

TECHNICAL REPORT OF GREEN CAMPUS AUDIT



Submitted to

**St. XAVIER COLLEGE (AUTONOMOUS),
PALAYAMKOTTAI – 627 002,
THIRUNELVELI, TAMILNADU**

Date of Audit: 25.07.2022

Submitted by



NATURE SCIENCE FOUNDATION

*(A Unique Research and Development Centre for Society Improvement)
[ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) &
EnMS (50001:2018) Certified and Ministry of MSME Registered Organization]*

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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. 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. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. 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 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 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. St. Xavier's College

St. Xavier's College, which was established in 1923, celebrates its 96 years of existence at Palayamkottai, and aims at training of young men of quality to be leaders in all walks of life so that they may serve the people of our nation in truth, justice and love. Accordingly, this College is to be an agent of social change, instilling in the youth an awareness of the great need in our country of social justice based on brotherhood and dignity of the human person. Thus, it aims at making its own contribution towards a transformation of the present social conditions, so that justice, equality and the moral values enshrined in the Constitution of India may prevail in the daily life of every citizen. The aim of St. Xavier's is the sound formation (religious, intellectual, social and physical) of the young based on Christian principles.

In 1987, the college became an Autonomous Institution. The College was accredited with Five Star status by the National Assessment and Accreditation Council (NAAC) on 17th April 2000. UGC conferred on our College the status of "College with Potential for Excellence" in 2004 and for the second time in 2010. The College was re-accredited with 'A' Grade by NAAC in April 2006. In the third cycle of NAAC reaccreditation (2012), the college received 'A' grade with the CGPA of 3.50. In the year 2014, Department Biotechnology (DBT) selected our college under 'Star College Scheme' and for the second time in 2017. The National Institute Ranking Framework (NIRF) ranked our college in the 74th position in 2019.

Motto of the College

Veritate Lumen et Vita (Light and Life through Truth)

Vision of the College

To mould young men and women as leaders in all walks of life so that they may serve the people especially the poor and the oppressed of our nation in truth, justice and love.

Mission of the College

- To achieve a synthesis of academic excellence and formation of character
- To ensure social justice through equity and access
- To include the excluded for empowerment
- To equip students with global competencies
- To engage in relevant research activities
- To promote Lab to Land through Outreach Programme (STAND)

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"> ➤ Mrs. 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"> ➤ Mrs. 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, 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar

	Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF	Srivastava ➤ Dr. R, Sudhakaran ➤ Er. N. Shanmugapriyan
ISO Certification	QMS (9001:2015), EMS (14001:2015), OHS (45001: 2018), ISMS (27001:2018), FSMS (22000:2018), QMSMD (13485: 2016), EnMS (50001: 2018)	➤ Er. Ashutosh Kumar Srivastava ➤ Mrs. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R. Mary Josephine

Table 1. The St. Xavier's College Campus facility details

S.No.	Details of Area	Total area
1.	Total Campus area	58 acres
2.	Total Built up area	16,296.67 Sq.mts
3.	Covered Car parking area	200 Sq ft.
4.	Air-conditioned area	-
5.	Non-Airconditioned area	-
6.	Gross Floor area	18967 Sq.ft
7.	Public area	NA
8.	Service area	NA
9.	Forest vegetation	43%
10.	Planted vegetation	57%

9. Audit Details

Date / Day of Audit	: 25.07.2022
Venue of Audit	: St. Xavier's College, Thirunelveli – 627 002, Tamil Nadu, India.
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Green Campus Audit
Name of Auditing Chairman	: Mrs. 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 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. R.S. Thulaja, 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).

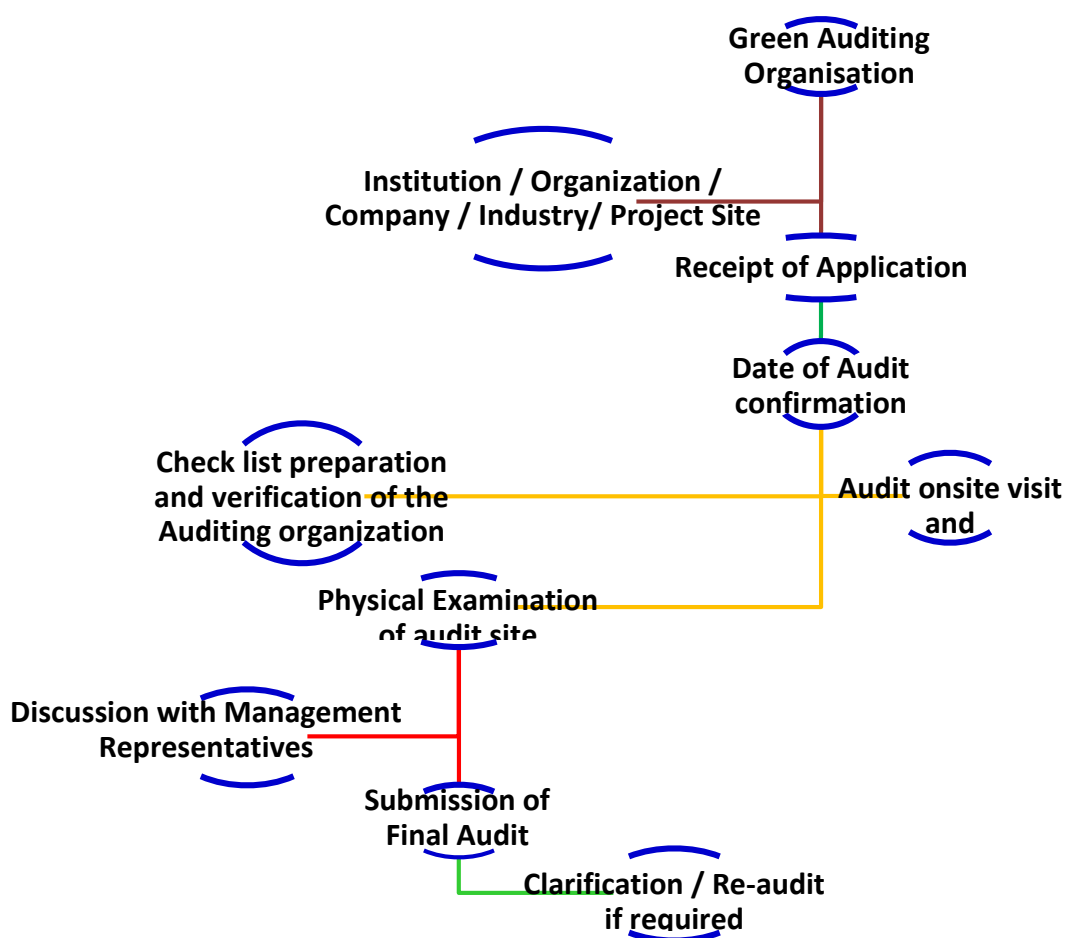
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green campus audit has been conducted as per the checklist of Nature Science Foundation, 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, trip 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 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 / 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 St. Xavier's College 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 St. Xavier's College 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 and Management Responsibilities of the St. Xavier's College and Audit Team of the Nature Science Foundation

Energy and Environment Audit Activity at the St. Xavier's College 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). 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).

10.4. Flora and Fauna diversity of study area



The St. Xavier's College is situated in Thirunelveli District, Tamil Nadu, India. It is located about 2.5 km via High Ground Road. 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 St. Xavier's College consists of an environment of Sandy and Red Loam type, located at an altitude of 485 m above mean sea level, 77° 41' E of longitude and 8° 43' N latitude.



10.4.2. Geology and Soil condition

Thirunelveli district is Located at the Southernmost tip of the Deccan Plateau. The Tamirabarani River Divides the City into the Thirunelveli quarter and the palyamkottai area. The Deep Red soil mixed with black and grey soil occurs along the stream beds. Based on geology, St. Xavier's College Campus is having the soil type of Deep Red sandy loam.

10.4.3. Climatic conditions

The temperature of the district has a tropical climate. It gets significant rainfall in most of the months, with a short dry season. The average annual temperature in Thirunelveli is 24.5°C. In a year, the average rainfall is 752 millimetres (29.61 inches). The Period from April and May is generally hot and dry; the South-west monsoon begins in June and ends in September. The Period of North-East Monsoon in this district is October and November. Winter is from December to February.

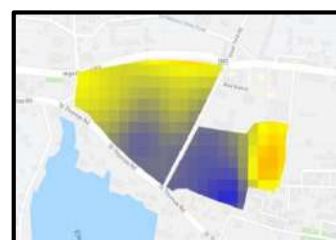


Table 2. Soil edaphic and environmental parameters of the St. Xavier's College

S.No	Details of Parameters	Data collected
Soil edaphic parameters		
1.	Soil pH	8
2.	Soil types	Deep Red Soil, Black 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	25°C
2.	Maximum Temperature	36°C
3.	Minimum Relative humidity	63%
4.	Maximum Relative humidity	74%
5.	Annual Average Rainfall	372 mm/avg.year
6.	Annual Average Sunshine	6 hrs/day
7.	Wind speed	12 miles/h

11. Identification of Plant Species

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across the St.Xavier's College 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 St.Xavier's College of Engineering & Technology 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 analyses 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 biotic 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. 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.	✓		
	f. Aquarium and aquatic (hydrophytes) plants	✓		
	g. Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc.	✓		
	h. Natural Topography or Forest, Planted vegetation	✓		
	i. Water well, Bore well, lake, water reservoir facility	✓		
	j. Water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use	✓		
	k. Treated water consumption towards plant cultivation, machinery cleaning, transport, toilet use and etc.	✓		
	l. 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		✓	
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	✓		
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	✓		
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	267 species belonging to 150 Genera under 85 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	125 such as Cats, Mice and Dog
4.	Total number of visiting Mammals inside the Campus	55 Species belonging Rabbit, Squirrel and Monkey
5.	Total number of living Birds inside the Campus	25 species belonging Common Myna, , House Sparrow, King- crow, House Crow, Jungle Babbler, , Honey bird
6.	Total number of visiting Birds inside the Campus	45 species belonging Mangrove heron, Common Wood shrike, Peacock.
7.	Total number of Aquarium	02
8.	Total number of Aquatic (hydrophytes) plant species	07
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 : 20 species Mosquitos: 03 species
12.	Percentage of Forest Vegetation	43%
13.	Percentage of Planted Vegetation	57%
14.	Percentage of Water consumption to total human population	5000 litres
15.	Percentage of Water consumption to total flora and fauna	-
16.	Per capita water consumption per day	5 lit/day

13.3 Flora and Fauna diversity in the St.Xavier's College Campus

13.3.1. Flora diversity in the St.Xavier's College Campus

13.3.1.1. Flowering plants diversity in the St.Xavier's College 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 St. Xavier's College 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 St. Xavier's College campus is the dry deciduous type. The remnants of this past vegetation are found in the campus.

The most plants 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., *Nerium indicum* Mill, *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*, *Anisomeles malabarica*, *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*, *Rottboellia cochinchinensis* (Lour.), *Asparagus racemosus* Wild., and *Commelina benghalensis* L.

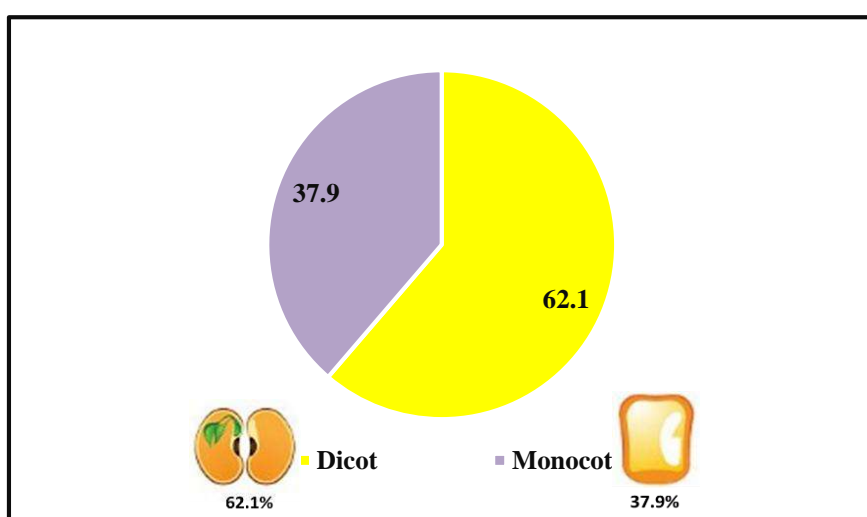
Most of the species found are common in the campus, some of the species *Cucumis dipsaceus* Ehrenb, *Chloris bournei* Rang & Tadul., *Hybanthus*, *Bothriochloa compressa* (Hook.F.), and *Caralluma bicolor* Ramach., is the rare species. Some endemic grass species like *Andropogon pumilus* Roxb., *Panicum 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

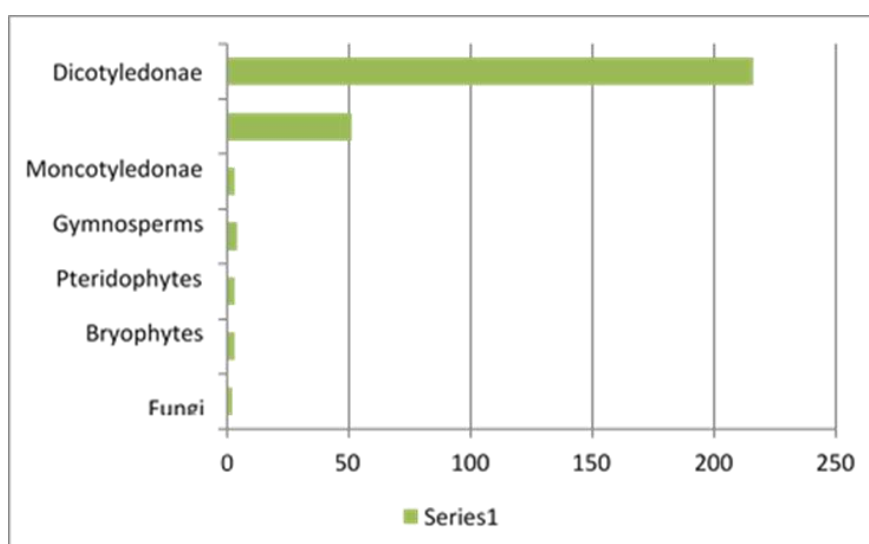
The campus has invasive species such as *Datura metal* L., *Borassus flabellifer* L., This is clearly indicated disturbances to the natural setting in the vegetated areas.

