized in their preferential option for a large number of Catholics, Dalit Catholics, first generation learners, orphans, semi-orphans, differently-abled students, neighbourhood children, refugees, migrants, gypsy children and economically poor and vulnerable students. Thus Jesuits in the education apostolate pay undivided attention to the empowerment of the marginalised and the oppressed.

Since its inception, Loyola College of Education (LCE) has been focussing on the formation of intellectual capacity, training of the will and formation of character of the student-teachers, thus ensuring the integral formation of the prospective teachers. LCE is committed to inculcating desirable social and human values and moral principles that would make the student-teachers self-disciplined, value-oriented and responsible teachers. LCE provides also a wide range of opportunities and experiences for student-teachers to discover their potentialities both physical and intellectual and cultivate their artistic and aesthetic sense through cultural extravaganza and nurture their social responsibility through rural / slum exposure camp.

Motto

Let your light shine

Mission

- Forming compassionate, competent, conscientious, creative and committed teachers with techno-pedagogical skills using education as the key to empower the youth to bring about a desirable social transformation.

- Train and form responsible socially committed teachers who promote the fundamental rights and duties, values of liberty, equality and fraternity, uphold the constitution and affirm the ideas of secularism, social justice and sustainable development

Vision

Holistic formation of human engineers with techno-pedagogical skills to develop a humane society.

9.2. About Nature Science Foundation (NSF)

NSF is an ISO 9001:2015, 14001:2015, 45001:2018 & 50001:2018 certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore- 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12A, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is to “Save the Nature to Save the Future” and “Go Green to Save the Planet”. NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the ‘Go Green Concept’ in a big way. NSF family is wide spread across India with over 115 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment day celebration, Ozone day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation. NSF is being released ‘Magazine’ and ‘Newsletter’ biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India.

In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies across the world, NSF tributes the deserved

meritorious candidates with various awards and honours such as ‘Best Faculty Award’, ‘Best Women Faculty’, ‘Best Scientist Award’, ‘Best Student Award’, ‘Best Research Scholar Award’, ‘Best Social Worker Award’, ‘Young Scientist Award’, ‘Life-Time Achievement Award’ and ‘Fellow of NSF’. These award and honours will be given to the deserved meritorious candidates during the ‘Annual Meet and Award Distribution Ceremony’ which will be conducted every year during the first week of January.

NSF has introduced various types of Audits such as ‘Eco Audit’, ‘Green Audit’, ‘Energy Audit’, ‘Hygienic Audit’ Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Checklist prepared by the NSF ISO Criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, Energy Policy, MoU, International Eco Club student Chapter.

Audit processes are being conducted through the certified Auditors as per the following by the NSF

Audit	Certified Auditors	Certified Auditors
Green Audit	<ul style="list-style-type: none"> • IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan
Energy Audit	<ul style="list-style-type: none"> • BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator 	<ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam ➤ Dr. P. Thirumoorthi ➤ Dr. G. Muruganath
Environment Audit	<ul style="list-style-type: none"> • IGBC -Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan
Hygiene Audit	<ul style="list-style-type: none"> • FSMS – Food Safety Management System & 	<ul style="list-style-type: none"> ➤ Dr. R. Sudhakaran ➤ Dr. N. Saranya

	<ul style="list-style-type: none"> • Occupational Safety & Health (ISO 22000:2018) • SBICM - Swatch Bharath under India Clean Mission 	
Waste Management Audits	<ul style="list-style-type: none"> • Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R. Sudhakaran ➤ Er. N. Shanmugapriyan
Academic & Administrative Audits	<ul style="list-style-type: none"> • Academic & Administrative Audits as per the NAAC Criteria and ISO implantation procedure • In compliance with the Environmental legislations and rules and regulations 	<ul style="list-style-type: none"> ➤ Dr. B. Anirudhan ➤ Dr. B. Shreeram ➤ Dr. R. Mary Josephine
ISO Certification	<ul style="list-style-type: none"> • QMS (9001:2015), EMS (14001: 2015), OHSMS (45001: 2018), ISMS (27001:2018), FSMS (22000: 2018), QMSMD (13485: 2016), EnMS (50001: 2018) 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. K. Sreedharan

10. Audit Details

Date / Day of Audit	: 31.01.2023
Venue of Audit	: Loyola College of Education, Chennai, Tamil Nadu.
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Waste Management Audit
Name of Auditing Chairman	: Dr. S. Rajalakshmi Jayaseelan, Chairman of NSF & ISO QMS, EMS, OHSMS, EnMS Auditor.
Name of Lead WM Auditor	: Dr. B. Mythili Gnanamangai, Vice Chairman of NSF, Indian Green Building Council Accredited Professional.
Name of ISO OHSMS Auditor	: Dr. K. Sreedharan, Lead Auditor, ISO Occupational Health & Safety Management System (45001:2018)

Name of the Hygiene Auditor	: Dr. P. V. Sreenivasan ISO FSMS OHS Hygiene Auditor, NSF.
Name of Subject Expert-I	: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of Subject Expert-II	: Dr. M. Ravichandran, Lead Auditor & Associate Scientist, Bayer Bioscience, Pvt. Ltd. Hyderabad, AP.
Name of Subject Expert-III	: Er. D. Dinesh Kumar, Certified Lead Auditor, IGBC, ASSOCHEM, GRIHA & LEED
Name of Eco & Green Officer	: Mrs. M. Priya, Environment, Energy & Green Council Programme Officer, NSF.

11. Procedures followed in Waste Management Audit

Waste Management is a structured process of documenting the credentials in terms of availability of adequate Dust bins, usage of personnel protected materials, separate transportation trolley and method of disposal of waste. it is a kind of a professional tool for assessing the waste management in the campus. Waste Management projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organisation has a central role in building the waste management, in order to validate the same (Adeniji, 2018).

Waste management is not intended for the self-sustainability of the building alone, it also involves in propagation of the waste management initiatives so as to be adopted by any individuals and organization at a minimum cost. Waste Management has been conducted as per the checklist of Nature Science Foundation, Coimbatore, Tamil Nadu, India (www.nsfonline.org.in) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices (Staniskis and Katiliute, 2016). Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of waste management Lead Auditors were selected to conduct the Waste Management process.

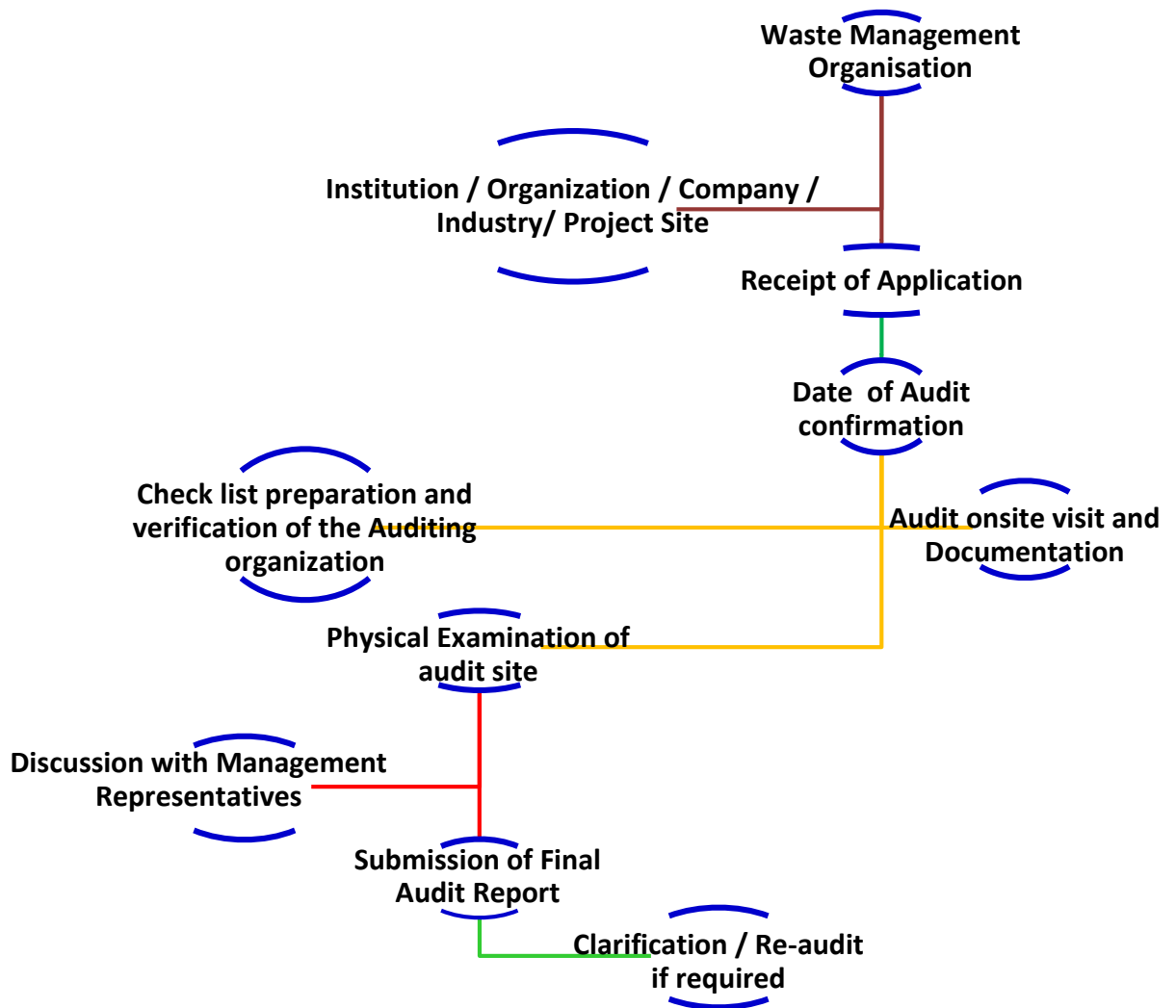
During the audit, Availability of Adequate number of Dust Bins as per Guidelines (Red, Yellow, Blue, and Black & Green Bins) in the campus for various wastes' collection, segregation and disposal, maintenance of 'Record Register' for waste disposal and puncture proof containers for Sharps / Blue Bags in the Campus, Availability and usage of personal protected materials like gloves, Caps, masks, aprons and gum boots etc. as per the guidelines of Tchobanaglou *et al.* (2007), PIB GoI (2016) and Tewari (2021) in the campus, Availability of 1% fresh Sodium hypochlorite or Bleaching Powder solution as per guidelines is checked to assess the personal and

hygiene environment. Checking whether e-wastes, wood wastes, construction wastes, plastic wastes, hazardous wastes and biomedical wastes mixed at the source of generation, checking whether the waste collected in covered bins and is the bins filled up to more than $\frac{3}{4}$ th level are monitored. In addition, checking whether the bins are cleaned with soap and disinfectant regularly and is the stored waste kept beyond 48- 72 hrs, checking whether the waste transported in closed containers or open bags and are the waste collection bins/Trolleys/wheel barrow used for transporting wastes are also monitored ring the audit process. Checking whether the E-Waste refurbished and used again in the institution are also done during the audit process as per the protocol of Gnanamangai *et al.* (2021).

Projects, Dissertations and Thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches towards the waste management. These should be disseminated through presentations and publications in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. These efforts taken by the students and staff members were deliberated while conducting the waste management. Waste management processes are taking place as per the following flow-chart starting from the receipt of application forms from the auditee (organization) and ending upon the submission of final report to the concerned organization (Leal Filho *et al.*, 2015). During the audit process, the best environmental practices followed and new initiatives undertaken in the organisation to reduce the environmental pollution and steps taken for nature conservation that brings added value to the organisation in maintaining the eco-friendly campus with respect to waste management process were assessed (WGBC, 2021). In addition, supporting activities of the scholars and staff with regard to “Vision and Mission” of the waste management activities of the Organization is also evaluated.

11.1. Onsite Waste Management Audit activities

Opening meeting is the first step between the audit team and auditee along the Management Representatives where the purpose of the audit, procedures to be adopted for the conduct of the audit, verification of the documents and the time schedules were discussed, in brief. Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the Audit team members visited different sites in the campus and required photographs were taken then and there for preparing the audit report. During the onsite phase of visit, it is vivid how the various facilities made by the College Management to the stakeholders to ensure the waste management in the campus. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders. The assessment reveals the strengths and weaknesses of the Auditee’s Management controls and risks associated with their failure in creating waste management facilities. Collecting audit proofs *ie*, data collection and information from the auditee as per the audit protocol were carried out. An exit meeting was conducted to describe the findings of the audit with Management Representatives and staff members along with the audit team in brief.



Flow-chart of Waste Management Audit Procedures

11.2. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of waste management audit process, wherein, audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al.*, 2018). Pre-audit stage activities are an essential prerequisite for the Waste Management to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al.*, 2019). Audit team was selected by the Nature Science Foundation as per the checklist comprised of Lead Auditor of ISO (EMS 14001:2015), Environmental and CII certified Waste management sustainability professional from Conventional and

Technical Universities, agencies, certifying bodies across India and Accredited Professionals from World Green Building Council.



Opening meeting with the PRO, Principal, Management Representatives, IQAC Coordinator, Staff members of Loyola College of Education, Chennai, TN and Audit Team of the Nature Science Foundation, Coimbatore, Tamil Nadu

11.3. Target Areas of Waste Management Auditing

Waste Management is nothing but a professional tool to assess the waste management activities in the educational institutions and give a value addition to the campus and considered as a resource management process. Waste management process may be undertaken at frequent intervals and their results can demonstrate improvement or change over time. Eco-campus focuses on the reduction of carbon emissions, water consumption, wastes to landfill and enhance energy use conservation to integrate environmental considerations into all contracts and services considered to have significant environmental impacts (Choy and Karudan, 2016). There are several target listed in the waste management process in which a few are taken into consideration as per the Indian scenario is concerned. They are the various sources (source of plastics, wood, e-waste, biomedical, construction and demolition waste and hazardous waste), segregation of waste, storage area of the waste, collection and transport units, processing units and the landfills.

12. Impact of Waste on Health and Environment

Waste represents a threat to the environment and human health if not handled or disposed of properly. Surface and ground water contamination takes place when waste reach water bodies. Residues from waste can change the water chemistry, which can affect all levels of an ecosystem. The health of animals and humans are affected when they drink the contaminated water. A specific environmental hazard caused by waste is leachate, which is the liquid that forms, as water trickles through contaminated areas

leaching out the chemicals. Movement of leachate from landfills, effluent treating plants and waste disposal sites may result in hazardous substances entering surface water, ground water or soil. Waste contaminates soil and can harm plants when they take up contaminants from their roots. Eating plants or animals that have accumulated soil contaminants can adversely affect the health of humans and animals. Emissions from incinerators or other waste burning devices and landfills can cause air contamination. Incinerators routinely emit dioxins, furans and polychlorinated by-phenyls, which are deadly toxins, causing cancer and endocrine system damage. Landfills are a big source of release of greenhouse gases, which are generated when organic waste decomposes in landfills. E-waste contains a mix of toxic substances such as lead and cadmium in circuit boards; lead oxide and cadmium in monitor cathode ray tubes; mercury in switches and flat screen monitors; cadmium in computer batteries; polyvinyl chloride in cable insulation that release highly toxic dioxins and furans when burned to retrieve copper from the wires. Thus, improper handling of waste has consequences both on the environment as well as on the health of the people.

13. Management of Wastes

Waste management can be simply defined as the collection, transport, recovery and disposal of waste together with monitoring and regulation of the waste management process. Waste prevention means measures aiming at the reduction of the quantity and harmfulness for the environment of diverse waste streams. Prevention is the most desirable waste management option as it eliminates the need for handling, transporting, recycling or disposal of waste. It provides the highest level of environmental protection by optimising the use of resources and by removing a potential source of pollution. The most popular types of waste management are Recycling, Incineration, Landfill, Biological Reprocessing and Animal feed. According to United Nations Environment Programme (UNEP), waste management includes both the components of prevention and disposal of waste. Rather than regarding 'waste' as a homogenous mass that should be buried, they argued that it was made up of different materials that should be treated differently i.e. some should not be produced, some should be reused, some recycled or composted, some should be burnt and others buried. According to this hierarchy, the priority of any country should be to extract the maximum practical benefits from products and prevent and minimize the waste that is generated. Thus, strategies for waste disposal should focus on waste prevention and minimization through 7R's - Recycle, refuse, Reduce, Reuse, Repair, Re-gift and Recover.

Incineration is the disposal of waste materials by means of burning. The power produced by burning waste materials to produce heat, energy or steam. One of the drawbacks of this disposal process is that it can be a source of air pollution. Landfills includes the collection, transportation, disposal and burying of waste in designated property. Landfill sites are a significant cause of health and environmental problems that concern many communities. The gas from these landfills is often incredibly dangerous. Chemical waste materials, such as kitchen waste and paper goods, can be reused after a procedure called biological reprocessing which is another popular system amongst the varied types of waste management. Multiple physiological systems, including recycling and biomass gasification, are used in biological reprocessing. Composting is a normal biological mechanism that is carried out under control

conditions. One of the ends of the stock is natural gas, which is used to produce heat and electricity. Biological reprocessing is commonly used for the disposal of industrial waste. Food waste can be preserved by manure and livestock feed and this is also one of the ecological types of waste management methods.

The three types of waste management based on the nature are (i) Solid Waste Management, (2) Liquid Waste Management and (3) Biomedical Waste Management. The term solid waste refers to all discarded and thrown away solid and semi-solid wastes arising from human and animal activities. These may be classified as municipal wastes, industrial waste, and hazardous waste. The use and throw culture of advanced societies has led to a tremendous increase in the generation of solid waste. To overcome the major causes of solid waste, we have to practice the rules of no littering zone, separate the dry waste and wet waste and dump it into the municipal vans, avoid usage of plastic, etc. liquid waste management is the practice followed to remove or prevent the discharge of pollutants to the drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid materials.