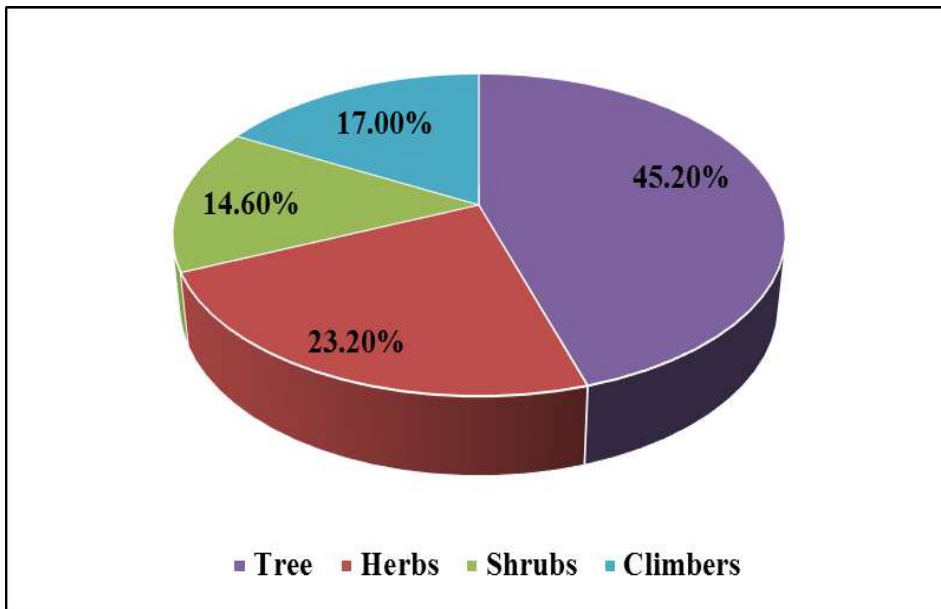
The alien / exotic species viz., *Plumeria*, *Anthurium* and *Tecoma stans* (L.) Kunth are occur in the campus.

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

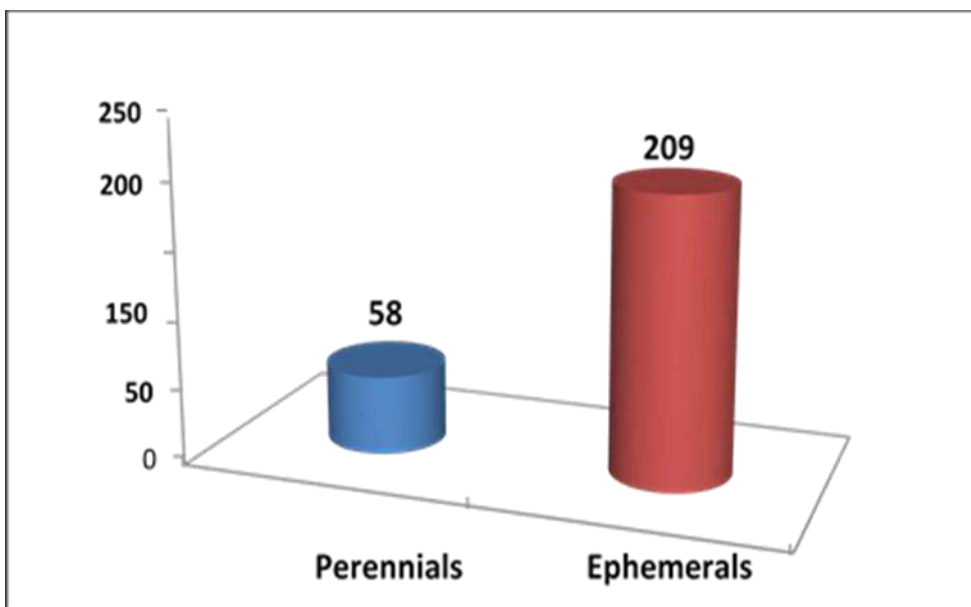


Systematic groups of the plants in the St.Xavier's College campus

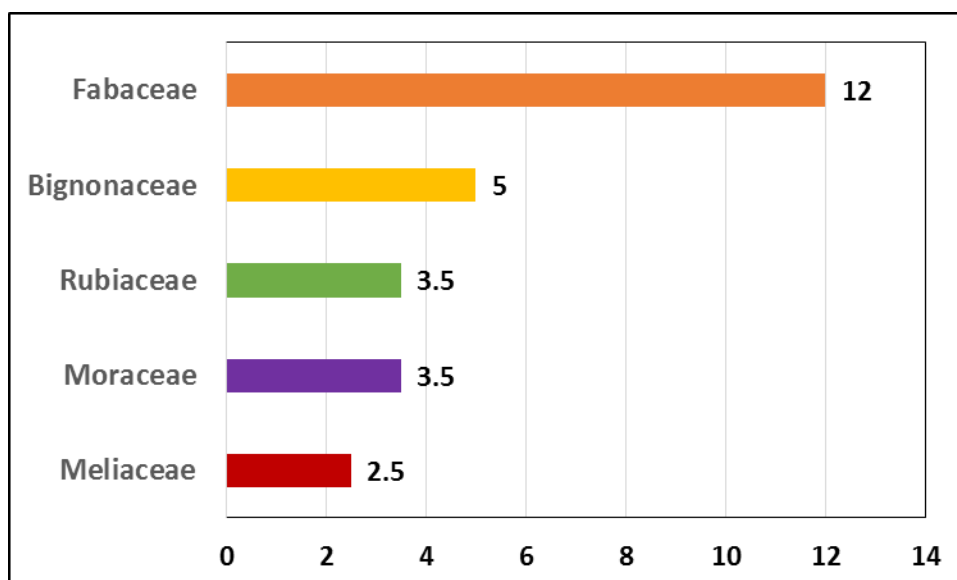




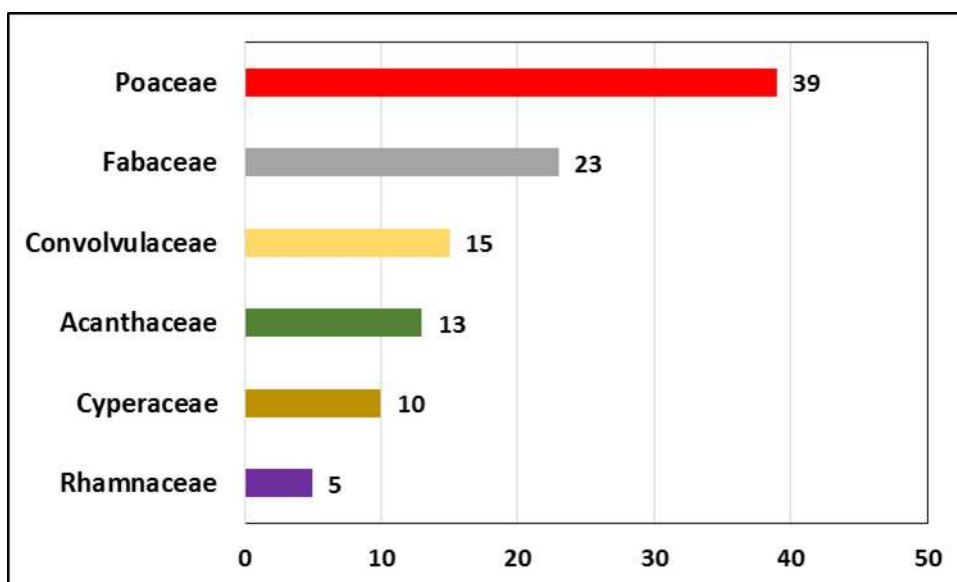
Analysis of habit-wise distribution of plant species in the campus area



Plant Diversity of St. Xavier's College (Autonomous)



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



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

The biodiversity of St. Xavier's College Campus comprises a sum of 267 species belonging to 150 genera under 85 families besides the lichens, mycoflora, pteridophytes and bryophytes. Among the documented higher plants, Dicots are dominating with 53 families followed by monocots (32 families). Over all analysis revealed that trees were dominating flora (45.20%) followed by herbs, shrubs and climbers which accounts 23.20 %, 14.60 % and 17.0%, respectively. Among the

documented dicots, Polypetalae formed a major proposition with 20 families, 43 genera and 68 species; Gamopetalae with 18 families, 38 genera and 63 species while Monochlamydeae with 15 families, 37 genera and 67 species. In monocots 10 families are spreading over 32 genera belonging to 69 species. Poaceae is first dominant family and followed, fabaceae, Convulvulaceae, Acanthaceae, cyperaceae, Rhamnaceae with 139, 23, 15, 13, 10 and 5 species for Epimerals and In Perennials, Fabaceae is first dominant family and followed, Bignonaceae, Rubiaceae, Moraceae, and Meliaceae with 12, 5, 3.5, 3.5, 2.5 respectively. At the time of green campus audit at St.Xavier's College campus, a total of 1 invasive floral species were recorded. This clearly specified the disturbances to the natural setting in the vegetated sector.

Table 5. List of Flowering plants in the St. Xavier's College Campus

Ephemerals				
S. No.	Common Name	Scientific Name	Family	Habitat
1.	Rosary Pea	<i>Abrus precatorius</i>	Fabaceae	Herb
2.	Monkey Bush	<i>Abutilon indicum</i>	Malvaceae	Shrub
3.	Black Wattle	<i>Acacia manchiyam</i>	Fabaceae	Tree
4.	Fringed Acalypha	<i>Acalypha ciliata</i>	Euphorbiaceae	Herb
5.	Indian Acalypha	<i>Acalypha indica</i>	Euphorbiaceae	Herb
6.	Prickly Chaff Flower	<i>Achyranthus aspera</i>	Amaranthaceae	Herb
7.	Malabar Nut	<i>Adhatoda vasica</i>	Acanthaceae	Shrub
8.	Knot Grass	<i>Aerva lanata</i>	Amaranthaceae	Herb
9.	Kapok bush	<i>Aerva javanica</i>	Amaranthaceae	Herb
10.	Century Plant	<i>Agave americana</i>	Asparagaceae	Herb
11.	Goat weed	<i>Ageratum conyzoides</i>	Asteraceae	Herb
12.	Alyce colover	<i>Alysicarpus vaginalis</i>	Fabaceae	Herb
13.	Spiny amaranth	<i>Amaranthus spinosus</i>	Amaranthaceae	Herb
14.	Lal saag	<i>Amaranthus tricolor</i>	Amaranthaceae	Herb
15.	Slender amaranth	<i>Amaranthus viridis</i>	Amaranthaceae	Herb
16.	King of Bitters	<i>Andrographis paniculata</i>	Acanthaceae	Herb
17.	Beard Grass	<i>Andropogon pumilus</i>	Acanthaceae	Herb
18.	Malabar catmint	<i>Anisomeles malabarica</i>	Lamiaceae	Shrub
19.	Coral wine	<i>Antigonon leptopus</i>	Polygonaceae	Creeper
20.	Mauritian grass	<i>Apluda mutica</i>	Poaceae	Herb
21.	Samudrasosh	<i>Argyreia cuneata</i>	Convolvulaceae	Shrub
22.	Oosi pullu	<i>Aristida adscensionis</i>	Poaceae	Herb
23.	Sixweeks threeawn	<i>Aristida depressa</i>	Poaceae	Herb
24.	Senegal	<i>Aristida funiculata</i>	Poaceae	Herb
25.	Cajanuses	<i>Atylosia goensis</i>	Fabaceae	Shrub
26.	Scarlet pimpernel	<i>Avagallis arvensis</i>	Primulaceae	

27.	Spiny barleria	<i>Barleria cuspidata</i>	Acanthaceae	Shrub
28.	Porcupine flower	<i>Barleria prionitis</i>	Acanthaceae	Shrub
29.	Orchid tree	<i>Bauhinia purpurea</i>	Fabaceae	Tree
30.	Little tree plant	<i>Biophytum sensitivum</i>	Oxalidaceae	Herb
31.	Para cress flower	<i>Blainvillea acmella</i>	Asteraceae	Herb
32.	Punarnava	<i>Boerhaavia diffusa</i>	Nyctaginaceae	Herb
33.	Punarnava	<i>Boerhaavia procumbens</i>	Nyctaginaceae	Herb
34.	Erect spiderling	<i>Boerhaavia erecta</i>	Nyctaginaceae	Herb
35.	Broad- leaf buttonweed	<i>Borreria hispida</i>	Rubiaceae	Herb
36.	Paperflower	<i>Bougainvillea glabra</i>	Nyctaginaceae	Shrub
37.	Browntop millet	<i>Brachiaria ramosa</i>	Poaceae	Herb
38.	Bearded Watergrass	<i>Bulbostylis barbata</i>	Cyperaceae	Herb
39.	Peacock flower	<i>Caesalpinia pulcherima</i>	Caesalpinaceae	Shrub
40.	Bottlebrushes	<i>Callistemon</i>	Myrtaceae	Tree
41.	Crown flower	<i>Calotropis gigantea</i>	Apocynaceae	Shrub
42.	Indian shot	<i>Canna indica</i>	Cannaceae	Herb
43.	Carray Cheddle	<i>Canthium parifolium</i>	Rubiaceae	Shrub
44.	Ballon vine	<i>Cardiospermum canescens</i>	Sapindaceae	Creeper
45.	Lesser ballon vine	<i>Cardiospermum halicacabum</i>	Sapindaceae	Shrub
46.	Pawpaw	<i>Carica papaya</i>	Caricaceae	Tree
47.	Senna	<i>Cassia angustifolia</i>	Fabaceae	Shrub
48.	Golden shower	<i>Cassia fistula</i>	Fabaceae	Tree
49.	Smooth Senna	<i>Cassia glauca</i>	Fabaceae	Tree
50.	Java Cassia	<i>Cassia javanica sub sp-renigera</i>	Fabaceae	Tree
51.	Feather leaved cassia	<i>Cassia mimosoides</i>	Fabaceae	Herb
52.	Coastal she-oak	<i>Casuarina equisetifolia</i>	Casuarinaceae	Tree
53.	Wool flowers	<i>Celosia polygonoides</i>	Amaranthaceae	Herb
54.	Ily Gourd	<i>Celphalandra indica</i>	Cucurbitaceae	Climber
55.	Foxtail buffalo grass	<i>Cenchrus ciliaris</i>	Poaceae	Herb
56.	Feather-leaved cassia	<i>Chamaecrista mimosoides</i>	Fabaceae	Herb
57.	Sensitive partridge pea	<i>Chamaecrista nictitans</i>	Fabaceae	Herb
58.	Swollen fingrgrass	<i>Chloris barbata</i>	Poaceae	Herb
59.	Rhodes grass	<i>Chloris gayana</i>	Poaceae	Herb
60.	Golden Beardgress	<i>Chrysopogen aciculatus</i>	Poaceae	Herb
61.	Bitter apple	<i>Citrullus colocynthis</i>	Cucurbitaceae	Herb
62.	Spiderwisp	<i>Cleome gynandra</i>	Capparaceae	Herb
63.	Asian spider flower	<i>Cleome viscosa</i>	Capparaceae	Herb
64.	Butterfly pea	<i>Clitoria ternatea</i>	Fabaceae	Herb
65.	Brown hemp	<i>Clitoria juncea</i>	Fabaceae	Climber
66.	Ily gourd	<i>Coccinia grandis</i>	Cucurbitaceae	Climber