To overcome the problem of liquid waste, we should stop dumping the oil containers on the ships, which disturb marine life, stop washing animals across the rivers, etc. Process of treating Liquid Waste by the Management includes (i) Primary treatment: Screening, grit removal, and sedimentation (settling), (ii) Secondary or biological treatment: Biological processes and additional settling and (iii) Tertiary or advanced treatment: Not all sewage treatment plant requires tertiary (advanced) treatment. Biological wastes are generated during the diagnosis, testing, treatment, research, or production of biological products for humans or animals. Major sources of biomedical waste are hospitals, blood banks, labs, etc. Process of treating Biomedical Waste Management includes (i) Incineration, (ii) Autoclaves, (iii) Mechanical / Chemical Disinfection, (iv) Microwave, (v) Irradiation and (vi) Vitrification. Waste management involves a process whereby wastes are collected, transported, and disposed of in the best possible way of limiting or eliminating the harmful effect of wastes. This aspect of environmental management

To overcome the problem of liquid waste, we should stop dumping the oil containers on the ships, which disturb marine life, stop washing animals across the rivers, etc. Process of treating Liquid Waste by the Management includes (i) Primary treatment: Screening, grit removal, and sedimentation (settling), (ii) Secondary or biological treatment: Biological processes and additional settling and (iii) Tertiary or advanced treatment: Not all sewage treatment plant requires tertiary (advanced) treatment. Biological wastes are generated during the diagnosis, testing, treatment, research, or production of biological products for humans or animals. Major sources of biomedical waste are hospitals, blood banks, labs, etc. Process of treating Biomedical Waste Management includes (i) Incineration, (ii) Autoclaves, (iii) Mechanical / Chemical Disinfection, (iv) Microwave, (v) Irradiation and (vi) Vitrification. Waste management involves a process whereby wastes are collected, transported, and disposed of in the best possible way of limiting or eliminating the harmful effect of wastes. This aspect of environmental management



is as important as other public amenities or infrastructures without which the life of a contemporary man would be extremely difficult.

14. Observations of Waste Management

During the waste management audit processes, how the organization is managing the various waste materials like e-wastes, wood wastes, construction wastes, plastic wastes, hazardous wastes and biomedical wastes in the campus effectively without harming the environment. It is ensured that a proper storage of the wastes as per their classification, characterization, mode of treatment and disposal and analysis of disposal and recycling process of wastes as per the guidelines of MOEF, CPCB & DPCC are carried out.

14.1. Qualitative Measurements of Waste Management

S.No.	Requirements and checklists of the audit	Conformity		
		Yes	No	Remarks
1.	Adequate number of Dust Bins as per Guidelines (Red, Yellow, Blue, and Black & Green Bins) are made available in the campus for various wastes, collection, segregation and disposal.	√		
2.	Record Register for waste disposal and Puncture proof Containers for Sharps / Blue Bags are made available in the campus	√		
3.	Mutilators (Needle / syringe cutters) and calibrated weighing machines for biomedical wastes collection*		√	
4.	Personal protected materials like Gloves, Caps, Masks, Aprons & Gum boots etc. used are adequately made available as per the Guidelines in the campus.	√		
5.	Around 1% fresh Sodium hypochlorite or Bleaching Powder solution is made available as per guidelines*			√
6.	Mercury Spill Management, kit, Post Exposure Prophylaxis Kit and Blood spill Management kit are available*			√
7.	Proof of Licensed Companies signed MoU with the Organization for wastes collection as per the Govt. regulation	√		
8.	Norms are being followed by the Organization as per the Central and State Government Pollution Control Board	√		
9.	Different Forms, Formats, Annual Report, etc. are available for waste collection and mode of transportation	√		
10.	Availability of a trained dedicated with skilled personals for waste management.	√		
11.	Is the waste segregated at the site of generation? If not, where are they segregated?	√		
12.	Is the infectious waste and non infectious waste mixed at the source of generation?*			√
13.	Is e-wastes, wood wastes, construction wastes, plastic wastes, hazardous wastes and biomedical wastes mixed at the source of generation?			√

14.	Is the waste covered in covered bins? and Is the bins filled up to more than ¾ th level ?	√		
15.	Is the bins cleaned with soap and disinfectant regularly and bins are overfilled? And is the stored waste kept beyond 48-72 hrs?*			√
16.	Is the waste transported in closed containers or open bags? and Are the waste collection bins/Trolleys/wheel barrow used for transporting wastes?	√		
17.	Is the personal protective gears like mask and gloves used while collecting the wastes from the site of deposition?	√		
18.	Whether the concept of E-Waste management is followed in the campus?	√		
19.	Has a Management Representative, E-Waste Specialist, Laboratory Staff been assigned?	√		
20.	Whether E-Waste management practices included in the purchase policy of electronic items?	√		
21.	Whether an authorised refurbisher appointed to manage the E-waste		√	
22.	Are the E-Waste refurbished and used again in the Institution?		√	
23.	Whether the importance waste and their implications on environmental and personal hygiene through awareness programmes are conducted for stakeholders?	√		
24.	Signing MOU with Government and NGOs ensure proper handling of waste materials	√		
25.	Whether construction and wood wastes are subjected to reuse them in the same organization campus?		√	
26.	Whether plastic wastes are burnt inside the campus? Any air pollution due to plastic materials burning takes place ?		√	
27.	Projects and dissertation works, scholarly publication on various wastes and their management carried out by staff members and students		√	
28.	Whether hazardous wastes are properly discarded in which acids, solvents and salts are disposed after diluting with water and poured after buried in the soil	√		
29.	Have programmes for the achievement of plastic free area objectives and targets been established and implemented as on today? Any display board is made in the campus?	√		
30.	Are recycling of plastic polymers promoted in the campus among the stakeholders?		√	
31.	Wood waste are collected and recycled properly and they used for fuel and degradation / green manuring purposes?	√		
32.	Residual wastes are properly disposed in the campus after burring the soil with proper dilution with water	√		

*Applicable for Hospitals/Labs/Pharmaceutical Industrial sectors

14.2. Plastic Waste Management

Plastics fuelled scientific and technological innovations due to their flexibility, durability, water resistance, and affordability. The most extensively used techniques of plastic waste management across the globe are mechanical recycling, incineration and landfilling. Recycling of plastic is considered as environmental friendly and the most effective way of plastic waste management. The other method of plastic waste management is incineration. The non-recyclable plastic waste irrespective of segregation, cross contamination, additives and impurities are burned through incinerators. Landfilling is another method of plastic waste management. But unsanitary landfill or dumping of waste leads to tremendous space constraints, leaching of harmful chemicals and can also result in open surface fire in dumps, often resulting in the release of harmful air pollutants like dioxins and furans. Waste management audit conducted at LCE is ensured the methodology adopted to reduce the use of plastics among the stakeholders. The institute is educating the students to avoid the usage the plastics and its impact on environment, Human health. Some plastic items are periodically collected and subjected to proper segregation into recyclable and non-recyclable wastes in appropriate colour coded and labelled bins. After segregation of plastic wastes, they are given to the Tamil Nadu Municipal Corporation for its further disposal and recycling processes as per the Central and State Government policies. The College Campus has taken sufficient attempts not to use single use plastics in the campus and ‘say no to plastics’ in places like canteen, hostel dining halls, seminar halls, corridors, etc. to the students, parents and public. The Management insisted the people use eco-friendly bags made from organic materials like plant fibres which are easily decomposable in nature. These efforts are very much essential to keep the environment neat and clean to conserve nature.



14.3. Construction and Demolition (C&D) Waste Management

The waste comprising of building materials, bris and rubble resulting from construction, re-modelling, repair and demolition of any civil structure. According to Technology Information, Forecasting and Assessment Council's (TIFAC), highest waste generation comes from demolition and construction of buildings. The typical composition of Indian C&D wastes are concrete, soil, sand, gravel, bricks, wood, asphalt and metal. Recycling of C&D wastes is important as it helps to reduce the dependence on natural resources and eliminates adverse environmental impacts. Recycling of C&D wastes has the additional advantage of controlling the quantum of C&D wastes destined for disposal at landfills besides reducing transportation costs. The list of reuse and salvage materials include appliances, bathroom fixtures, bricks, blocks, masonry stone, structural steel, cabinets, carpeting, ceiling tiles, timber and timber based boards, door and window frames and shutters, flooring tiles, stone tiles/platforms, insulation, landscaping materials, lighting fixtures, metal framing including for partitions and ceiling, panelling, pipes, antique mouldings, accessories and hardware of furniture, PVC water tanks, roofing sheets used for garages, outdoor areas, fabric of tensile structures etc. Waste management audit conducted at the Campus is ensured the

C&D wastes properly disposed from the campus. C&D waste management activities such as segregation, reuse and recycling are properly done without harming the environment. The College has performed the estimation of the amount and type of recyclable and non-recyclable waste materials that are expected to be generated on site. Listed all expected quantities of each type of waste and recycled into aggregates which are effectively used in the construction of pillars and pathways.

14.4. Biowastes Management

Biowastes are originated from plants animals and food wastes which also affect the environment to a greater extend. Depending on the biowastes quality, it can be recycled or reused for energy production. Plant wastes can be reused as a building material, recycled into mulch for landscaping, pulp for paper production, and used as a fuel. The rising cost of waste material disposal and a growing environmental consciousness also contribute to the increasing importance of waste wood recycling. The reason for recycling waste wood is world approaching closer to global warming and reduce their global footprints. Campus collects the various biowastes across the campus and recycle them properly without harming the environment. Recycles biowastes are reused for plant cultivation as manuring.

14.5. Hazardous Wastes

Hazardous-waste management, the collection, treatment, and disposal of waste material that, when improperly handled, can cause substantial harm to human health and safety or to the environment. Hazardous wastes can take the form of solids, liquids, sludges, or contained gases, and they are generated primarily by chemical production, manufacturing, and other industrial activities. They may cause damage during inadequate storage, transportation, treatment, or disposal operations. Improper hazardous-waste storage or disposal frequently contaminates surface water and groundwater supplies as harmful water pollution and can also be a source of dangerous land pollution. There is no usage of hazardous chemical waste usage inside the Loyola College of Education campus.

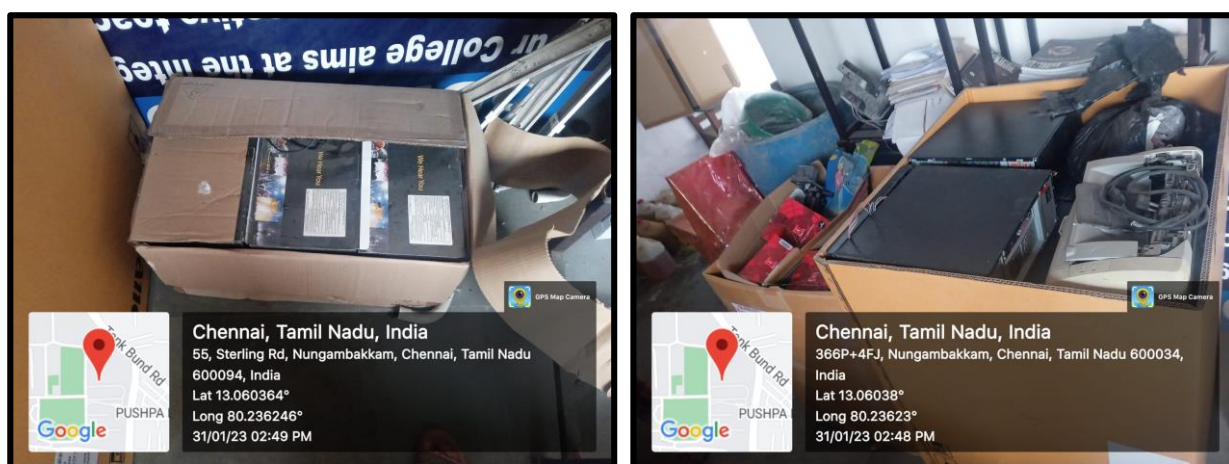
14.6. Electronic Waste

Electronic waste, as known as e-waste, is generated when any electronic or electrical equipment becomes unfit for the intended use or if it has crossed its expiry date. E-waste posses the huge risk to humans, animals, and the environment. E-waste typically consists of plastics, metals, cathode ray tubes (CRTs), printed cables, circuit boards, and so on. The presence of toxic substances like liquid crystal, lithium, mercury, nickel, selenium, polychlorinated biphenyls (PCBs), arsenic, barium, brominates flame retardants, cadmium, chrome, cobalt, copper, and lead makes it very hazardous, in case e-waste get dismantled and processed in a crude manner with the rudimentary techniques. The computers, mainframes, servers, monitors, printers, scanners, compact discs (CDs), copiers, calculators, battery cells, cellular phones, fax machines, transceivers, TVs, medical apparatus, iPods, refrigerators, washing machines, and air conditioners are examples of e-waste when they become unfit for its use. If these



electronic items are discarded with other household garbage, the toxics pose a threat to both health and vital components of the ecosystem.

According to E-Waste Management Rules, 2016 (Ministry of Environment, Forest and Climate Change, Government of India), electronic waste or e-waste includes old and non-functional electrical and electronic appliances. As per the Rules, the producer of the electrical and electronic equipment shall be responsible to collect and channelize the e-wastes generated under the criteria Extended Producer Responsibility. In compliance to the E-Waste Management Rules, 2016, Government of India, e-waste materials were collected from the College are being segregated and then sold to Authorised Agencies which are approved by the Pollution Control Board (PCB) for handling e-waste. Segregation of e-waste helps in proper management of e-wastes are segregated from other waste and collected in red coloured bin. Due to this e-waste activity disposal, the e-waste pollution is significantly reduced in the Campus.



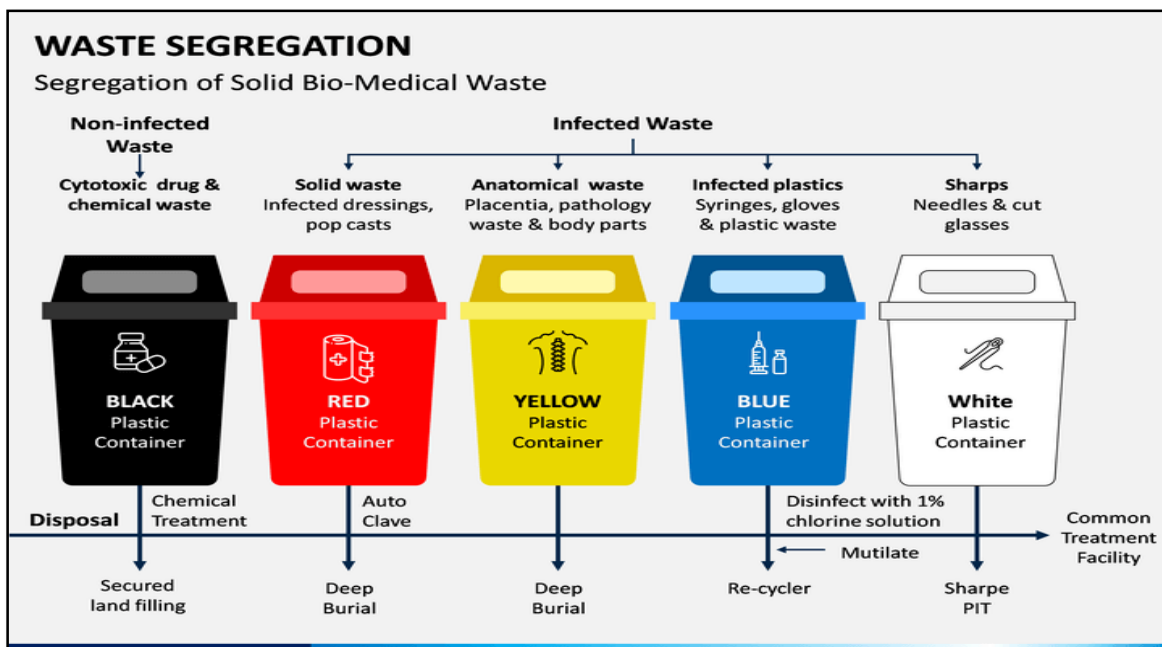
Segregated e – waste at Loyola College of Education, Chennai, TN.

14.7. Biomedical Wastes Management

Biomedical waste comprises of all liquid and solid wastes generated from medical establishments and activities involving biological materials. Besides health care, the relevant activities include clinical research, research involving animals, animal farms, dead animals, and others. The generation of biomedical waste is not restricted to specific activity or organisations. It can originate from homes during dialysis and using insulin injections, animal health activities in rural areas, butchering of sick animals in butcher houses, medical shops, use of sanitary napkins and ear buds, use of diapers, and air ports when passengers through away restricted medicines without prescription. Negligence in biomedical waste management contributes to environmental pollution, sickness of humans/animals, and depletes natural as well as financial resources.



Typical biomedical waste management steps are includes (1) segregation into various components, (2) waste handling and storage, (3) transportation, (3) treatment and disposal. Rural areas and areas where service of common biomedical waste treatment



14.8. Solid Waste Management

The term, solid waste control refers to the method of accumulating and treating solid wastes by following eco- friendly methods. It also offers solutions for recycling objects that do not belong to garbage. In the solid waste management, the wastes are accrued from different parts and are disposed of based on degradability materials like paper and non-degradability materials like glasses, plastics and



metals. Integrated Solid Waste Management (ISWM) is an activity that promotes reduction of waste, recycling, composting, and disposal besides offering methods/solution to manage stable wastes in the context of protect all living organisms in the ecosystem. As per Solid Waste Management Rules, 2016 (Ministry of Environment, Forest and Climate Change, Government of India), solid waste refers to solid or semi-solid wastes generated from domestic, commercial, institutional, catering, and markets and other non-residential wastes (street sweepings, silt removed or collected from surface drains, horticulture/agriculture and dairy waste, bio-medical waste excluding industrial waste, and e-waste, battery/radio-active waste). According to the rules, the local authorities are responsible to collect, treat and dispose the solid wastes. The 'Central Board of Solid Waste Management' is the monitoring authority and is responsible for granting authorization to local bodies for processing and disposal of solid waste.



Solid waste management practices at LICET Campus, Chennai, TN

Table 1. Wastes Management Strategies in LICET.

S.No	Kinds of Wastes	Collection (kg/year)	Collection frequency	Remarks
1.	Plastic wastes	NIL	NIL	NIL
2.	Construction and demolition wastes	Quantity is not known	Weekly	Utilized by the Campus premises itself
3.	Biowastes	300-500	Daily	Recycled in the Campus premises itself as manuring
4.	E-wastes	50-100	Yearly	Segregated and Collected by the waste collectors
5.	Biomedical wastes	0-1	Need based	Segregated and Collected by the waste collectors
6.	Hazardous wastes	NIL	NIL	NIL

The Campus has a very good solid waste recycling unit which operates a few vehicles to collect wastes using compostable bags across the campus. Both degradable and non-degradable items are being collected from different Department laboratories, canteens, cafeteria, stationary shops and hostels every day and dumped in the place which is subsequently segregated based on the nature of degradability. The segregated

items are neatly packed in eco-friendly covers and subjected to degradation without harming the environment. In addition, dust bins are kept in different places across the campus to provide a dust free atmosphere to the stakeholders. The dust bins are labelled properly for the indication of degradable and non-degradable items. These bio composts are utilized for cultivation of plants in the campus and enhance the health of soils and population density of beneficial microorganisms to a greater extend.