67.	Riceweeds	<i>Coldenia procumbens</i>	Boraginaceae	Herb
68.	Benghal dayflower	<i>Commelina benghalensis</i>	Commlinaceae	Herb
69.	Rats ear	<i>Commelina forskaolii</i>	Commlinaceae	Herb
70.	White jute	<i>Corchorus capsularis</i>	Tiliaceae	Shrub
71.	Wild jute	<i>Corchorus trilocularis</i>	Tiliaceae	Herb
72.	Firecracker flower	<i>Crossandra undulaefolia</i>	Acanthaceae	Shrub
73.	Rattle pod	<i>Crotalaria laburiniifolia</i>	Fabaceae	Herb
74.	Ban tulsi	<i>Croton bonplandianum</i>	Euporbiaceae	Herb
75.	Ban tulsi	<i>Croton sparsiflorus</i>	Euporbiaceae	Herb
76.	Jews mallow	<i>Croton olitorius</i>	Euporbiaceae	Herb
77.	Rubber vine	<i>Cryptostegia grandiflora</i>	Apocynaceae	Shrub
78.	Palm rose	<i>Cymbopogon martimii</i>	Poaceae	Herb
79.	Bermuda grass	<i>Cynodon dactylon</i>	Poaceae	Herb
80.	Annual sedge	<i>Cyperus compresses</i>	Cyperaceae	Herb
81.	Variable flatsedge	<i>Cyperus defformis</i>	Cyperaceae	Herb
82.	Yellow Nutsedge	<i>Cyperus esculentus</i>	Cyperaceae	Herb
83.	Haspan flatsedge	<i>Cyperus haspan</i>	Cyperaceae	Herb
84.	Purple nutsedge	<i>Cyperus rotundus</i>	Cyperaceae	Herb
85.	White water sedge	<i>Cyperus triceps</i>	Cyperaceae	Creeper
86.	Crowfoot grass	<i>Dactyloctenium aegypticum</i>	Poaceae	Creeper
87.	Halfa grass	<i>Demostachya bipinnata</i>	Poaceae	Creeper
88.	False Amaranth	<i>Digera muricata</i>	Amaranthaceae	Herb
89.	Asian crabgrass	<i>Digitaria bicarnis</i>	Poaceae	Herb
90.	Spreading Ruellia	<i>Dipterocanthus patulus</i>	Acanthaceae	Herb
91.	Golden dewdrop	<i>Duranta plumier</i>	Verbenaceae	Shrub
92.	Green shrimp	<i>Ecbolium viride</i>	Acanthaceae	Shrub
93.	Jungle rice	<i>Echinochola colona</i>	Poaceae	Herb
94.	varigated cockspur grass	<i>Echinochola picta</i>	Poaceae	Herb
95.	false daisy	<i>Eclipta alba</i>	Asteraceae	Herb
96.	Fasle Daisy	<i>Eclipta prostrata</i>	Asteraceae	Herb
97.	yard-grass	<i>Eleusine indica</i>	Poaceae	Herb
98.	Lilac Tasselflower	<i>Emilia sonchifolia</i>	Asteraceae	Herb
99.	Indian Whitehead	<i>Enicostemma axillare</i>	Gentianaceae	Herb
100.	Vellarugu	<i>Enicostemma littorale</i>	Gentianaceae	Herb
101.	Mopane grass	<i>Enteropogon monostachyos</i>	Poaceae	Herb
102.	candy grass	<i>Eragrostis ciliansis</i>	Poaceae	Herb
103.	lovegrass	<i>Eragrostis nutans</i>	Poaceae	Herb
104.	India lovegrass	<i>Eragrostis pilosa</i>	Poaceae	Herb
105.	Japanese lovegrass	<i>Eragrostis tenella</i>	Poaceae	Herb
106.	weeping lovegrass	<i>Eragrostis tenuifolia</i>	Poaceae	Herb

107.	Chinese lovegrass	<i>Eragrostis unioloides</i>	Poaceae	Herb
108.	Canegrass	<i>Eragrostis viscosa</i>	Poaceae	Herb
109.	Double-Row Lovegrass	<i>Ergrostiella bifaria</i>	Poaceae	Herb
110.	thalia lovegrass	<i>Ergrostis altrovirens</i>	Poaceae	Herb
111.	Asthma Weed	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb
112.	Dwarf morning-glory	<i>Evolvulus alsinoides</i>	Convolvulaceae	Herb
113.	Banyan	<i>Ficus benghalensis</i>	Moraceae	Tree
114.	sacred fig	<i>Ficus religiosa</i>	Moraceae	Tree
115.	grasslike fimbry	<i>Fimbristylis milacea</i>	Cyperaceae	Herb
116.	False Amaranth	<i>Gigera alternifolia</i>	Amaranthaceae	Shrub
117.	Prostrate Globe Amaranth	<i>Gomphrena decumbens</i>	Amaranthaceae	Herb
118.	Globe amaranth	<i>Gomphrena globosa</i>	Amaranthaceae	Herb
119.	Prostrate Globe Amaranth	<i>Gomphrena serrata</i>	Amaranthaceae	Herb
120.	Indian heliotrope	<i>Heliotropium indicum</i>	Boraginaceae	Herb
121.	Black Speargrass	<i>Heteropogon contortus</i>	Poaceae	Herb
122.	Tiny Flower Hibiscus	<i>Hibiscus micranthes</i>	Malvaceae	Shrub
123.	Spade Flower	<i>Hybanthus enneaspermus</i>	Violaceae	shrub
124.	Pignut	<i>Hyptis suaveolens</i>	Lamiaceae	Herb
125.	Spade Flower	<i>Hybanthus enneaspermus</i>	Violaceae	Herb
126.	cogongrass	<i>Imperata cylindrical</i>	Poaceae	Herb
127.	Birdsville Indigo	<i>Indigofera linnaei</i>	Fabaceae	Shrub
128.	true indigo	<i>Indigofera tinctoria</i>	Fabaceae	Shrub
129.	Spade Flower	<i>Ionodium suffruticosum</i>	Violaceae	Herb
130.	white moonflower	<i>Ipomoea alba</i>	Convolvulaceae	Herb
131.	Water Morning Glory	<i>Ipomoea aquatica</i>	Convolvulaceae	Herb
132.	coast morning glory	<i>Ipomoea cairica</i>	Convolvulaceae	Climber
133.	ivy-leaved morning glory	<i>Ipomoea hederifolia</i>	Convolvulaceae	Creeper
134.	Blue Dawn Flower	<i>Ipomoea indica</i>	Convolvulaceae	Herb
135.	Obscure Morning Glory	<i>Ipomoea obscura</i>	Convolvulaceae	Herb
136.	Tiger's Footprint	<i>Ipomoea pestigridis</i>	Convolvulaceae	Climber
137.	Cypress Vine	<i>Ipomoea quamoclit</i>	Convolvulaceae	Herb
138.	Akhuparni	<i>Ipomoea reniformis</i>	Convolvulaceae	Herb
139.	Clustered Morning Glory	<i>Ipomoea staphylina</i>	Convolvulaceae	Shrub
140.	Indian murainagrass.	<i>Ischaemum indium</i>	Poaceae	Herb
141.	saramollagrass	<i>Ischaemum dispar</i>	Poaceae	Herb
142.	Skyblue Clustervine	<i>Jacquemontia pentanthos</i>	Convolvulaceae	Herb
143.	shortleaf spikesedge	<i>Kylinga brevifolia</i>	Cyperaceae	Herb
144.	common lantana	<i>Lantana camera</i>	Verbenaceae	Shrub
145.	red sprangletop	<i>Leptochola chinensis</i>	Poaceae	Herb
146.	Thumbai	<i>Leucas aspera</i>	Lamiaceae	Herb

147.	Kidney Leaf Morning Glory	<i>Merremia emarginata</i>	Convolvulaceae	Herb
148.	Woodroses	<i>Merremia hastata</i>	Convolvulaceae	Herb
149.	Woodroses	<i>Merremia hastate</i>	Convolvulaceae	Herb
150.	Mercury Doughwood	<i>Micrococca mercurialis</i>	Euphorbiaceae	Herb
151.	Naked-Stem Carpetweed	<i>Mollugo nudicaulis</i>	Molluginaceae	Herb
152.	Indian Mulberry	<i>Morinda tinctoria</i>	Rubiaceae	Tree
153.	Common Basil	<i>Ocimum basilicum</i>	Lamiaceae	Herb
154.	African Basil	<i>Ocimum canum</i>	Lamiaceae	Herb
155.	Holy Basil	<i>Ocimum tenuiflorum</i>	Lamiaceae	Shrub
156.	Chay Root	<i>Oldenlandia umbellata</i>	Rubiaceae	Herb
157.	Dog-Tooth Grass	<i>Panicum paludosam</i>	Poaceae	Herb
158.	Jerusalem Thorn	<i>Parkinsonia aculeata</i>	Fabaceae	Shrub
159.	Famine Weed.	<i>Parthenium hysterophorus</i>	Asteraceae	Shrub
160.	Stinking Passion Flower	<i>Passiflora foetida</i>	Passifloraceae	Herb
161.	Ceylon Leadwort	<i>Pavonia zeylanica</i>	Malvaceae	Herb
162.	Large Caltrops	<i>Pedaliium murex</i>	Pedaliaceae	Shrub
163.	Oriental Fountain Grass	<i>Pennisetum alopecuros</i>	Poaceae	Shrub
164.	Veliparuthi	<i>Pergularia daemia</i>	Acanthaceae	Herb
165.	Panicled Foldwing	<i>Peristrophe bicalyculata</i>	Acanthaceae	Herb
166.	Adhedi	<i>Peristrophe paniculata</i>	Acanthaceae	Herb
167.	Indian Comet Grass	<i>Perotis indica</i>	Poaceae	Herb
168.	Carry-Me-Seed	<i>Phyllanthus amarus</i>	Phyllanthaceae	Herb
169.	Madras Leaf-Flower	<i>Phyllanthus madraspatensis</i>	Phyllanthaceae	Herb
170.	Native Gooseberry	<i>Physalis minima</i>	Solanaceae	Herb
171.	Manila Tamarind	<i>Pithecellobium dulce</i>	Fabaceae	Tree
172.	Doctorbush	<i>Plumbago zeylanica</i>	Plumbaginaceae	Shrub
173.	Heart Leafed Priva	<i>Priva cordifolia</i>	Verbenaceae	Herb
174.	Heart-Leaf Velvet Bur	<i>Priva leptostachya</i>	Verbenaceae	Herb
175.	mesquite	<i>Prosopis julifera</i>	Fabaceae	Shrub
176.	manyspike flatsedge	<i>Pycnus polystachyos</i>	Cyperaceae	Herb
177.	Madanaphala	<i>Randia dumetorum</i>	Rubiaceae	Shrub
178.	Minnieroot	<i>Ruellia tuberosa</i>	Acanthaceae	Herb
179.	Creeping Rungia	<i>Rungia repens</i>	Acanthaceae	Herb
180.	Indian Bowstring Hemp	<i>Sansevieria roxburghiana</i>	Asparagaceae	Herb
181.	groundsel	<i>Senecio vulgaris</i>	Asteraceae	Herb
182.	yellow foxtail	<i>Setaria pumila</i>	Poaceae	Herb
183.	hooked bristlegrass	<i>Setaria verticillta</i>	Poaceae	Herb
184.	wireweed	<i>Sida acuta</i>	Malvaceae	Shrub
185.	flannel weed	<i>Sida cordifolia</i>	Malvaceae	shrub
186.	black nightshade	<i>Solanum nigrum</i>	Solanaceae	Shrub

187.	Turkey Berry	<i>Solanum torvum</i>	Solanaceae	Shrub
188.	Red Pea Eggplant	<i>Solanum trilobatum</i>	Solanaceae	Herb
189.	Sporobolus	<i>Sporobolous maderaspatans</i>	Poaceae	Herb
190.	Sticky Blue Rod	<i>Stemodia viscose</i>	Scrophulariaceae	Herb
191.	Narrow-Leaved Witchweed	<i>Striga angustifolia</i>	Orobanchaceae	Herb
192.	Red witchweed	<i>Striga asiatica</i>	Orobanchaceae	Herb
193.	Witchweed	<i>Striga cuphrasioides</i>	Orobanchaceae	Herb
194.	Cinderella Weed	<i>Synedrella nodiflora</i>	Asteraceae	Herb
195.	Wasteland weed	<i>Tephrosia purpurea</i>	Fabaceae	Herb
196.	Wild Indigo	<i>Tephrosia spinosa</i>	Fabaceae	Herb
197.	Kew Bull	<i>Tragus roxburghii</i>	Poaceae	Herb
198.	Giant Pigweed	<i>Trianthema portulacastrum</i>	Aizoaceae	Herb
199.	Afro-Asian Horse-Purslane	<i>Trianthema triquetra</i>	Aizoaceae	Herb
200.	Puncture vine	<i>Tribulus terrestris</i>	Zygophyllaceae	Herb
201.	Adhapushpi	<i>Trichodesma indicum</i>	Boraginaceae	Herb
202.	Tridax daisy	<i>Tridax procumbens</i>	Asteraceae	Herb
203.	Clover	<i>Trifolium micranthum</i>	Fabaceae	Herb
204.	Sahadevi	<i>Vernonia cinerea</i>	Asteraceae	Herb
205.	White dammar	<i>Vicoa indica</i>	Asteraceae	Tree
206.	Sweet violet	<i>Viola oderata</i>	Violaceae	Shrub
207.	Common cocklebur	<i>Xanthium strumarium</i>	Asteraceae	Herb
208.	Jujube	<i>Zizyphus jujuba</i>	Rhamnaceae	Tree
209.	Indian jujube	<i>Zizyphus mauritiana</i>	Rhamnaceae	Shrub