14.9. Biogas plant facility

A biogas plant is the structure where it is produced by fermenting biomass (cow dung and plant waste products). This is done by developing methane-containing fuel that is usually present in energy crops like corn, or waste substances (manure or organic food waste). The fermentation residue left over from the substrates at the end of fermentation can be used as fertilizer. Biogas is produced by the microbial/bacterial decomposition of the substrate under anaerobic situations. This is implemented by pumping the substrate into the fermenters. The substrate is stored beneath anaerobic conditions and is periodically shifted *via* agitators to avoid the formation of surface scum and sinking layers which allows the biogas to rise greater effortlessly. Installing biogas in educational institutions and industries help in the waste management process, as the wastes accumulated in canteen, hostels, mess and restaurants can be used for biogas plant, which in turn can be used for cooking. This fulfils two purposes simultaneously by energy saving and waste management. The Campus has a well organised Biogas plant facility inside the LICET campus for the purpose of waste management,

14.10. Vermicompost, Organic and Green manures

Natural or eco-friendly methods should be used to grow plants vigorously in the campus which could reduce the environmental pollution. Use of biofertilizers, organic manures (cow dung, vermicompost and plant wastes and litters) and green manures to grow healthy plants in the medicinal plant garden, kitchen garden and terrace garden should be ensured to keep the campus organic. The plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts should be used to make green manures.

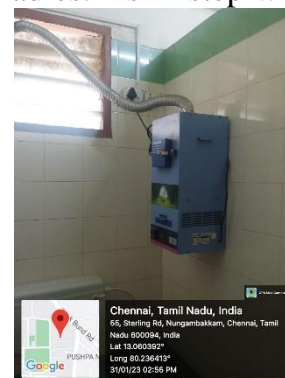


A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal-based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but nil use of chemical fertilizers is highly appreciable and also helps to keep the campus more of an organic ecosystem. The soil, air, water and sunlight are the four major natural resources any campus gets. Proper use and conservation of these resources are mandatory in Waste Management sites. Biofertilizers such as Nitrogen fixing bacteria, Potassium and Phosphorus solubilizing bacteria, Potassium mobilizing fungi (VAM), farmyard manure, dried cow dung manure, vermicompost manures and biofungicides and biopesticides are extensively used in Campus to cultivate plants. Agrochemicals, chemical fertilizers, pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is

eradicated which in turn to improve the soil health significantly. LICET is in the initial development process for setting up manuring facilities in the campus which in turn useful to adopt the green and environmentally safe practices.

14.11. Napkin disposal facility

Menstrual Hygiene Management (MHM) is an indispensable part of the Swachh Bharath Mission Guidelines (SBM-G) for adolescent girls and ladies. As in step with MHM hints, 'Safe disposal' method making sure that the process of destruction of used and dirty materials is performed without human touch and with minimum environmental pollutants and 'Unsafe disposal' method throwing used material into ponds, rivers, or inside the fields exposes others inside the vicinity to decaying material and must be averted. Some of the unsafe practices of napkins include throwing them unwrapped into fields and rooftops, wrapping them in paper/ plastic bags and throwing them outdoors or in dustbins, burying them for decomposting, throwing them in latrine / toilets, burning it. These unsafe practices are to be avoided and rather health practices can be adopted. The Campus Management is implementing the safe practices of disposing of napkins using small scale incinerators in ladies' hostels. Incinerator's facility and disposal structures in the proper directions and other social stigmas connected to menstruation influences the sanitary waste disposal conduct of women within the campus is very much appreciated. The Management is taking care of adolescent girls and ladies significantly in their personal hygiene.



14.12. Environmental Education on Waste Management

An environmental study is the learning principle of the ecosystem and how it will expand sustainable techniques to defend the surroundings. It enables people to develop an understanding of the environment in which we live and helps to overcome tough environmental troubles affecting nature. In addition, the physical aspects of the environment should be studied, it also emphasizes the need to conserve biodiversity and undertake an extra sustainable way of life and make use of sources in a responsible manner. To create attention amongst today's generation on pressing environmental troubles, the University Grants Commission (UGC) in India has made it mandatory for the Universities and Autonomous Colleges to introduce a course in 'Environmental studies' and teach to the students about the ecosystem, pollution and problems associated with the environment. Environmental education refers to structured efforts to deliver how natural environments function, how human beings can manage to protect the ecosystems in sustained manner. It is a multi-disciplinary field integrating Biology (Botany and Zoology), Chemistry, Physics, Ecology, Environmental Science & Engineering, Earth Science, Atmospheric Science, Mathematics, and Geography. These subjects may be useful to convey the importance of ecosystem, ecology and environment to the students and scholars.

15. Action Plan and Suggestions for Waste Reduction in the Organization

Preparing one's own waste reduction action plan allows one to rethink procedures to produce less waste or redesign processes and hence boost efficiency. There are eight steps to be taken by the Organization as per the following:

Step 1: Review the site waste audit report and ensure 3R's actions to be followed

Review site Waste Audit Report and gather information about the 3R's actions that are currently in place, such as waste reduction strategies, quantity of current waste Reduction, Reuse, Recycling, and analysis of operating costs after following 3R's.

Step 2: Using the 3Rs, identify major waste reduction opportunities

Examining the materials that make up a substantial part of the waste produced is a key aspect in identifying 3R's potential for waste reduction. Consider the cost of waste disposal, the potential for source separation, the potential to reduce, reuse, or recycle, the complexity of handling, and current and potential regulatory requirements.

Step 3: Determine waste reduction after identifying potential areas

Possible impacts of other priorities on the 3R's should be investigated when developing a waste reduction action plan in which review the costs and benefits of each waste reduction opportunity. Be aware of anticipated landfill closures, increased tipping fees, or other factors that may affect the disposal of waste and ensure the availability of on-site storage space and storage space with adequate fire safety should be considered.

Step 4: Figure out why waste is produced?

When evaluating waste reduction possibilities, the Organization should start by asking, "Why is this material being used?". It may reveal the possibilities for reducing, reusing, or recycling the waste significantly. There are some questions such as 1) where waste can be eliminated during the operations by reducing the use of specific materials or procedures, 2) where other materials that can be reused or recycled can be used, 3) where it is possible to utilise disposable materials and 4) where can we put controls in place to limit waste production during the operations?

Step 5: Evaluate impact of material purchasing practices on waste reduction

Material purchasing procedures involve a lot of waste reduction possibilities. Actions to change the materials used to manufacture the products or provide very good services which may involve discussions with suppliers. Replacing non-recyclable materials with reusable or recyclable materials gives economic benefits and greater waste diversion.

Step 6: Achievable waste reduction action plan

A waste reduction action plan is a compilation of the identified waste reduction opportunities and the actions intended to be taken in reducing waste. At this stage, realistic waste reduction targets should be set. Excessive over-targeting could have negative effects on employee attitudes and confidence in future work plans. The work plan focuses on the wastes for which reduction measures, actions and objectives have been specified. The format enables us to identify activities on specific waste materials as well as the total amount of waste reduced, reused, and recycled.

Step 7: Identify the waste reduction, reuse, and recycling opportunities

The following are some opportunities to improve the management of waste products:

a) Reduce Waste

Employees at campus facility may already be employing a variety of waste-reduction techniques. Some disposable products may have already been replaced with reusable products in the facility. Use fewer disposable supplies and equipment that we use. Focus on strengthening purchasing rules in administrative departments to reduce the amount of incoming packaging.

b) Minimize Paper Usage

Avoiding the waste of paper by implementing double-sided printing and photocopies. E-mail memos and reports to staff or clients instead of providing hard copies. Encourage staff to save digital copies of documents instead of printing them. Remove names from mailing lists if magazines or catalogues are no longer needed.

c) Bulk Purchasing

To get volume discounts, look into buying in bulk. Bulk purchases frequently come with less packaging than items purchased individually.

d) Disposable / Reusable / Eco-friendly Packaging

Request loose products rather than individually packed ones when purchasing supplies. Instead of using disposable tape dispensers, use permanent tape dispensers. Request that the package be "taken back" by the vendor or it should be reusable or eco-friendly.

e) Cafeteria Waste

Single-serve condiment containers should be avoided. Customers that bring their own coffee/travel mug should receive a discount. To cut down on waste, go over the menus again, focusing on portion sizes. Start a "litter less lunch" campaign to encourage employee or students to bring lunches in reusable containers. Napkin dispensers might help to avoid using too many napkins.

f) Washrooms

Replace disposable hand towel dispensers with hand dryers where possible.

g) Manufacturing Technology

Where possible, adopt newer production technologies that reduce material usage. Due to older technology, make sure that process start-up and/or cut-off tolerances aren't exorbitant. To avoid waste, improve process controls.

h) Reuse Equipment

Reusable things can be donated or sold. The organisations are typically interested in equipment and supplies that are no longer needed.

i) Donate Left Over or Unused Food

Donations of consumable fresh foods and out-of-date packaged foods are welcomed by many food banks. To determine if it can assist in this way, contact the local social organisations.

j) Recycle Waste

Many recyclable materials, such as corrugated cardboard, office paper, newspaper, glass, aluminium, steel, plastic products, and food waste, have markets. As the markets grow, more items may be added to the recycling list.

k) Use of Recyclable Materials

Look for ways to include recycled materials in products development. The success of recycling is dependent on stable material markets. It can also contribute to the environment by buying products containing recycled materials.

l) Internal Recycling

Recycle the own products' materials. Where feasible, introduce processes to support internal recycling of waste materials.

m) Employee Training on Source Separation

Make sure that the segregation in different types of waste materials at source of origination. All personnel should be trained in source-separation techniques and given enough well-labelled containers and storage facilities to collect recyclable material.

n) Organic and Inorganic Wastes

Examine the options for composting and look into composting organic materials like food waste, leaves and yard trash, and paper towels with private operators or the local Government sectors.

o) Internet or Business Directory

Find recycling companies in the Organization campus area by using a local business directory or by doing a search on the internet.

Follow 3Rs: Reduce , Reuse and Recycle**Reduce**

- Buy less and use less.
- Purchase recycled papers.
- Use softcopy instead of hard copy
- Purchase environmentally friendly office supplies.
- Choose to purchase items with less packaging.
- Double-side printing and photocopying.
- Use one-sided printed paper instead of throwing in trash.
- Set printer to print double sided as a default setting.
- Print notices on half-sheets.
- Use emails instead of faxes.
- Post newsletters online.

- Avoid printing out emails.
- Host paper-free meetings by setting the agenda on the board.
- Use fewer paper towels in the washroom or replace them with electric hand dryer.
- Use refillable soap dispenser in washroom
- Encourage waste-free lunches.
- Reduce the use of tetra-packs by using refillable containers.
- In the dining area replace the paper napkins with the cloth napkins.
- Purchase condiments, sweeteners, salt, and pepper in bulk.
- Use dispensers instead of individually packaged servings.

Reuse

- Replace disposable items with reusable items and learn to share or donate to avoid the landfill.
- Reuse the other side of used paper.
- Use reusable coffee cups and water bottles.
- Stock cafeteria with reusable or biodegradable plates, cups, and cutlery.
- Donate uneaten lunch items to a “share a lunch” program.
- Donate used computers, eyeglasses, cell phones, clothes, textbooks, and other items.
- Host a clothing swap/sale/collection.
- Host a schoolyard/garage sale-type fundraiser.

Recycle

- Divert garbage by recycling items such as paper, glass, plastics, cans, tetra packs, and cardboard.
- Recycle special items such as batteries, electronics, cell phones, and computers.
- Compost organic waste.
- Limit contamination of recycled items by ensuring they are clean.
- Recycle ink and toner products.
- Ensure correct disposal methods are used for chemicals.

Step 8: Recommendations for Sustainable Waste Management

- A proper step may be taken to minimize the environmental degradation by means of developing ‘Sanitation and hygiene policy’, ‘Waste management policy’, ‘Green campus and Environment policy’, ‘Energy policy’ and ‘Purchase policy’ in collaboration with Governmental and Non-Governmental Organizations.
- Helpline numbers for waste collection may be made available in the Campus which may be useful for door-to-door collection of wastes thus avoiding improper disposal by individuals.
- The concept of eco-friendly culture and sensitize the students to minimize the use of plastics, non-biodegradable materials and exploitation of natural resources which pose the environmental hazards may be carried out.

- Waste disposal management for both dry and wet wastes should be proper in which from collection to disposal of the waste, together with monitoring and regulation of the same may be undertaken. Attempts may be made to segregate the wastes and to convert organic wastes into fertilizing material through recycling and composting processes which may be used for vegetation purpose.
- Students may be taken to some industrial areas including the waste management sites to teach about the recycling of wastewaters, solid wastes, natural ecosystem, pollution-free environment and environmental education.

16. Best Practices on Waste Management Initiatives followed in the Organization

1. The Campus has taken green and environmental protection initiatives in a substantial manner by means of creating solid waste management, wastewater treatment, sanitation, and natural vegetation in the campus without harming the environment.
2. Various kinds of degradable and non-degradable wastes such as plastics, construction & demolition, biowastes, hazardous, electronic, biomedical, solid & liquid wastes, organic & inorganic wastes are segregated properly and subjected recycle and/or given to Tamil Nadu Municipal Corporation for their further processing.
3. The Management is also taking efforts in establishing vermicompost, organic and green manures facilities, identification of waste reduction reuse, and recycling opportunities, origination of wastes, use of disposable / reusable / eco-friendly packaging materials in the campus in a big way.
4. The Organization is created massive facilities for solid waste management and wastewater treatment to purify the wastewaters to manage both solid wastes and wastewaters effectively without harming the environment.
5. The dust bins and eco-friendly trashes are kept in different places across the campus to provide a dust free atmosphere to the stakeholders which are labelled properly for the indication of degradable and non-degradable items.
6. The management has created a very good campus ecosystem for making a coexisting and sustainable environment which includes natural and planted vegetation supporting a rich biodiversity of flora and fauna.
7. 'Eco Club' and 'Nature Club' along with NCC / NSS Units are functioning well and conducting a large number of awareness programmes related to nature conservation and environmental protection.
8. Swachh Bharath Abhiyan and National service schemes are implemented effectively towards sanitation, solid waste management and refining drinking water quality to promote cleanliness to rural and tribal people across the city.

17. Conclusion

Loyola College of Education, Chennai, Tamil Nadu is a well-established Institute in India in terms of academic and social activities. The Management is taking enormous efforts continuously in providing an eco-friendly atmosphere to the students, research scholars, parents and staff members. It is observed that the green and environmental protection initiatives are substantial by means of creating solid waste management, wastewater treatment, sanitation, and natural vegetation in the campus without harming the environment. Various kinds of degradable and non-degradable wastes such as plastics, construction & demolition, biowastes, hazardous, electronic, biomedical, solid & liquid wastes, organic & inorganic wastes are segregated properly and subjected recycle and/or given to Tamil Nadu Municipal Corporation for their further processing. The Management is also taking efforts in establishing vermicompost, organic and green manures facilities, identification of waste reduction reuse, and recycling opportunities, origination of wastes, use of disposable / reusable / eco-friendly packaging materials in the campus in a big way. The College has 'solid waste management and wastewater treatment facility to recycle the solid wastes and wastewaters; respectively. The campus ecosystem is supported a rich biodiversity of flora and fauna which is making a sustainable environment and eco-friendly campus due to effective waste management implantation policy. Waste management audit is carried out to provide an indication on how the environmental organization system is working towards the noble cause of environmental protection and nature conservation. To conclude the waste management audit report, the College is an eco-friendly campus and providing very good amicable atmosphere to the stakeholders.

18. Acknowledgement

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Mrs. S. Rajalakshmi, B.Sc., M.B.A., FNSF,
 Founder & Chairman
 NATURE SCIENCE FOUNDATION
 LIG-II, 2669, Gandhi Managar
 Peelamedu, Coimbatore - 641 004
 Tamil Nadu, India.


Dr. P.V. Sreenivasan, M.Sc., M.Phil., Ph.D.,
 Director
 NATURE SCIENCE FOUNDATION
 LIG-II, 2669, Gandhi Managar
 Peelamedu, Coimbatore - 641 004
 Tamil Nadu, India.


Dr. D. Vinothkumar, M.Sc., M.Phil., Ph.D., FNSF,
 Joint Director
 NATURE SCIENCE FOUNDATION
 LIG-II, 2669, Gandhi Managar
 Peelamedu, Coimbatore - 641 004
 Tamil Nadu, India.

Certificates of
Nature Science Foundation,
Coimbatore, Tamil Nadu.

- 1.ISO Certificate (QMS 9001:2015)
- 2.ISO Certificate (EMS 14001:2015)
- 3.ISO Certificate (OHSMS 45001:2018)
- 4.ISO Certificate (EnMS 50001:2018)
- 5.MSME Certificate
- 6.NGO Darpan NITI Aayog
- 7.12A Certificate
- 8.80G Certificate
- 9.10AC Certificate

Certificate of Registration



This is to Certify That The Quality Management System of



NATURE SCIENCE FOUNDATION

LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641004, TAMILNADU, INDIA.

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

PROVIDING ENVIRONMENT, ENERGY, GREEN AND HYGIENE AUDITS
TO ACADEMIC INSTITUTIONS AND ORGANISATIONS
AS PER THE OWN CHECKLIST AND AWARDS TO
MERITORIOUS CANDIDATES.

Certificate No	20DQHY90	
Initial Registration Date	: 08/01/2021	Issuance Date : 08/01/2021
Date of Expiry*	: 07/01/2024	
1st Surve. Due	: 08/12/2021	2nd Surve. Due : 08/12/2022

DIRECTOR

ROHS Certification Pvt. Ltd.

408, Madhuban Building, 55, Nehru Place, New Delhi - 110 019, India
phone : +91.11.41525522 | e-mail : info@rohs-certification.co.in | website : www.rohs-certification.co.in
The Registration is not a Product Quality Certificate, *Subject to successful completion of surveillance audits, Visit for verification on www.rohs-certification.co.in
Certificate is the property of ROHS and return when demanded



eiaCI
مركز الإمارات العالمي للاعتماد
Emirates International Accreditation Centre
035-CB-QMS

Certificate of Registration



This is to Certify That The Environmental Management System of



NATURE SCIENCE FOUNDATION

LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,
TAMILNADU, INDIA.

has been assessed and found to conform to the requirements of

ISO 14001:2015

for the following scope :

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

Certificate No	22DEJI67		
Initial Registration Date	: 21/05/2022	Issuance Date	: 21/05/2022
Date of Expiry*	: 20/05/2025		
1st Surve. Due	: 21/04/2023	2nd Surve. Due	: 21/04/2024




DIRECTOR

ROHS Certification Pvt. Ltd.

B-7, 1st Floor, Sector-2 Noida, Gautam Budh Nagar, UP-201301

e-mail : info@rohscertification.co.in | website : www.rohscertification.co.in

The Registration is not a Product Quality Certificate. *Subject to successful completion of surveillance audits. Visit for verification on www.rohscertification.co.in
Certificate is the property of ROHS and returns when demanded.





QCS MANAGEMENT PVT. LTD.

MANAGEMENT SYSTEMS CERTIFICATION

Certificate of Registration

ISO 45001:2018 (Occupational Health & Safety Management System)

NATURE SCIENCE FOUNDATION

ADDRESS: NO. 2669, LIG-II, GANDHI MANAGAR PEELAMEDU COIMBATORE - 641 004 TAMIL NADU, INDIA.