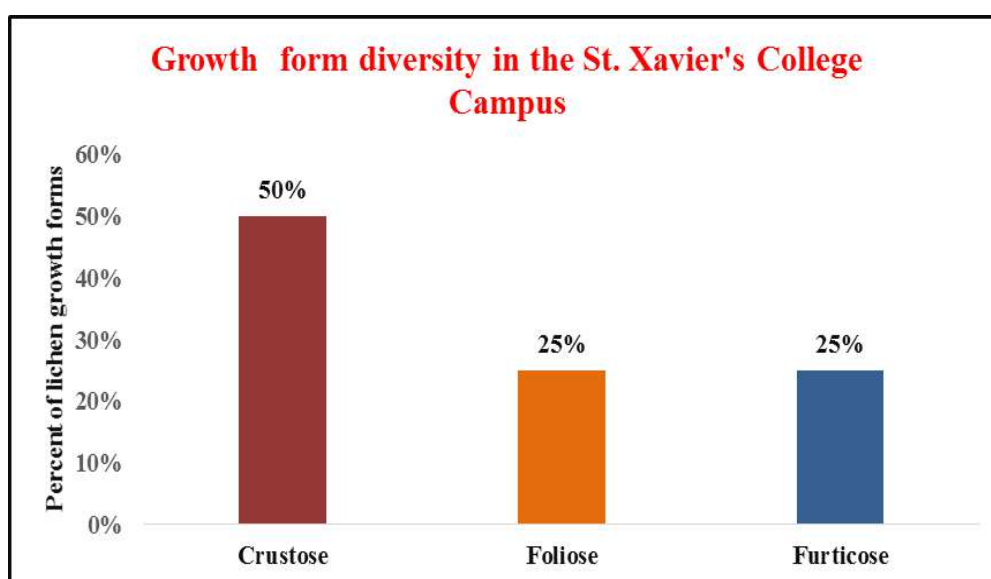
Perinials				
S. No.	Common Name	Scientific Name	Family	Habitat
1.	Neem	<i>Azadirachta indica</i>	Meliaceae	Tree
2.	white-bark acacia	<i>Acacia leucophloea</i>	Fabaceae	Tree
3.	Silver Dollar	<i>Adiantum</i>	Filicopsida	Fern
4.	Sugar apple	<i>Anona squamosa</i>	Annonaceae	tree
5.	Flamingo Flower	<i>Anthurium andraeanum</i>	Araceae	Herb
6.	monkey puzzle tree	<i>Araucaria araucana</i>	Araucariaceae	Tree
7.	Butterfly Tree	<i>Bauhinia purpurea</i>	Fabaceae	Tree
8.	Wine palm	<i>Caryota urens</i>	Areaceae	tree
9.	Golden Shower	<i>Cassia fistula</i>	Fabaceae	Tree

10.	Red cassia / ceylon senna	<i>Cassia roxburghii</i>	Fabaceae	Tree
11.	Indian Cherry	<i>Cordia dichotoma</i>	Boraginaceae	Tree
12.	Monterey Cypress	<i>Cupressus macrocarpa</i>	Cupressaceae	Tree
13.	Beddome's cycas	<i>Cycas bedonii</i>	Cycadaceae	Tree
14.	King sago	<i>Cycas revoluta</i>	Cycadaceae	Tree
15.	Indian Rose wood	<i>Dalbergia latifolia</i>	Fabaceae	Tree
16.	Flame buoyant	<i>Delonix regia</i>	Fabaceae	Tree
17.	Curtain Fig	<i>Ficus microcarpa</i>	Moraceae	Tree
18.	Bodhi tree	<i>Ficus religiosa</i>	Moraceae	Tree
19.	Flame Lily	<i>Gloriosa superba</i>	Liliaceae	Herb
20.	White teak	<i>Gmelina arborea</i>	Lamiaceae	Tree
21.	Honey Fruit Tree	<i>Guazuma tomentosa</i>	Sterculiaceae	Tree
22.	Anjan	<i>Hardwickia binata</i>	Fabaceae	Tree
23.	Shoe Black plant	<i>Hibiscus rosasinensis</i>	Malvaceae	Shrub
24.	Flame of Woods	<i>Ixora coccinea</i>	Rubiaceae	Shrub
25.	Sausage Tree	<i>Kigelia pinnata</i>	Bignoniaceae	Tree
26.	Black Pearl	<i>Majidea Zangueberica</i>	Sapindaceae	Tree
27.	Indian Cork Tree	<i>Millingtonia hortensis</i>	Bignoniaceae	Tree
28.	Spanish cherry	<i>Mimusops elunji</i>	Sapotaceae	Tree
29.	Indian Mulberry	<i>Morinda tinctoria</i>	Rubiaceae	Shrub
30.	Drumstick	<i>Moringa oleifera</i>	Moringaceae	Tree
31.	Mulberry	<i>Morus alba</i>	Moraceae	Tree
32.	Jamaican Cherry	<i>Muntingia calabura</i>	Muntingiaceae	Shrub
33.	Curry tree	<i>Murraya koenjii</i>	Rutaceae	Tree
34.	Dhobi Tree	<i>Mussaenda glabrata</i>	Rubiaceae	Tree
35.	Tuberous sword fern	<i>Nephrolepis cordifolia</i>	Polypodiaceae	Fern
36.	Rose Bay	<i>Nerium oleander</i>	Apocyanaceae	Shrub

37.	Oodi mara	<i>Odina wodier</i>	Anacardiaceae	Tree
38.	Yellow Flame Tree	<i>Pelthophorum pterocarpum</i>	Fabaceae	Tree
39.	White Frangipani	<i>Plumeria alba</i>	Apocyanaceae	Shrub
40.	Indian Mast tree	<i>Polyalthia longifolia</i>	Annonaceae	Tree
41.	Indian Beech	<i>Pongamia pinnata</i>	Fabaceae	Tree
42.	Chinese Brake	<i>Pteris vittata</i>	Pteridaceae	Fern
43.	Travellers Tree	<i>Ravenala madagascariensis</i>	Strelitziaceae	Tree
44.	Rain tree	<i>Samanea saman</i>	Fabaceae	Tree
45.	Sandal Wood	<i>Santalum album</i>	Santalaceae	Tree
46.	Tanner's Cassia	<i>Senna auriculata</i>	Fabaceae	Shrub
47.	big leaved mahogany	<i>Sweeten macrophylla</i>	Meliaceae	Tree
48.	Black Plum	<i>Syzygium cuminii</i>	Myrtaceae	Tree
49.	Rosy trumpet tree	<i>Tabebuia rosea</i>	Bignoniaceae	Tree
50.	Tamarind	<i>Tamarindus indicus</i>	Fabaceae	Tree
51.	Yellow bells	<i>Tecoma stans</i>	Bignoniaceae	Shrub
52.	Teak	<i>Tectona grandis</i>	Lamiaceae	Tree
53.	Indian Almond	<i>Terminalia catappa</i>	Combretaceae	Tree
54.	Indian laurel	<i>Terminalia eliptica</i>	Combretaceae	Tree
55.	Indian Tulip	<i>Thespesia populnea</i>	Malvaceae	Tree
56.	heart-leaved moonseed	<i>Tinospora cordifolia</i>	Menispermaceae	Shrub
57.	Peacock Chaste Tree	<i>Vitex altissima</i>	Verbenaceae	Tree
58.	Horseshoe vitex	<i>Vitex negundo</i>	Verbenaceae	Shrub

13.3.1.2. Lichen diversity in the St. Xavier's College 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 results 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 recorded in the St. Xavier's College 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 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.

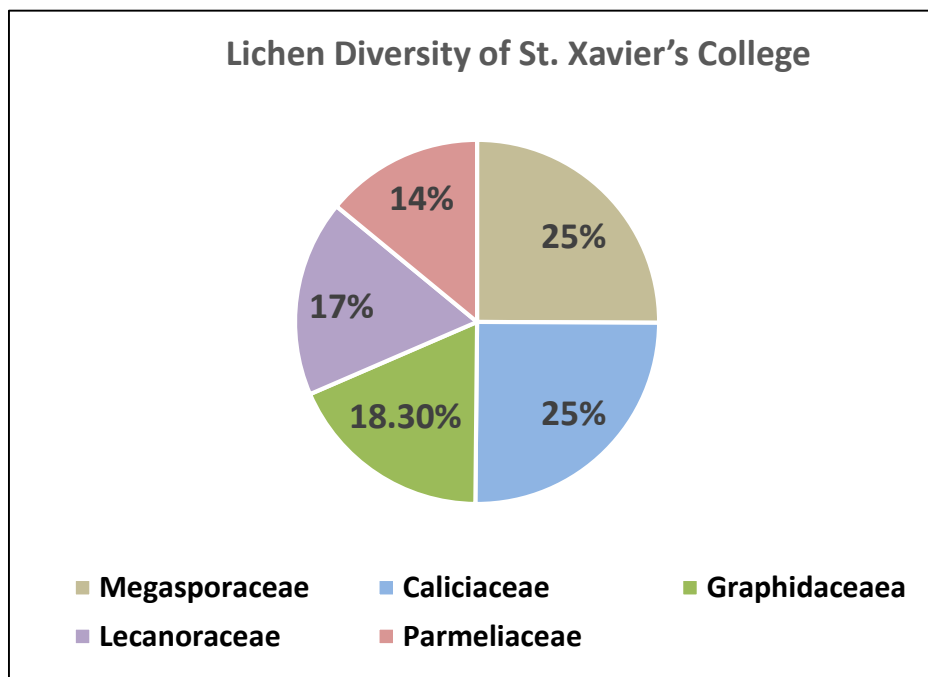


Table 6. Lichen diversity of the St. Xavier's College campus with respect to family, substratum and growth forms in genus and family wise classification

S.No	Lichen diversity of the St. Xavier's College 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 St. Xavier's College 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 St.Xavier's College 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 St. Xavier's College 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 St.Xavier's College 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 St.Xavier's College campus

13.3.2.1. Birds Diversity in the St.Xavier's College campus

The observations on fauna diversity indicated that the St. Xavier's College campus has a large number of living as well as visiting animals, birds, reptiles and insects including termites. A total number of 30 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

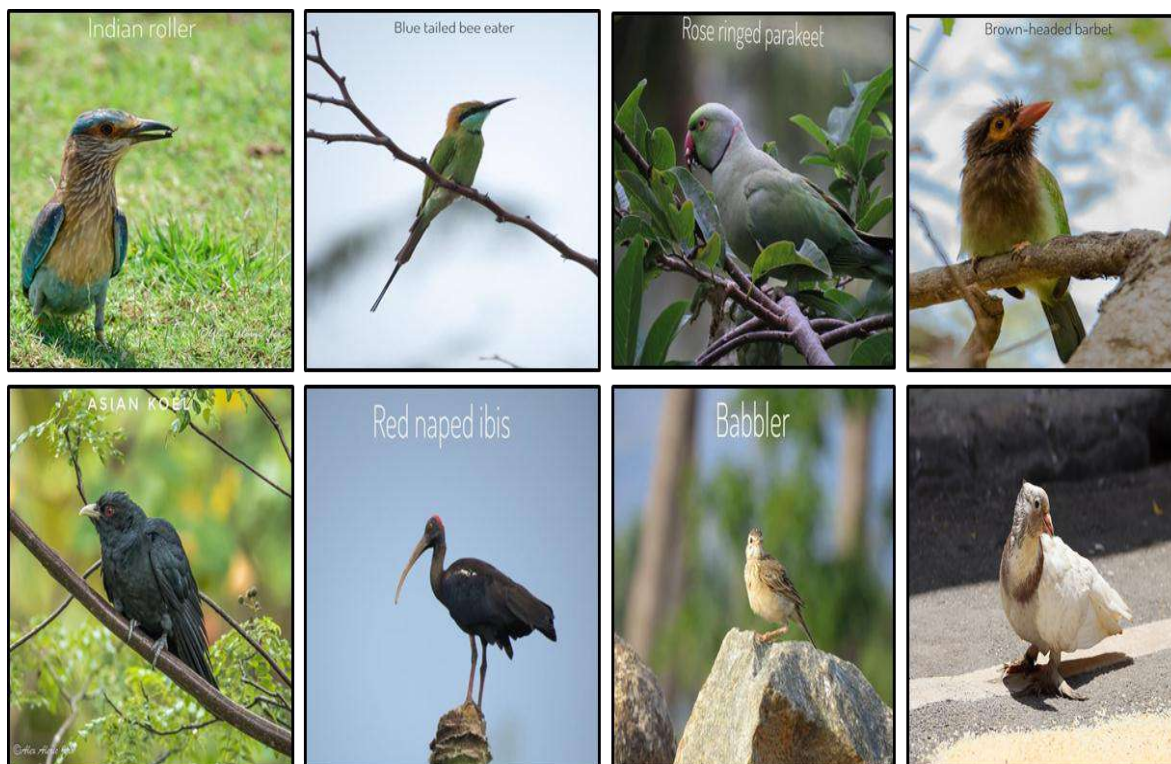
representing 2 families and 2 orders were observed during this study, passeiformes constituted the predominated group representing 15. Total number of 6 bird species, out of them 2 species were migrant, 2 species were local migrant during winter and summer season because of unfavourable environment and 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 St. Xavier's College campus

S.no	Scientific name	Common name
1.	<i>Leptocoma zeylonica</i>	Purple-rumped sunbird
2.	<i>Megalaima zeylanic</i>	Brown-headed barbet
3.	<i>Turdoides caudata</i>	Common babbler-
4.	<i>Pseudibis papillosa</i>	Red-naped ibis
5.	<i>Plegadis falcinellus</i>	Glossy ibis-
6.	<i>Pavo cristatus</i>	Indian peacock
7.	<i>Acridotheres tristis</i>	common myna
8.	<i>Corvus splendens</i>	House crow
9.	<i>Dendrocitta vagabunda</i>	Rufous Tree pie
10.	<i>Halcyon smyrnensis</i>	white-throated kingfisher
11.	<i>Psittacula krameri</i>	Rose-ringed parakeet
12.	<i>Vanellus malabaricus</i>	yellow-wattled lapwing
13.	<i>Spilopelia chinensis</i>	spotted dove
14.	<i>Merops orientalis</i>	Green bee-eater
15.	<i>Dicrurida macrocercus</i>	black drongo
16.	<i>Eudynamis scolopaceus</i>	Asian koel-
17.	<i>Centropus parroti</i>	barn owl-tylo alba
18.	<i>Saxicoloides fulicatus</i>	southern coucal-
19.	<i>Motacilla</i>	Indian robin
20.	<i>Anthus rufulus</i>	black kite-
21.	<i>Milvus migrans</i>	shikra-accipiter babius
22.	<i>Haliastur indus</i>	brahminy kite-
23.	<i>Accipiter</i>	shikra
24.	<i>Elanus axillaris</i>	black-shouldered kite
25.	<i>Athene brama</i>	spotted owlet
26.	<i>Orthotomus</i>	Tailorbirds
27.	<i>Prinia inornata</i>	Plain Priniap
28.	<i>Bubulcus ibis</i>	Cattle egret
29.	<i>Egretta garzetta</i>	Little egret
30.	<i>Coracias benghalensis</i>	Indian roller

Table 8. Total number of visiting birds in the St. Xavier's College campus

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



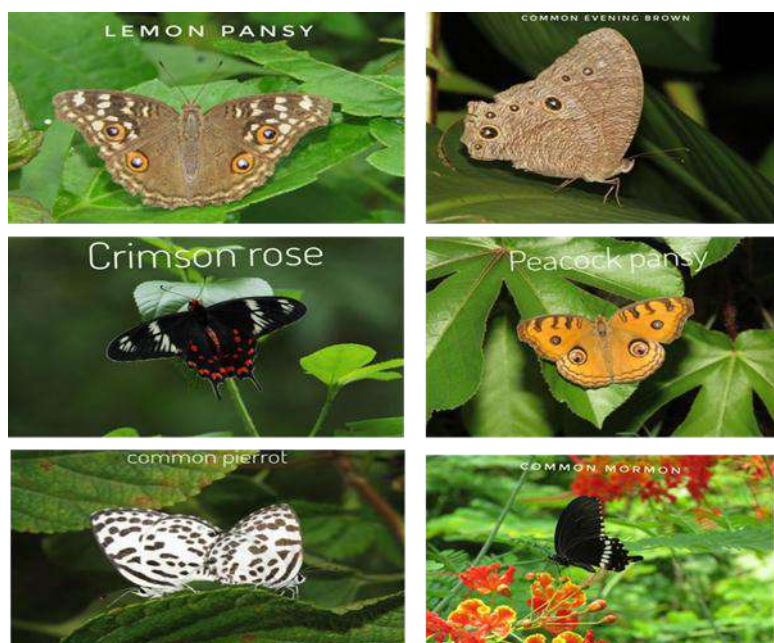
13.3.2.2. Butterflies diversity in the St. Xavier's College campus

The St. Xavier's College campus has five family level diversities such as Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperidae in which Common butterfly 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.

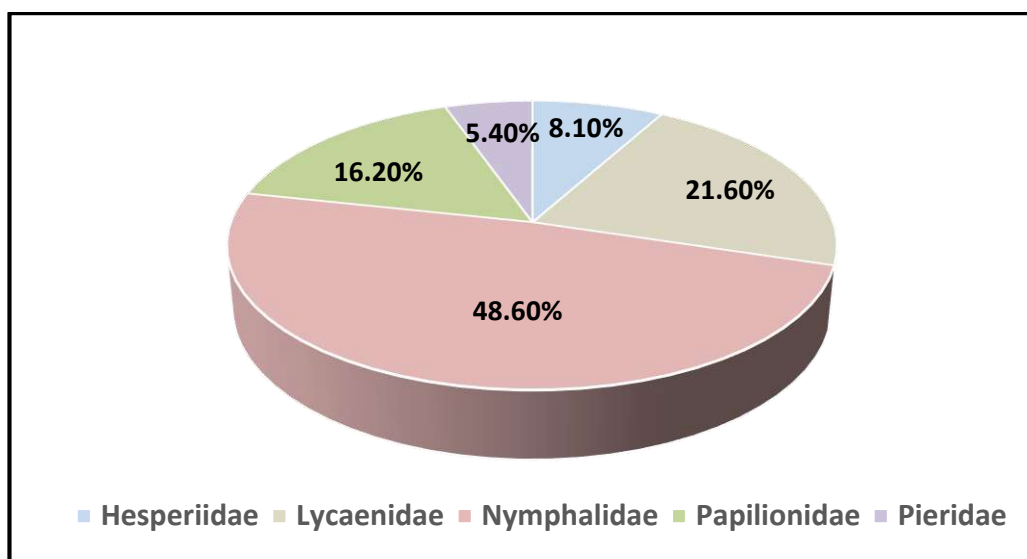
Table 9. List of Butterflies recorded in the St. Xavier's College campus

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.	Angled pierrot	<i>Caleta caleta</i>	Lycaenidae
5.	Common mpierrot	<i>Castalius rosimon</i>	Lycaenidae
6.	Tamil yeoman	<i>Cirrochroa thais</i>	Nymphalidae
7.	Rustic	<i>Cupha erymanthis</i>	Nymphalidae
8.	Plain tiger	<i>Danaus chrysippus</i>	Lycaenidae
9.	Tiger	<i>Danaus genutia</i>	Nymphalidae
10.	Common crow butterfly	<i>Euploea core</i>	Papilionidae
11.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperidae
12.	Tailed jay	<i>Graphium agamemnon</i>	Papilionidae
13.	Common banded	<i>Hasora chromus</i>	Hesperidae

14	Yellow Orange Tip	<i>Ixias pyrene</i>	Pieridae
15	Common cerulean	<i>Jamides celeno</i>	Lycaenidae
16	Lemon pansy	<i>Junonia lemonias</i>	Papilionidae
17	Blueokleaf	<i>Kallima horsfieldi</i>	Nymphalidae
18	Bamboo treebrown	<i>letheeopa</i>	Nymphalidae
19	Gladeye bushbrown	<i>Mycalesis patina</i>	Nymphalidae
20	Whitebar bushbrown	<i>Mycalesis anaxias</i>	Nymphalidae
21	Common bushbrown	<i>Mycalesis perseus</i>	Nymphalidae
22	Common sailor	<i>Neptis hylas</i>	Nymphalidae
23	Crimson rose	<i>Pachliopta hector</i>	Nymphalidae
24	Common Lascar	<i>Pantoporia hordonia</i>	Nymphalidae
25	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae
26	Red Pierrot	<i>Talicauda nyseus</i>	Lycaenidae
27	Common Grass Dart	<i>Taractrocera maevius</i>	Hesperiidae
28	Blue tiger	<i>Tirumala limniace</i>	Nymphalidae
29	Dark blue tiger	<i>Tirumala septentrionis</i>	Nymphalidae
30	Southern birdwin	<i>Triodes minos</i>	Papilionidae
31	Southern Birdwing	<i>Troides minos</i>	Papilionidae
32	White hedgege	<i>Udara akasa</i>	Lycaenidae
33	Painted lady	<i>Vanessa cardui</i>	Nymphalidae



Butterfly Diversity in the St. Xavier's College campus



13.3.2.3. Mammals diversity in the ST. XAVIER'S COLLEGE 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 St. Xavier's College 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.

Table 10. List of Mammals diversity in the St. Xavier's College campus

S.No.	Common Name	Scientific Name	Common Name
1.	Black-naped Hare	<i>Lepus nigricollis</i>	Muyal
2.	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>	Anil
3.	Indian Flying Fox	<i>Pteropus giganteus</i>	Periya Vowaal
4.	House Rat	<i>Rattus rattus</i>	Sundeli
5.	Indian Mole-rat	<i>Bandicota bengalensis</i>	Peruchali

13.3.2.4. Amphibians diversity in the St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College 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 pests of cereals, vegetables and pasture, especially when they swarm to destroy the crops over huge contiguous areas. Surveillance audit at St. Xavier's College on diversity of Grasshoppers demonstrated that 4 species are Amphibians are commonly distributed which includes *Eyprepocnemis alacris*, *Cyrtacanthacris tartarica*, *Crucinotacris decisa* and *Aulacobothrus luteipes*.

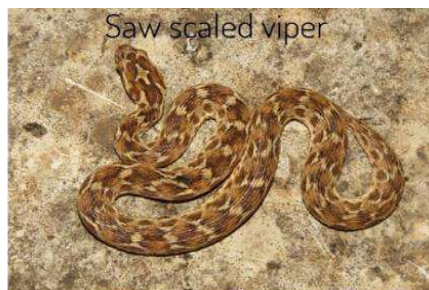


13.3.2.6. Termites Diversity in the St. Xavier's College Campus

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 St. Xavier's College and they are belonging to the Genera *Odontotermes*, *Trivitermes* and *Nasutitermes*.

Common Reptiles Found in the Campus

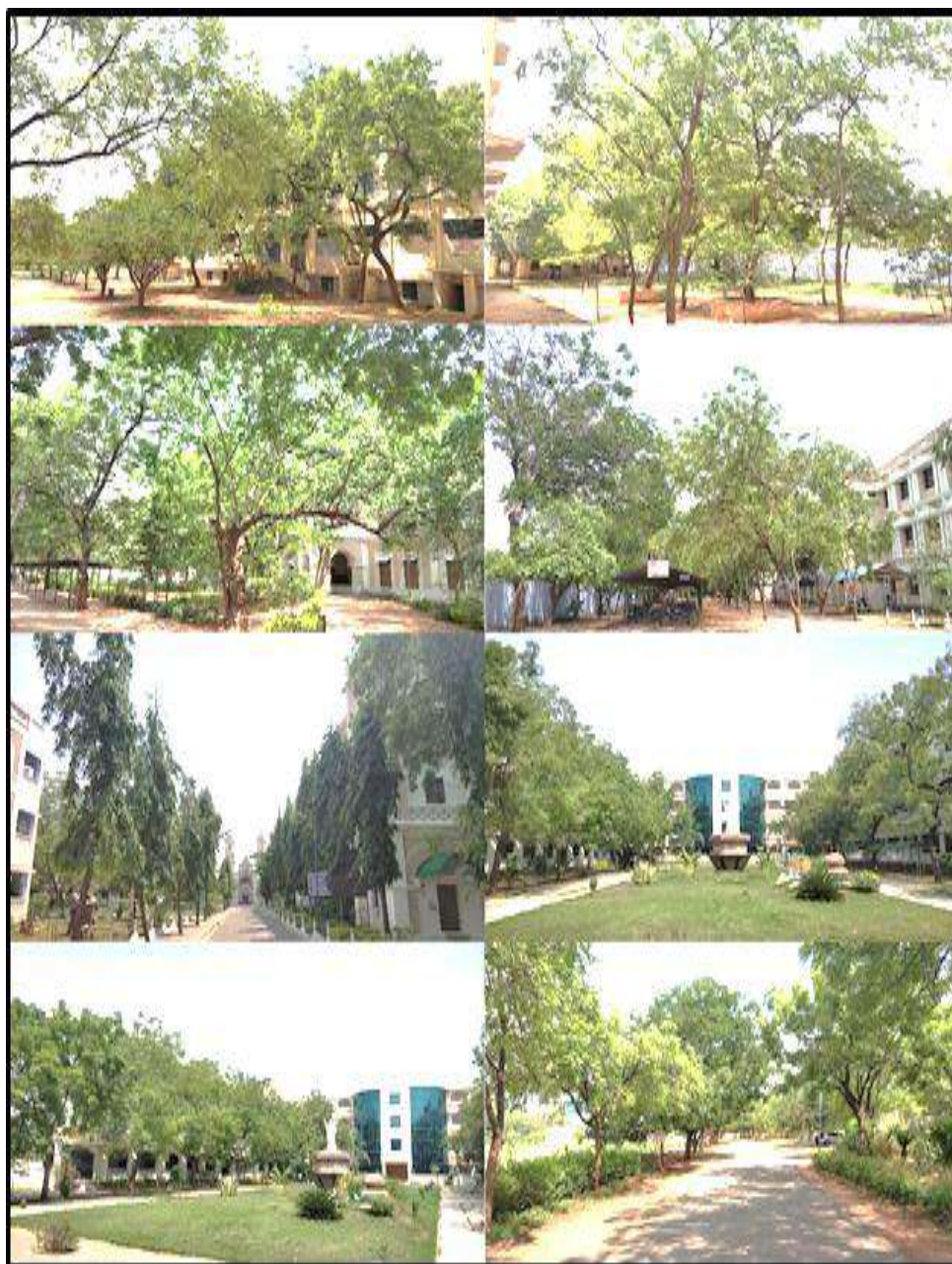


13.4. An account of more Oxygen releasing and Carbon dioxide assimilating plants in the St. Xavier's College Campus

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 St. Xavier's College campus revealed that the capus 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* and *Medicinal garden* is also available in the campus.



Oxygen releasing and Carbon dioxide assimilating plants in the St. Xavier's College Campus

Table 11. List of Oxygen releasing and Carbon dioxide assimilating, Ornamental / Medicinal plants in the St. Xavier's College Campus

S.No	Plant Name (Tamil Name)	Plant Name (English)	Scientific Name	Grouping / Nature	Characteristic Features of the plant
1.	Kuppaimeni	Copper leaf	<i>Acalypha wilkesiabna</i>	Dicots	O ₂ releasing Plant
2.	Katralai	Aloe Vera	<i>Aloe barbadensis miller</i>	Dicots	O ₂ releasing Plant
3.	Vembu	Neem	<i>Azadirachta indica</i>	Dicots	O ₂ releasing Plant
4.	Munkil	Bamboo	<i>Bambusa vulgaris</i>	Monocots	O ₂ releasing Plant
5.	Kaatu panai	Areca Palm	<i>Dypsis lutescens</i>	Monocots	O ₂ releasing Plant
6.	Neenda maravagai	Weeping Fig	<i>Ficus benjamina</i>	Dicots	O ₂ releasing Plant
7.	Arasu	Peepal, Bot-tree	<i>Ficus religiosa</i>	Dicots	O ₂ releasing Plant
8.	Vetchi	Chinese ixora	<i>Ixora chinensis</i>	Monocots	O ₂ releasing Plant
9.	Sinduram	Sxarlet jungle flame	<i>Ixora coccinea</i>	Monocots	O ₂ releasing Plant
10.	Thulasi	Tulsi	<i>Ocimum tenuiflorum</i>	Dicots	O ₂ releasing Plant
11.	Puli	Tamarind	<i>Tamarindus indica</i>	Dicots	O ₂ releasing Plant
12.	Money Plant	Money Plant	<i>Epipremnum aureum</i>	Monocots	O ₂ releasing Plant

13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College campus are Kakithapoo (*Bougainvillea spectabilis*), Madhanakamaboo (*Cycas revolute*), Sembaruthi (*Hibiscus rosa-sinensis*), Vetchi (*Ixora coccinea*), Malli (*Jasminum sambac*) and Arali (*Nerium odorum*).

Similar to that of shrubs, there are 3 kinds of herbs available in the St. Xavier's College campus. The predominant species of herbs available in the St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College campus.



13.6. Establishment of different Gardens in the St. Xavier's College 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 St. Xavier's College, 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 10 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 30 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 St. Xavier's College campus indicated that more than 50% 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 St. Xavier's College campus. Rainwater harvesting structures have been commissioned in the campus at different locations.



13.9. Landscape design and Soil Erosion control

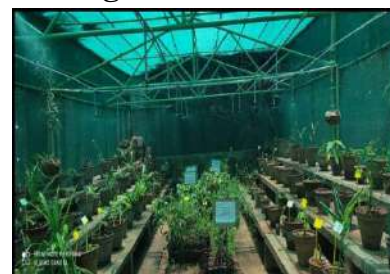
Landscape management is the maintenance of land to make sure that backgrounds can fulfil the needs and objectives in an effective and sustainable manner for current and future members. It is an action that forms a perception of viable expansion, to ensure the preservation of a panorama, in order to help 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 St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College campus is free of exotic plants that cause threat to the natural vegetation. It is like a 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 St. Xavier's College 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 St. Xavier's College 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 St. Xavier's College 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 initiatives

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 St. Xavier's College 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 across Mannar of Coimbatore. The St. Xavier's College 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 St. Xavier's College

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.