Scope of Certification:

PROVIDING TRAINING AND AUDITING SERVICES IN THE FIELD OF GREEN CAMPUS, ENVIRONMENT, ENERGY, OCCUPATIONAL HEALTH AND SAFETY, HYGIENE AND WASTE MANAGEMENT AT EDUCATIONAL INSTITUTES AND INDUSTRIAL SECTOR.

Certificate Number : QCS/EUAS/OHS/002

Issue Date : 03/08/2022
Expiration Date : 02/08/2023

1ST Surveillance Audit Within : 02/07/2023
2ND Surveillance Audit Within : 02/07/2024
Re-certification Due Date : 02/08/2025



Partha Bagchi
(Managing Director)

Validity of this Certificate is subject to Surveillance Audits to be conducted before scheduled due dates of surveillance audits as mentioned on the certificate, failing which the certificate will stand to be withdrawn and need to be treated as an initial certification process to reactivate its continuity on the register of EUAS and QCS. This Certificate is valid when confirmed by data listed on the (Euro Universal Accreditation Systems) EUAS" www.euas-ac.org. The authenticity & validity of this certificate may be re-affirmed by referring to our company website - www.qcsp.com. Lack of fulfillment of conditions as set out on the 'Certification Contract' (Annex 13) may render this certificate invalid. Any alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of law. This certificate remains the property of QCS and to be returned on request.

REGISTERED OFFICE: 37E/1(310) 2ND STREET, MODERN PARK, GREENAGE APARTMENT - 2ND FLOOR,
SANTOSH PUR, KOLKATA - 700075, WEST BENGAL, INDIA.
Email: info@qcsp.com. Call: +91 8697724963, +91 8902447427. Website: www.qcsp.com



Certificate of Registration

This is to certify that

NATURE SCIENCE FOUNDATION

**LIG II, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004,
TAMILNADU, INDIA.**

has been independently assessed by QRO
and is compliant with the requirement of:

ISO 50001:2018

Energy Management Systems

For the following scope of activities:

PROVIDING CONSULTANCY SERVICES FOR ENVIRONMENT, ENERGY, GREEN, HYGIENE, SOIL AND WATER, WASTE MANAGEMENT, BIOMEDICAL WASTE MANAGEMENT, E-WASTE MANAGEMENT, PLASTIC WASTE MANAGEMENT AND ACADEMIC AND ADMINISTRATIVE AUDITS TO EDUCATIONAL INSTITUTIONS AND INDUSTRIAL SECTORS AS PER THE OWN CHECKLISTS, START UP THE INTERNATIONAL ECO CLUB STUDENTS CHAPTER, OFFERING LEAD AUDITOR COURSE ON ENERGY AND ENVIRONMENT, AWARDS TO MERITORIOUS CANDIDATES.

Date of Certification: 9th August 2022

2nd Surveillance Audit Due: 8th August 2024

1st Surveillance Audit Due: 8th August 2023

Certificate Expiry: 8th August 2025

Certificate Number: 305022080903EN



Chumant...
Head of Certification

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit. (In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at www.qrocet.org

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : www.qrocet.org, E-mail : info@qrocet.org

UDYAM REGISTRATION NUMBER		UDYAM-TN-03-0073706																												
NAME OF ENTERPRISE		M/S NATURE SCIENCE FOUNDATION																												
TYPE OF ENTERPRISE *		MICRO																												
MAJOR ACTIVITY		SERVICES																												
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL																												
NAME OF UNIT(S)		<table border="1"> <thead> <tr> <th>S.No.</th> <th colspan="4">Name of Unit(s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td colspan="4">Green Campus, Energy and Environment Management Audits</td> </tr> </tbody> </table>				S.No.	Name of Unit(s)				1	Green Campus, Energy and Environment Management Audits																		
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OFFICIAL ADDRESS OF ENTERPRISE		<table border="1"> <thead> <tr> <th>Flat/Door/Block No.</th> <th>LG-1L2669</th> <th>Name of Premises/ Building</th> <th colspan="2">GANDHIMAA NAGAR</th> </tr> </thead> <tbody> <tr> <td>Village/Town</td> <td>Gandhimanagar S.O</td> <td>Block</td> <td colspan="2">LG-II</td> </tr> <tr> <td>Road/Street/Lane</td> <td>Peelamedu</td> <td>City</td> <td colspan="2">Coimbatore South</td> </tr> <tr> <td>State</td> <td>TAMIL NADU</td> <td>District</td> <td colspan="2">COIMBATORE , Pin 641004</td> </tr> <tr> <td>Mobile</td> <td>9566777255</td> <td>Email:</td> <td colspan="2">chairmananf@gmail.com</td> </tr> </tbody> </table>				Flat/Door/Block No.	LG-1L2669	Name of Premises/ Building	GANDHIMAA NAGAR		Village/Town	Gandhimanagar S.O	Block	LG-II		Road/Street/Lane	Peelamedu	City	Coimbatore South		State	TAMIL NADU	District	COIMBATORE , Pin 641004		Mobile	9566777255	Email:	chairmananf@gmail.com	
Flat/Door/Block No.	LG-1L2669	Name of Premises/ Building	GANDHIMAA NAGAR																											
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Road/Street/Lane	Peelamedu	City	Coimbatore South																											
State	TAMIL NADU	District	COIMBATORE , Pin 641004																											
Mobile	9566777255	Email:	chairmananf@gmail.com																											
DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE		28/11/2017																												
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS		12/03/2020																												
NATIONAL INDUSTRY CLASSIFICATION CODE(S)		<table border="1"> <thead> <tr> <th>SNo.</th> <th>NIC 2 Digit</th> <th>NIC 4 Digit</th> <th>NIC 5 Digit</th> <th>Activity</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>69 - Legal and accounting activities</td> <td>6920 - Accounting, bookkeeping and auditing activities; tax consultancy</td> <td>69201 - Accounting, bookkeeping and auditing activities</td> <td>Services</td> </tr> <tr> <td>2</td> <td>85 - Education</td> <td>8542 - Cultural education</td> <td>85420 - Cultural education</td> <td>Services</td> </tr> <tr> <td>3</td> <td>85 - Education</td> <td>8549 - Other education n.e.c.</td> <td>85499 - Other educational services n.e.c.</td> <td>Services</td> </tr> </tbody> </table>				SNo.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity	1	69 - Legal and accounting activities	6920 - Accounting, bookkeeping and auditing activities; tax consultancy	69201 - Accounting, bookkeeping and auditing activities	Services	2	85 - Education	8542 - Cultural education	85420 - Cultural education	Services	3	85 - Education	8549 - Other education n.e.c.	85499 - Other educational services n.e.c.	Services					
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DATE OF UDYAM REGISTRATION		26/02/2022																												

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the Mo/ MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from <https://udyamregistration.gov.in> & Date of printing: - 26/02/2022

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)

2. MSME-DI: CHENNAI (TAMIL NADU)

Visit : www.msme.gov.in ; www.dcmsme.gov.in ; www.champions.gov.in

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The screenshot displays the NGO DARPAN website. At the top left, there are logos for the Government of India, the NGO sector, and the DARPAN portal. The text 'NITI Aayog, Government of India' is positioned on the right side of the header. A navigation menu includes links for Home, About Us, NGO Directory, Search NGOs, Report, Guidelines, Circulars, Help, Apply Grant, and Blacklisted NGOs. A 'Login/Register' button is located in the bottom right of the header. The main banner features a photograph of a group of people and the text 'NGO DARPAN' in large white letters. Below the banner, a message states: 'In order to strengthen services of the portal, Government has decided to make PAN Number of VOs/NGOs mandatory.' A light blue notification bar says 'Please Update Your Profile'. A teal bar below it reads 'Welcome, Nature Science Foundation'. At the bottom, a light blue box displays the unique ID: 'Your Unique Id: TN/2018/0187711'.



PROCEEDINGS OF THE COMMISSIONER OF INCOMETAX (EXEMPTIONS),
III FLOOR, ANNEXE BLDG, NO.121, MAHATMA GANDHI SALAI, CHENNAI-34

Present : G.M.DOSS, I.R.S
Commissioner of Income Tax (Exemptions)

** URNo. AACTN7857J/05/18-19/T-1105

Dated:03/09/2018

Sub: Registration u/s. 12AA of the Income tax Act 1961 - in the case of

"Nature Science Foundation"
LIG-II, 2669, Gandhimaa Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 28/03/2018

ORDER UNDER SECTION 12AA OF THE INCOME TAX ACT 1961.

1. The above ~~Trust/Society/Association/ Company/others/~~, bearing PAN AACTN7857J was constituted by ~~Trust Deed / Memorandum of Association~~ dated 29/11/2017 registered with ~~Sub-Registrar's Office/Registrar of Societies/Registrar of Companies/others~~ on 29/11/2017.

2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~

3. The above TRUST filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.

4. On going through the objects of the TRUST and its proposed activities as enumerated in the Trust Deed / Memorandum of Association, I am satisfied about the genuineness of the TRUST as on date.

5. The application has been entered at Sl.No.1105 maintained in this office. The above Trust is accordingly registered as a PUBLIC CHARITABLE TRUST u/s 12 AA of the Income Tax Act, 1961 with effect from 29/11/2017.