**An awareness programme about plastic, chemical and cool drinks
Organized by AICUF from 27/12/2014 to 29/12/2014.**



Tree Plantation by NCC Students of St. Xavier's College



Awareness Campaign on WORLD OZONE DAY



ACTIVITIES OF 'GO GREEN CLUB' OF XIBA Tree plantation



A special talk on “Let’s save our Mother Earth “was rendered by Mrs. S. Sorna Latha M.A., ML Advocate & Notary, Commission of Oaths, Tuticorin.



Go GREEN CLUB OF XIBA SAPLING PLANTATION



The St. Xavier's College is implemented the Government schemes (Swachh 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 Coimbatore 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 St. Xavier's College 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.

Swacch Bharath and Tree plantation on 15/08/2017 (Independence Day).



The St. Xavier's College 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 St. Xavier's College 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.

STAND outreach programme of St. Xavier's College



AT
NOCHIKULAM
VILLAGE



AT
VETIYAPANTHI
VILLAGE



AT
AROCKIYANATHAPURAM
VILLAGE



AT
KEELANATTARKULLAM
VILLAGE



AT
PADAGASALAI
VILLAGE



AT
MAHILCHIPURAM
VILLAGE



AT THAMARASELVI
VILLAGE

13.15. Establishment of Aquarium and Aquatic plants

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 St. Xavier's College campus has a good aquatic site in which aquatic plants and birds are living generously.



Fishes Found in the St. Xavier's College



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 St. Xavier's College 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 St. Xavier's College 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 43% and planted vegetation was 57%.

2. The St. Xavier's College campus is established in south Western Ghats of India, belonging to Coimbatore which provide 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. The St. Xavier's College has created 'Medicinal 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 was established 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.
4. In view of floral biodiversity in the St. Xavier's College campus, a sum 267 species belonging to 150 Genera under 85 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.
5. In view of faunal biodiversity in the St. Xavier's College campus, a total of 125 living Mammals representing two Genera under two families, visiting Mammal species (55), 25 species of birds, 3 species of Grasshopper, 2 species of Termites, 3 species of Amphibians, 3 species of Reptiles, 20 species of Butterflies and Three species Mosquitos were recorded and documented.
6. The St. Xavier's College 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.
7. The campus has a maximum number of more oxygen releasing and carbon dioxide assimilating plants such as *Areca* Palm, Banyan tree, Money plant, Neem tree, *Arjun* tree and *Pongam* trees including some of the shrub and herbal plants.
8. Faculties and students of St. Xavier's College are using Bicycles inside the campus is one of the Best Practices.
9. 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.
10. Gardens inside the college premises are found well maintained.
11. Hundred percent ban of plastics in the campus (Thermocole/Plastic plates, Cups, Water bottles, etc.,)

12. Waste Management in the Campus is one of the Best Practices.

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.
- St. Xavier's College Management has 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.
- Eco club student chapters, forums, cells, etc. may be established to among the students from which a large number of programmes on nature conservation and environmental protection may be conducted to rural, tribal and urban people.
- Proper treatments for waste were also suggested.
- Use of fossil fuels has to be reduced for the sake of community health.
- Rain water harvesting systems, solar power generation, environmental education programs have to be strengthened.
- Exotic grassland can be replaced by growing native grasses which yield revenue

16. Conclusion

After the establishment of St. Xavier's College, Coimbatore, 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 St. Xavier's College is a well-established Private Institution in Coimbatore 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 St. Xavier's College Campus is maintaining more than 75% of the green cover area after building construction along with 65% of natural vegetation and 35% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the St. Xavier's College. 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.

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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.....	Mangnoliaceae
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 dotted	21
21a. Placentas parietal; Fruit elongated	Moringaceae
b. Placentas axile; Fruits not elongated	22
22a. Ovules and seeds pendulous; sometimes horizontal.....	Meliaceae
b. Ovules and seeds erect or ascending	23
23a. Stamens alternate with the petals.....	Anacardiaceae
b. Stamens opposite the petals	Vitaceae
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 ring	28
26a. Stamens 15; anther united	Sterculiaceae
b. Stamens 2; anther free.....	27
27a. Anther unilocular; pollen muricate	Malvaceae
b. Anther bilocular; pollen smooth	Bombacaceae
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 petals	30
29a. Shrub	Lythraceae
b. Straggler	Rhamnaceae
30a. Anther dehisce by slits; fruits capsule	Tiliaceae
b. Anther dehisce by spores; fruits drupe	Elaeocarpaceae
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 free	Caesalpiniaceae
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 reticulæ.....	Acanthaceae
b. Fruits indehiscent; seeds not supported on reticulæ.....	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. Arbrorescent 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.....	Lilliaceae
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	<i>Leptogium cyanascens</i> .
1 b. Photobiont green alga	2
2. Thallus leprose, crustose.....	Group I
3. Thallus foliose.....	Group II
4. Thallus fruticose.....	Group III

Group I

1 a. Thallus leprose,.....	<i>Chrysothrix chlorina</i>
1 b. Thallus crustose.....	<i>Graphis</i> sp

Group II

1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc	<i>Pseudocyphellaria</i>
1 b. Thallus lacking pseudocyphellae	2
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.....	<i>Heterodermia leucomelos</i>
3 b. Thallus lower side no canaliculated only in medulla.....	<i>Heterodermia diademata</i>
4 a. Cilia bulbate at the base, thallus grey to grey brown	<i>Bulbothrix</i>
4 b. Cilia present or absent, not bulbate.....	5
5 a. Rhizines dichotomously branched present throughout the margins....	<i>Hypotrachyna</i>
5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining.....	6
6 a. Lobes narrow, long, dichotomously branched, canaliculate.....	<i>Everniastrum</i>
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>Ahphanizomenon</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 -----*Golenkinia*
 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*
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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*
 398. 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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Issue Date : 03/08/2022
Expiration Date : 02/08/2023

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(Managing Director)

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Email: info@qcspil.com. Call: +91 8697724963, +91 8902447427. Website: www.qcspil.com

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NAME OF ENTERPRISE		M/S NATURE SCIENCE FOUNDATION																					
TYPE OF ENTERPRISE *		MICRO																					
MAJOR ACTIVITY		SERVICES																					
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL																					
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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)		<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 M/o MSME.

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For any assistance, you may contact:

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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.

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//

N. Srinivasa Rao
(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. Geethakarhi, 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

Geethakarthi 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**

Dinesh Kumar D

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 (i) 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	<i>Dinesh Kumar D</i>		

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
CONSERVE IT

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

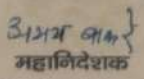
प्रमाणित किया जाता है कि


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



10531234-AP-BD+C

CREDENTIAL ID

26 DEC 2016

ISSUED

25 DEC 2022

VALID THROUGH

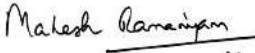
GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP[®] Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED[®] green building program.



MAHESH RAMANIYAM
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.



GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a GRIHA Certified Professional For V. 2015

Date of issue: 19th June 2020

Note : This certification is valid only for GRIHA version 2015.



Chief Executive Officer
GRIHA Council

TECHNICAL REPORT OF ENERGY AUDIT



Submitted to

**ST. XAVIER'S COLLEGE PALAYAMKOTTAI,
TIRUNELVELI – 627 002, TAMIL NADU**

Date of Audit: 25.07.2022

Submitted by



NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)

*[ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) &
EnMS (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

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1. Introduction

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an Organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to a greater extent. Conventionally, electrical energy is generated by means of fossil fuels, hydraulic and wind. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of electric energy. In general, the primary objective of an energy auditing and management of energy consumption is to offer goods or services at the lowest possible cost and with the least amount of environmental impact (Backlund and Thollander, 2015). The need for an energy audit is to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where, the waste occurs and find the scope for improvement.

An energy audit is proposed and conducted to ensure that energy from Fossil Fuel to be minimised through saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Preparation and completion of a questionnaire, physical examination of the campus, observation and examination of documentation, key person interviews, data analysis, measurements and suggestions are all part of the audit process. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc. (Cabrera *et al.*, 2010) With these facts in mind, the audit's specific objectives are to assess the competence of the sustainability management and control system, as well as the departments' compliance with applicable rules, policies, and standards. It has the potential to have a significant influence on the organization's operational cost as well as the environmental impact (Singh *et al.*, 2012).

Energy Conservation Building Code (ECBC) is established in the year 2017 which provides minimum requirements for the energy-efficient design and construction of buildings across India. It also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements. Bureau of Energy Efficiency (BEE) came into force in 2002 towards implementation of energy saving practices in an Organization. Energy-efficiency labels are information affixed to manufactured products and usually communicate the product energy performance (Ingle, 2014). BEE has developed a scheme for energy efficiency labelling of buildings coinciding with the star ratings of the building at accelerating energy efficiency activities. BEE Star Rating Scheme is based on actual performance of the building as well as equipment in terms of specific energy usage termed as 'Energy Performance Indicator' by means of star ratings labelled items used which will be useful for energy savings in a sustainable manner (Mishra and Patel, 2016).

Energy audit programmes provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on. In general, an energy audit process dealt with the driving conservation concepts into reality by giving technically possible solutions within a specified time limit while also considering the economic and other organizational issues (Asnani and Bhawana, 2015). It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of production in terms of savings. It serves as a —benchmark (reference point) for managing energy in the organization for planning more energy-efficient use across the board (Cabrera *et al.*, 2010).

2. Need for an Energy Audit

In an organization, the top three operating expenses are energy, labour and materials. Relating the manageability of the cost or potential cost savings in each of the above components, energy management is found to be the top ranker, and thus energy management constitutes the essential part in reducing the cost. Energy Audit helps in understanding the ways energy and fuel are being used in any organization, and identifies the areas where wastes occur and the scope for improvement exists. The Energy Audit gives a positive orientation to the energy cost reduction, preventive maintenance quality control programmes and will help to keep focus on variations which occur in the energy costs, availability, and reliability of supply of energy. The main objective of Energy Audit is to find ways to reduce energy consumption per unit of product output. The Energy Audit provides a —benchmark (Reference point) and a basic planning for managing energy and for more effective use of energy throughout the organization.

The Ecofriendly-campus concept essentially focuses on the efficient use of energy conservation and its savings opportunities in a sustainable way. It also gives importance for reduction of contribution to carbon emissions, carbon footprint calculation, use of star rated equipment, encouraging energy use conservation practices in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrating environmental considerations into all contracts and services considered to have significant environmental impacts.

Auditing for Energy Management may be studied in terms of energy savings and opportunities. In general, energy cannot be seen, but we know it is there in wire, pipes and other non-living materials because it shows visible effects in the forms of heat, light and power. The energy consumption, energy sources, energy monitoring, lighting, vehicle movement, electrical and electronics appliances, and transportation are addressed by this indicator. Energy usage is an important aspect of campus sustainability and requires no explanation for its inclusion in the assessment. However, energy saving, and opportunities may be taken into consideration while energy is extensively used. An old incandescent bulb uses approximately 50W to 100W while an energy efficient LED uses only less than 10W which shows the positive indication on energy savings. Energy auditing deals with the conservation methods to reduce its consumption related to environmental degradation. In addition, suggestions and recommendations might be given after auditing which in turn useful

for energy savings. Thus it is essential for any environmentally responsible institution to review its energy use practices periodically using at management level as well as through internal and external auditors.

The conduct of energy audit using internal and external energy auditors is playing important role in any organization in terms of energy management. The Energy audit is able to measure the impact of energy potential in an organization so that it helps in determining the better ways to manage the impact on environment. In addition to liquid and solid wastes, biomedical and electronic wastes energy potential and biodiversity audits, attempts may be made to measure the carbon footprint in the organization based on the amount of carbon emissions created by the electrical appliances, vehicles, and human population. It takes into consideration the measure of bulk of CO₂ equivalents exhaled by the organization by which the carbon footprint accounting is done. It is necessary to know how much the organization is contributing towards sustainable development in terms of energy management is being done. It is therefore recommended to measure the carbon footprint in each organization which may be useful for maintaining the ecofriendly campus to the stakeholders.

3. Aims and Objectives of an Energy Audit

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an organization. The aim 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 as per the following.

- Review of energy saving opportunities and measures implemented in the audit sites and identification of additional various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board.
- List ways that the use of energy in terms of electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others.
- Analysis of electricity bill amount for the last two to three years, amount paid for LPG cylinders for last one year and amount paid for water consumption for human beings and watering to the plants.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, air conditioners, cooling apparatus, heaters, computers, photo copiers, inverter, generators and laboratory equipment and instruments installed in the organization (for example- 60-watt bulb x 6hours x number of bulbs = kwh).
- Alternative energy sources / nonconventional energy sources are employed / installed in the organization (photovoltaic cells for solar energy, windmill, energy efficient stoves, Biogas, etc.).

- Creating awareness among the stakeholders on energy conservation and utilization.

4. Benefits of an Energy Audit

- **Reduced Energy Expenses:** The most obvious benefit is that the less energy the Organization uses, the less money that the Organization will have to spend on energy costs.
- **Identify Problems:** An energy audit can also help to identify any issues that the equipment might have. For example, the auditor could find small leaks in the compressed air system. These leaks would cost a significant amount of money if it is not noticed. Auditors can also detect dangerous health risks like the carbon monoxide that's emitted from equipment that hasn't been vented properly. With a regular energy audit, the organization will be able to address these kinds of issues promptly to help ensure the health and safety of the staff members.
- **Increased Employee Comfort:** During the audit, the Organization might learn about changes that have been made regarding insulation and air sealing. Completing these enhancements will help create a more reliable and more efficiently cooled or heated space for the employees. In turn, more comfortable employees tend to be more productive, so not only will the Organization save on energy costs, but may also improve overall well-being.
- **Personalized Recommendations:** Working with an energy expert can help learn about new energy-efficient technologies. The professional will customize a plan, recommending which upgrades will give the most return on investment. These might include updated lighting systems, a new HVAC system, weatherization measures like insulation and air sealing, and more. While some of the recommendations might have a substantial up-front cost that many of them will pay for themselves in a short period of time with significantly reduced energy expenses.
- **Show Environmental Concern:** By taking steps to be more energy efficient, the Organization will be showing the employees and clients that the organization cares about the impact on the environment.
- **Increased Property Value:** Using the recommendations of an energy auditor to make facility more energy efficient could also help to increase its overall worth. Things like solar panels, high-efficiency LED lighting, and weatherization procedures are all things that contribute to a higher property value.
- **Longer Equipment Lifespan:** An energy auditor might recommend to update some of the equipment for maximum energy savings. If the Organization decide to upgrade, it will not only save on energy costs, but also expect the equipment to last a long time. This is because newer, more energy-efficient equipment doesn't have to work as hard as older, outdated units to provide the same level of performance.
- **Energy audit evaluation:** Energy audits will evaluate the Organization —as a whole, the aim is to consider a wide range of available alternatives (Electrical, Mechanical, Thermal Water and Transportation).
- **Energy audit Opportunities:** The audit will not only inform about the opportunities but also provide information with financial analysis. This will enable prioritization based on financial benefit and return on investment. It

provides technical information regarding the proposed energy conservation measures.