6. It is hereby clarified that the Registration so given to the Trust/Institution is not absolute. Subsequently, if it is found that the activities of the Trust/Institution are not genuine or are not being carried out in accordance with the objects and clauses of the Trust Deed / Memorandum of Association submitted at the time of registration or modified with the approval of the Commissioner of Income-tax (Exemptions), Chennai or there is a violation of the provisions of Section – 13, the Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the Trust/Society/Association/Company/Others/ complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961.

7. Granting of Registration u/s 12AA does not confer any automatic exemption of income from taxation. The Trust/Institution should conform to the parameters laid down in Sections '11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.

** This Unique Registration No. URNo. AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.

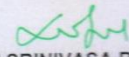


Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income-tax(Exemptions), Chennai.

Copy to:

1. The Assessee.
2. The ACIT(Exemptions), Coimbatore Circle.
3. Office Copy.

//CERTIFIED TRUE COPY//


(N SRINIVASA RAO)
Asst. Commissioner of Income-tax (H.Qrs)(Exemptions),
Chennai.



GOVERNMENT OF INDIA
INCOMETAX DEPARTMENT
OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
Aayakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URNo. AACTN7857J/05/18-19/T-1105/80G

Date: 10.04.2019

Name of the Trust-/Society /Company/Institution : NATURE SCIENCE FOUNDATION
Address : LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004
PAN : AACTN7857J
Date of Application : 12.11.2018

Received
Rajy S. Ponnudurai
17/07/19

APPROVAL UNDER SECTION 80G(5)(vi) OF THE INCOME TAX ACT, 1961

The aforesaid Trust-/Society/Company/Institution has been registered u/s.12AA of the Income Tax Act with effect from 29.11.2017 vide AACTN7857J/05/18-19/T-1105 dated 03.09.2018. It is certified that donation made to NATURE SCIENCE FOUNDATION at LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004 shall qualify for deduction u/s 80G(5)(vi) of the Income Tax Act, 1961, subject to the fulfillment of conditions laid down in clauses [i] to [v] of sub-section (5) of section 80G of the I.T Act, 1961.

2. This approval shall be valid in perpetuity with effect from A.Y. 2019-20 unless specifically withdrawn. The details and validity of the certificate is available @ office.incometaxindia.gov.in
3. The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually to the Assessing Officer having jurisdiction over the case.
4. No change in the Trust Deed/Memorandum of Association shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai.**
5. Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. URNo. AACTN7857J/05/18-19/T-1105/80G and date of this order i.e. **10.04.2019.**
6. Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.



Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income Tax (Exemptions)
Chennai.

Copy to:

1. The applicant
2. Guard File
3. The DCIT(Exemptions) Coimbatore Circle.

//Certified True Copy//

(Signature)
(N. SRINIVASA RAO)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

FORM NO. 10AC

(See rule 17A/11AA/2C)

Order for registration.

1	PAN	AACTN7857J
2	Name	NATURE SCIENCE FOUNDATION
2a	Address	
	Flat/Door/Building	LIG-II, 2669
	Name of premises/Building/Village	GANDHIMAA NAGAR
	Road/Street/Post Office	Coimbatore South
	Area/Locality	COIMBATORE
	Town/City/District	Gandhimasnagar S.O
	State	Tamil Nadu
	Country	INDIA
	Pin Code/Zip Code	641004
3	Document Identification Number	AACTN7857JE2021501
4	Application Number	739995830271021
5	Unique Registration Number	AACTN7857JE20215
6	Section/sub-section/clause/sub-clause proviso in which registration is being granted	01-Sub clause (i) of clause (ac) of sub-section (1) of section 12A
7	Date of registration	03-11-2021
8	Assessment year or years for which the trust or institution is registered	From AY 2022-23 to AY 2026-2027
9	Order for registration:	
	a. After considering the application of the applicant and the material available on record, the applicant is hereby granted registration with effect from the assessment year mentioned at serial no 8 above subject to the conditions mentioned in row number 10.	
	b. The taxability, or otherwise, of the income of the applicant would be separately considered as per the provisions of the Income Tax Act, 1961.	
	c. This order is liable to be withdrawn by the prescribed authority if it is subsequently found that the activities of the applicant are not genuine or if they are not carried out in accordance with all or any of the conditions subject to which it is granted, if it is found that the applicant has obtained the registration by fraud or misrepresentation of facts or it is found that the assessee has violated any condition prescribed in the Income Tax Act, 1961.	
10	Conditions subject to which registration is being granted	
	The registration is granted subject to the following conditions:-	

	o. This certificate cannot be used as a basis for claiming non-deduction of tax at source in respect of investments etc. relating to the Trust/ Institution.
	p. All the Public Money so received including for Corpus or any contribution shall be routed through a Bank Account whose number shall be communicated to Office of the Jurisdictional Commissioner of Income Tax.
	q. The applicant shall comply with the provisions of the Income Tax Act, 1961 read with the Income Tax Rules, 1962.
	r. The registration and the Unique registration number has been instantly granted and if, at any point of time, it is noticed that form for registration has not been duly filled in by not providing, fully or partly, or by providing false or incorrect information or documents required to be provided under sub-rule (1) or (2) of rule 17A or by not complying with the requirements of sub-rule (3) or (4) of the said rule, the registration and Unique Registration Number (URN), shall be cancelled and the registration and URN shall be deemed to have never been granted or issued.
Name and Designation of the Registration Granting Authority	Principal Commissioner of Income Tax/ Commissioner of Income Tax (Digitally signed)



Certificates of Waste Management Auditors

1. ISO Environment Management System (14001:2015) of Dr. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
3. ISO Occupational Health and Safety, Management Systems Auditing (45001:2018) of Dr. K. Sreedharan, Lead Auditor of NSF
4. Indian Green Building Council (IGBC AP) Accredited Professional and Associated Chambers of Commerce and Industry of India (ASSOCHAM) of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Botanist and Subject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
6. Bureau of Energy Efficiency (BEE) and National Productivity Council of Er. N. Dinesh kumar and Dr. N. Balasubramanian, Certified Energy Auditors of NSF.



Certificate of Training

TNV hereby certifies that

S. Rajalakshmi

has successfully completed the 5 days

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

ISO 14001:2015

Issue Date: 17th Jun. 2021

Training Date : 20th to 24th May. 2021

Certificate Number : 2106170721010105

Authorised Signatory
(Pragyaesh Singh)

This course is certified by Exemplar Global vide registration number: TN006669

Note: The course conforms to the principles and practice of audits of Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For verification of this certificate, please write to Mail: info@isindia.org



**PR315: ISO 14001:2015 Lead Auditor
(Environmental Management Systems)
Training course**

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

A handwritten signature in black ink, appearing to be "G. Alagarsamy".

for TÜV NORD CERT GmbH

Essen, 2019-04-26

The course is certified by CQI and IRCA (Certification No. 18125). The learner meets the training requirements for those seeking certification under the IRCA EMS Auditor certification scheme.

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com





Certificate of Achievement

Is conferred upon

SREEDHARAN .K

on successfully completing process required for Internal Auditor
In the E-training

**" INTERNAL AUDITING BASED ON ISO 45001
OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM"**

Conducted during 9th to 11th June ,2021

Regional Director

NPCBBSR/W66/9-11/6/2021/1 National Productivity Council , Bhubaneswar, India

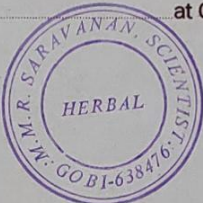


Medicinal Plants Farmos 1999-2000
Kuppayee Thottam, Vadugampalayam Privu,
Gobi.

ATTENDANCE CERTIFICATE
FOR INSITUTIONAL TRAINING

This is to Certify that Mr. D. VINOTHKUMAR
of B.Sc., BOTANY FINAL YEAR of
Chikkaiah Naicker College, Erode-4. Has undergone institutional training in Plantation, Cultivation
and Collection of medicinal plants for 14 days from 18.12.99 to
31.12.99 at Gobi.

Station : GOBI
Date : 31.12.99



M. R. Saravanan
SIGNATURE OF THE CONCERNED AUTHORITY
M. R. SARVANAN, GOBI



BUREAU OF ENERGY EFFICIENCY



Examination Registration No. : **EA-14056** Serial Number **9176**

Certificate Registration No. : **9176**

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. **Dinesh Kumar D**
Son/Daughter of Mr./Mrs. **R M Dhanasekaran** who has passed the National Examination for certification of energy manager held in the month of **October 2011** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number **9176** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. **Dinesh Kumar D** is deemed to have qualified for appointment or designation as energy manager under clause (f) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this **7th** day of **February, 2013**

Secretary
Bureau of Energy Efficiency
New Delhi

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

Regn. No. EA-7391  Certificate No. 5093

National Productivity Council
(National Certifying Agency)
PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. N. Balasubramaniam
son / daughter of Mr. M. Nanjukkuttigounder
has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on
behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.


He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the
fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau
of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India
Date : 11th February 2010


Controller of Examination

 ENERGY IS LIFE
BEE
CONSERVE IT

ऊर्जा दक्षता ब्यूरो
BUREAU OF ENERGY EFFICIENCY
विद्युत मंत्रालय, भारत सरकार
MINISTRY OF POWER, GOVERNMENT OF INDIA

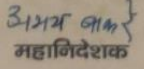
प्रमाणित किया जाता है कि

श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता
के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक एम्पनआईटी / सीईपीटी / आईआईआईटी
द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।

This is to certify that

Shri/Smt. Dinesh Kumar has successfully
completed the Master Trainer Certificate Programme conducted by MNIT / GEPT / IIIT
from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 07 JUL 2017
New Delhi, _____


महानिदेशक
Director General