- **Analysing the quality of Energy Audit:** A good quality audit will investigate the historical energy usage and find the essential issues using statistical methods. It provides information with emissions analysis to help understand the benefits of the decisions from an environmental standpoint. The audit provides benchmark information to help compare the energy use performance with others.

5. Procedures followed in an Energy Audit

In order to conduct an energy audit, several methods are adopted in the audit sites in which walk-through audit is conducted. The balance of total energy inputs with total energy outputs and identification of all energy streams in a facility are taken into account. The amount of energy used by each of its energy streams are calculated as per the methodology mentioned in the Manual. The top three operating expenses of the Organization are typically observed to be energy (both electrical and thermal), labour and materials. During the audit, physical verification of Lighting, Ceiling, Table and Exhaust Fans, A/C machines, Solar panels, Heaters, Generators, Uninterrupted power supply machines and ventilators load fixtures and verification of installed energy efficient system's capacities are carried out. Inspection of when the cost or prospective cost savings in each of the above components are considered, energy always wins, and the energy management task becomes a key cost reduction area. The energy audit assisted in better understanding how energy and fuel are used in the Organization as well as identifying waste factors and development potential towards energy savings opportunities. Finally, after the audit process, the energy audit included suggestions/ recommendations for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the auditee (Organization).

The audit involved visiting the campus and physical verification of the loads and sources installed. The entire campus is divided into different sections and those sections are audited in which electrical fittings and energy supply are monitored. The production process flow is studied and electricity consumption are measured. Location of the electrical machines, conditions of them and their accessories are inspected through physical verification is observed. The energy bill from the supply utility company (Example: Tamil Nadu Electric Generation and Distribution Corporation Limited, Chennai) is audited and assessed for the load demand requirement and efficient consumption of energy. Stakeholders are interacted with the scope for improvement and energy management during the audit. Potential areas in which the scope of energy conservation and saving opportunities available in the current context have been identified and suggested for implementation to the Organization. The level of carbon dioxide might be measured in different places across the Organization campus using a portable CO₂ Analyzer to calculate the carbon footprint. It may be useful to check where carbon emission is prominent which could be taken into account to reduce.

The audit involves visiting physical position of load & carry out inventory of load. Due measurement of electrical load of equipment & circuit is carried out. Energy bill received from TNEB is audited & studied for KWH requirement & how efficiently energy is used. Various positions are interacted, familiarized with energy audit & involved for successful & result oriented energy audit. Energy conservation & saving opportunities are identified during round & measurement for implementation.

6. Types of Energy Audit

The Energy Audit types depends on the following factors:

- Industry/ Organization type and its function
- Intense and the extent to which final audit is required, and
- The magnitude of cost reduction

Thus Energy Audit can be classified into the following types.

- 1) Preliminary Energy Audit
- 2) Detailed Energy Audit
- 3) Potential and magnitude of Energy Audit
- 4) Comprehensive Energy Audit

6.1. Preliminary Energy Audit Methodology

Preliminary energy audit gives a quick access to:

- Estimating and establishing energy consumption in the organization
- Estimate the scope of audit
- Identify the areas of maximum energy consumption
- Identify the areas of improvement
- Setting benchmark
- Performing Preliminary energy audit uses existing data.

6.2. Detailed Energy Audit Methodology

The detailed Energy audit offers the most accurate estimation of energy savings and cost. A comprehensive audit provides a detailed energy implementation plans for a facility, as it evaluates all major energy consumption systems. It considers the effects of all projects, accounts for the energy use of all major equipment, and includes detailed energy cost saving calculations and project cost. Energy Balance is the key element in detailed energy audit. The estimated use is compared to utility bill charges. There are three phases in detailed energy audit

Phase I - Pre -Audit Phase

Phase II - During-Audit Phase

Phase III - Post Audit Phase

6.3. Potential and Magnitude of Energy Audit

A systematic and structured method is necessary for an efficient working of energy audit process. An initial site study is carried out for planning the procedures necessary for an audit.

Initial Site Study and Preparation for Detailed Auditing

An initial site study visit might take one or two days and gives the Energy Auditor an opportunity to meet the concerned person (Auditee), to familiarize with the

site and to assess the procedures necessary to carry out the energy audit.

During the initial site visit the Energy Auditor carries out the following actions: -

- Discussing the aims of the energy audit with the audit study site's management.
- Discussing the economic factors associated with the recommendations of the audit.
- Analysing the major energy consumption data with the concerned person.
- Obtaining the available audit site drawings – building layout, electricity distribution, steam distribution, compressed air distribution, etc.
- Conducting Walk-through audit around site.

The main aims of this visit are:

- Finalizing the Audit team members
- Identifying and analyzing the main energy consuming areas during the audit.
- Identifying existing instrumentation/ additional metering required.
- To decide if any meters will have to be installed prior to the audit eg. kWh, steam, oil or gas meters.
- Identifying the instruments required for carrying out the audit.
- Planning the time management
- Collecting the macro data on major energy consuming areas.
- Conducting awareness meetings/ programmes.

6.4. Comprehensive Energy Audit

A comprehensive audit can take from several weeks to several months depending on the nature and complexity of the site to complete the audit process. Detailed study is carried out to establish, and investigate, energy and material balances for specific departments. Possible checks of plant operations were carried out over extended periods of time, at nights and at weekends as well as during normal daytime working hours, to ensure that nothing is overlooked.

The audit report includes list of energy inputs and product outputs by major department or by major processing function and estimates the efficiency of each step of the Organization. The methods for improving the efficiency will be listed, and it also includes preliminary assessment of the cost of the improvements and expected payback on any capital investment needed. The audit report concludes with specific recommendations for detailed engineering studies and feasibility analysis. The comprehensive energy audit is useful in identifying the major energy consuming areas to be surveyed during the audit and to identify any existing instrumentation/ additional metering required. Proper care should be taken while identifying the instrumentation required for carrying out the audit and to plan the time management for collecting the macro data from energy consuming areas. The audit report is definitely useful for energy management.

The information to be collected during the detailed audit includes:

1. Energy consumption by type of energy, by department/area, by type of process equipment, by end-use
2. Energy cost and tariff data

3. The distribution and generation of site services (eg. Electricity, Compressed air, steam).
4. Sources of energy and its supply (e.g. electricity from the grid or self-generation)
5. Potential alternative for fuel substitution, process modifications, and the use of co-generation systems (combined heat and power generation).
6. Energy conservation and management awareness training programs within the Organization.

The audit team collects the following baseline data:

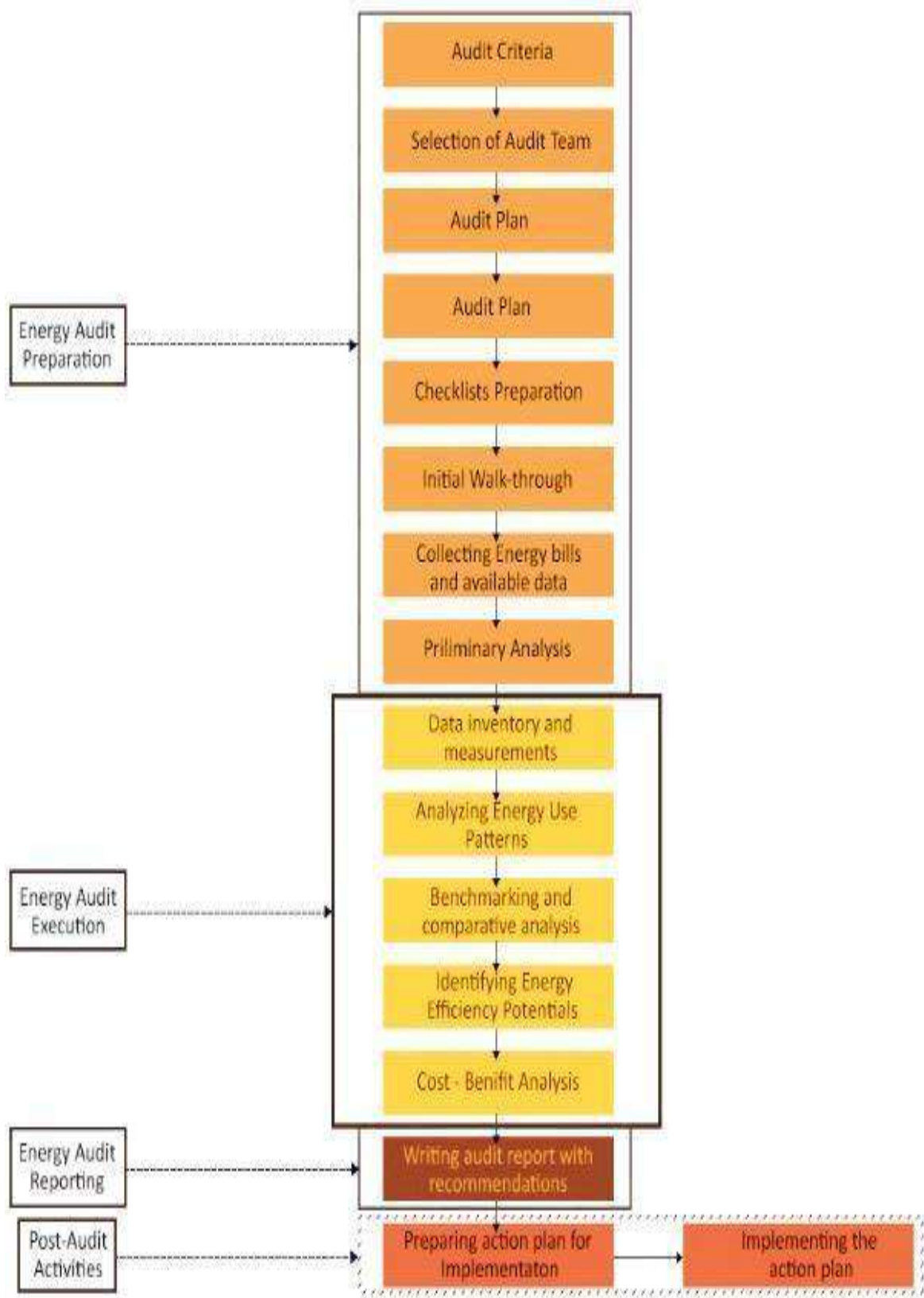
- Major Equipment details, process/technology used
- Water consumption
- Fuel usage
- Capacity utilization
- Electrical energy consumption
- Steam consumption
- Yield/ Efficiency

7. 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 (Non dispersive infra-red meter). 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 meter started measurements of CO₂ level in the atmosphere after powered ON and updated the readings every second in the display screen. If the operating environment is changed (example from high to low temperature) which took 30 seconds for CO₂ sensor to respond and 30 minutes for flexibility in relative humidity. The meter features an audible alarm to give warnings when CO₂ concentration exceeds the set limit. It emits beeps (Abt.80Db) when CO₂ level goes over the set value and stops when any key (except SET) is pressed, or the readings fall below the set values.

The Carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO₂e emission from electricity and the sum of transportation per year in terms of number of the shuttle buses service operated by the Organization and number of cars, motorcycles and trucks entering in the Organization campus. These factors are multiplied with total number of trips in each day and approximate travel distance of vehicles covered in each day with a coefficient (0.01) to calculate the emission of CO₂e in metric tons per year.

Humans contribute to a massive increase of carbon dioxide emissions by burning fossil fuels, deforestation, and other industrial activities. Methane (CH₄) is largely released by fossil fuels like coal, oil, and natural gas industries. Anthropogenic activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years. The largest source of greenhouse gas emissions from human activities is from burning fossil fuels for electricity, heat, and transportation.



Flow chart of Energy Audit Methodology



Calculating Carbon footprint

8. Energy Audit Process

Energy audit is a sequence of tasks performed in a planned manner. It requires discussion, survey, collection of data, analysis, and reporting.



Opening Meeting for the conduct of Energy Audit

8.1. Steps involved in an Energy Audit

- Step 1: Opening meeting among the audit team and auditee
- Step 2: Planning and organizing the energy audit
- Step 3: Conduct a walk-through audit at different sites
- Step 4: Macro data collection and observation
- Step 5: Analysis of data collected from the Organization
- Step 6: Best practices followed in the Organization towards energy savings
- Step 7: Recommendations for further improvement
- Step 8: Exit meeting after the audit to discuss about the audit findings

8.2. Systems studied during the Energy Audit

- Physical verification of lighting, fan a/c machines, ventilators load fixtures.
- Verification of installed energy efficient systems.
- Inspection of Solar panel, Generators, Uninterrupted power supply machines.
- Inspect and verify the maintenance aspects of installed Generators and additional backup power sources.
- Analyse the electricity consumption through the supply utility company (Example: Madhyanchal Vidyut Vitran Nigam Limited).
- Review the potential usage of alternative energy resources.
- Review the energy conservation awareness among the stakeholders for optimum use of electricity and its savings.

8.3. Planning and organizing the Energy Audit

Planning and organizing are the integral part of the energy audit. An initial visit to the audit sites is organized and the areas to be inspected are listed. Following the listing, information on the energy consumption of various blocks in the recent past is obtained, and a planned analysis is carried out.

8.4. Walk-through Audit Process

Simple audit, screening audit or visual audit are the other names, by which walk-through audits are addressed. The main purpose of the walk-through audit is to obtain general information about the sites in which electrical energy is being used at the maximum. More specific information has been obtained from the maintenance and operational people during the time walk-through audit. It also included a walk-through of the facility to become familiar with the building's operation and a brief evaluation of facility utility bills (amount paid for electricity) and other operating data. During the audit the primary problem areas are discovered.

8.5. Macro Data collection and observation

Current level operation and practices within the campus are assessed and then the data regarding the number of electrical loads connected in each section are collected. The power ratings of each component and their respective hours of operation are also observed and documented for preparing the recommendations to the Organization.

8.6. Measurements in the Energy Audit process

An energy audit required measurements, such as the energy identification and quantification, and these quantities necessitate the instruments used in a consistent way. Some of the basic electrical parameters are monitored during the energy audit such as Voltage (V), Current (I), Power factor, active power (kW), apparent power (demand in KVA), energy consumption (kWh), frequency (Hz), harmonics, illumination level, etc. Temperature and heat flow, radiation, air and gas flow, liquid flow, speed, air velocity, noise and vibration, dust concentration, TDS, pH, moisture content, relative humidity, flue gas analysis – CO₂, O₂, CO, SO₂, NO₂, combustion efficiency are the mechanical, thermal and other parameters that are analysed during the audit depending upon the requirements

9. About the Institution

9.1 About St. .Xavier's College, Palayamkottai, Tamil Nadu.

The Jesuit College aims at the training of young men of quality to be leaders in all walks of life so that they may serve the people of our nation in truth, justice and love. Accordingly, this College is to be an agent of social change, instilling in the youth an awareness of the great need in our country of social justice based on brotherhood and dignity of the human person. Thus, it aims at making its own contribution towards a transformation of the present social condition, so that justice, equality and the moral values enshrined in the Constitution of India may prevail in the daily life of every citizen. The aim of St.Xavier's is the sound formation (religious, intellectual, social and physical) of the young based on Christian principles. Every student is required, therefore to attend Religion (for Catholics) or Ethics (for others) classes, and classes on social analysis and personality development. They are also expected to take part in the extension service programmes organised by the College.

In recognition of its service and to increase its efficiency still further, autonomy has been conferred on St.Xavier's College with effect from June 1987. In the autonomous set up, this College is free to determine the course pattern, frame its own syllabi for the various courses and adopt suitable methods of teaching and evaluation. The College is an affiliated First Grade College of the Manonmaniam Sundaranar University which will award degrees with the name of St.Xavier's College mentioned on them. The College was accredited with Five Stars by the National Assessment and Accreditation Council (NAAC) on 17th April 2000. The College was re-accredited with 'A' Grade by NAAC in April 2006.

Vision of SXC

To mould young men and women as leaders in all walks of life so that they may serve the people especially the poor and the oppressed of our nation in truth, justice and love.

Mission of SXC

- To achieve a synthesis of academic excellence and formation of character
- To ensure social justice through equity and access
- To include the excluded for empowerment
- To equip students with global competencies
- To engage in relevant research activities
- To promote Lab to Land through Outreach Programme (STAND)

9.2 About Nature Science Foundation, Coimbatore, Tamil Nadu.

NSF is an ISO 9001:2015 & 14001:2015 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 implementing 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 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 Janua.

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 Industriestowards the accreditation process as well as maintaining a hygienic eco-friendlyenvironment 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

10. Audit Details

Date / Day of Audit	: 25.07.2022
Venue of Audit	: St. Xavier's College, Palayamkottai, Tirunveli – 627002, Tamil Nadu
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Energy Audit
Name of Auditing Chairman	: Mrs. 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	: Dr. D. Vinoth Kumar Joint Director of NSF & ISO EnMS Auditor.
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 Auditors of NSF.
Name of the Eco Auditor	: Er. S. Srinivash, Tamil Nadu Fire and Rescue Services, Coimbatore.
Name of Eco & Green Officer	: Ms. S. Kavi Malar, Environment, Energy & Green Council Programme Officer, NSF.

Audit	Certified Auditors	Certified Auditors
Green Audit	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"> • Mrs. S. Rajalakshmi • Dr. R. Mary Josephine • Dr. B. Mythili Gnanamangai • Er. Ashutosh Kumar Srivastava • Er. N. Shanmugapriyan
Energy Audit	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	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"> • Mrs. S. Rajalakshmi • Dr. A. Geetha Karthi • Dr. R. Mary Josephine • Dr. B. Mythili Gnanamangai • Er. Ashutosh Kumar Srivastava • Er. N. Shanmugapriyan
Hygiene Audit	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 • Er. Ashutosh Kumar Srivastava • Dr. R. Sudhakaran • Dr. N. Saranya
Waste Management Audits	Water Audit, Soil Audit, Biomedical Waste Audit, Solid Waste Management Audit as per the IGBC, GRIHA and BEE	<ul style="list-style-type: none"> • Mrs. Gaanaappriya Mohan • Er. Ashutosh Kumar Srivastava • Dr. R. Sudhakaran • Er. N. Shanmugapriyan
Academic & Administrative Audits	Academic & Administrative Audits as per the NAAC Criteria	<ul style="list-style-type: none"> • Dr. B. Anirudhan • Dr. B. Shreeram
ISO Certification	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 • Mrs. S. Rajalakshmi • Dr. A. Geetha Karthi • Mrs. Gaanaappriya Mohan • Dr. R. Mary Josephine

11.Observations of the Energy Audit

11.1 Facilities visited during the Energy Audit

Date	Section where Energy Audit is conducted
25.07.2022	Administrative Block
	Power House
	Faculty Rooms
	Classrooms
	Seminar Halls
	Multipurpose
	Laboratories
	Computer Lab
	Well, Sump and pumps.
	Sewage Treatment Plant
	Library

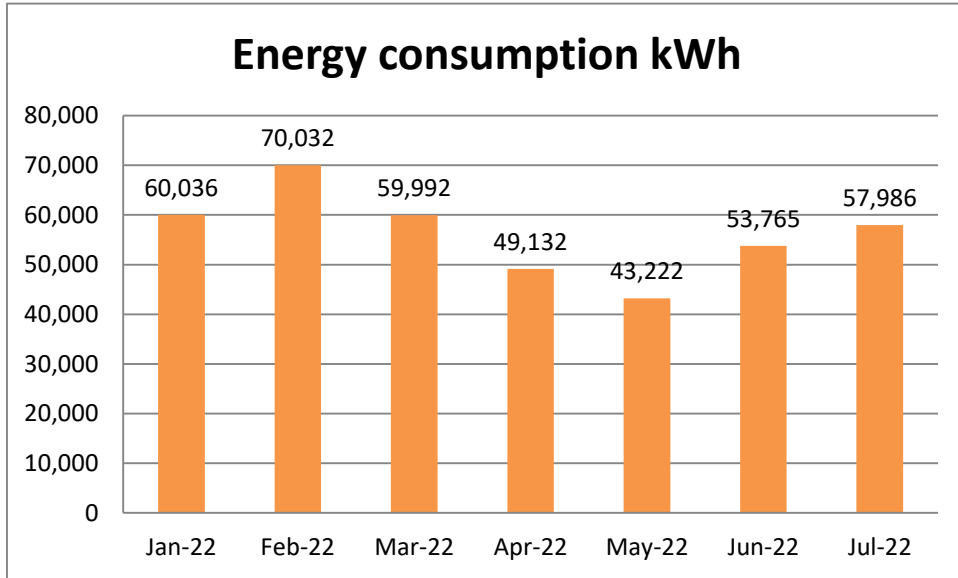
In the sections, the services offered are monitored, verified, and analysed on the aspects of energy consumption. In all these areas lighting systems forms the major consumer of electrical energy. The electric supply consumed in the institute is from the state supply grid only. For renewable energy, 12 streets light which are through Solar power is connected. In case of emergency, two generators are installed.

11.2 Systems Studied during the Energy Audit

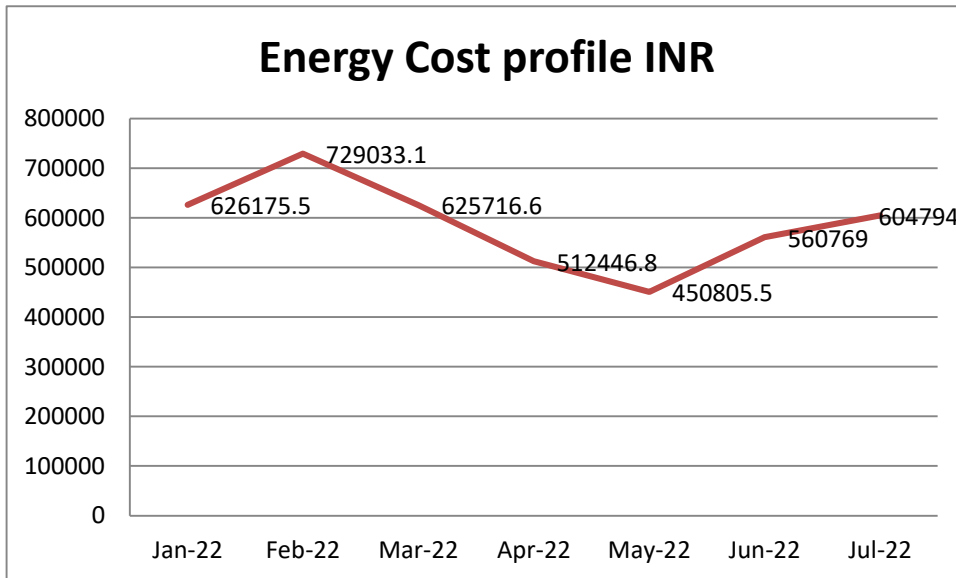
1. Lighting fixtures are verified physically.
2. Installation of energy efficient lighting systems are verified.
3. Installation of safety systems are verified
4. Installation of power backup systems (generators and UPS) are verified on the aspect of maintenance and consumption.
Electricity consumption through the state supply grid bills was analysed.
5. The energy conservation awareness among the stakeholders for optimum use of electricity and its savings are reviewed.

11.3 Energy Consumption and Cost Profile

The following chart shows the profile of energy consumed and the cost for one year by the SXC.



Energy Consumption at St. Xavier’s College



Energy Cost Profile of St. Xavier’s College

11.4 Power supply Equipment and Major Loads

Table 1. Major Equipment related to Electrical energy utilization at SXC

S.No	Major and Minor Equipment, Instrument and Machineries	Rating/Capacity	Quantity (No's)
1	LED Tube Lights	40 W	549
2	Fluorescent Lamps	-	-
3	CFL	60 W	58
4	LED Focusing Light	-	-
5	LED Bulb	-	-
6	Solar Water Heater	-	6
7	Solar Panel	-	2
8	UPS	12 kVA	5
		51 kVA	7
9	LCD Projectors	-	58
10	Refrigerators	-	1
11	Veranda Light Load	20 W	15
12	Lift	-	1
13	Water Doctor (RO)	-	3
14	Water Purification System	-	3
15	AC Split, Window and Centralized AC)	2 ton	12
		1.5 ton	47
		1 ton	11
16	Air Cooler	-	--
17	Portable Fans	-	24
18	Celling Fans	-	425
19	Generators	-	2
20	Pumps	-	3
21	Vacuum Cleaner	-	5
22	Drip & Sprinklers Irrigation	-	-
23	Ventilators	-	-
24	Exhaust Fans	-	37
25	Insect Trap	-	-
26	Automatic Lights	-	-
27	Internet Connectivity	Modem	24
		Server(1kVA)	7
		1.5 kVA	1
28	Podium Containing Mike	-	44
29	Speakers	-	27
30	Amplifiers	-	21
31	Sensors	-	-
32	Computers	Laptop	43

		Desktop	307
33	Dot- Matrix Printers	-	8
34	Laser Printers	-	17
35	Xerox Machines	-	3
36	Scanners	-	3
37	Camera	-	10
38	Intercom	-	-
39	Motors	5HP	7

Table 2. Annual Energy Consumption of Fuels

S.No	Month	Units Consumed (kWh)	Diesel Consumption (Litres)	Petrol Consumption (litres)	LPG Consumption (kg)
1.	January 2022			NA	Approximately 9 cylinders (21 kg) per day with full load of 6000 students for both hostel and canteen at institute
2.	February 2022				
3.	March 2022				
4.	April 2022				
5.	May 2022				
6.	June 2022				
7.	July 2022				
8.	August 2022				
9.	September 2022				
10.	October 2022				
11.	November 2022				
12.	December 2022				

Table 3. Energy Consumption and Cost Profile

S.No	Months	Rating/Capacity Units in kWh	Cost (Rupees)
1.	January 2022	60,036	626175.5
2.	February 2022	70,032	729033.1
3.	March 2022	59,992	625716.6
4.	April 2022	49,132	512446.8
5.	May 2022	43,222	450805.5
6.	June 2022	53,765	560769
7.	July 2022	57,986	604794

The sum of electricity usage per year = kWh

The CO₂ emission from electricity = (Electricity usage per year in kWh/1000) x 0.84

= (394,165/1000) x 0.84 = 331.09MT per year

Table 4. Transportation Facilities available in the campus

S.No	Type of Vehicle	Fuel Used	No. of Vehicles	Non Pollution Certified (Y/N)
1.	Bus	Diesel	2	Yes, all buses have pollution certificate (PUC)
1.	Car	Both	22	NA
2.	Cycles	NA	50	NA

Table 5. 11.5 Quantitative and Qualitative Measurement at SXC

S.No	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have internal Energy audit procedures been developed and implemented in the Organization?		✓	
2.	Have programmes for the achievement of energy efficiency and conservation objectives been established and implemented as on today in the campus?	✓		
3.	Has a Management Representative, Electrical Engineer, Staff in charge been assigned for energy savings on power consumptions?	✓		
4.	Have programmes for the achievement of prescribed financial outlay for current bills for each building in the campus towards power consumptions?		✓	
5.	Has the organization ensured that personnel performing environmental specific tasks have the required knowledge on energy audit (e.g. education, training programme, seminar, workshop, camp, etc.)?	✓		
6.	Are objectives and targets documented towards energy audit periodically and any Register is made?		✓	
7.	Any analysis of energy flows for energy conservation in terms of the amount of energy input into the system without negatively affecting the output in buildings		✓	
8.	Implications of alternative energy efficiency measures sufficient to satisfy the financial criteria of sophisticated investors		✓	
9.	Identification of the most efficient and cost-effective Energy Conservation Opportunities (ECOs) or Measures (ECMs) taken by the Management	✓		
10.	Are the following energy efficiency and conservation aspects considered in sufficient detail?	✓		
	a. Fluorescent (tube) lights, Incandescent lamp and sodium vapour lights are replaced with LED		✓	

	b. Number of Uninterruptible power supply (UPS) and Power generators for power back-up to alternative current supply facility in each building	✓		
	c. Number of solar panels, solar lights, <u>solar water heaters</u> , electric water heater installed	✓		
	d. Automatic sprinkler system used for irrigation purpose		✓	
	e. Ultra-violet lights and any other harmful lights used with safety precautions		✓	
	f. Attempt in reducing the energy expense and carbon footprint	✓		
	g. Disposal facility for hazardous arise from electrical gadgets, equipment and installation	✓		
	h. Renewable energy utilization (solar panel, wind mill)		✓	
	i. Natural / Mechanical air ventilation at Indoor / Outdoor auditorium, stadium, seminar halls, etc.	✓		
	j. Sign boards indicating Switch OFF / ON, Danger at Electrical equipment and Power transformers in the campus	✓		
11.	Signing of MoU with Govt. and NGOs to ensure about the energy conservation and efficiency in the campus		✓	
12.	Conduction of awareness programmes and outreach programmes on the energy conservation and efficiency	✓		
13.	The details of public transport, battery operated / electric vehicles, biofuel use, exhaust fans, boiling water system, chillers and geysers on energy savings mode		✓	
14.	Projects and Dissertation works on the energy conservation and efficiency carried out by students and staff members	✓		
15.	Steps taken to take care of daylighting, AC machines heat emission and ecofriendly Refrigerators, etc.	✓		
16.	Use of water metering, based energy efficiency practices, remote waterlines, automation of electrical fittings and gadgets to save energy		✓	
17.	Are all monitoring electrical equipment appropriately maintained and calibrated?	✓		
18.	Are any energy conservation technologies and retrofit for energy conservation equipment being implemented?	✓		
19.	Skylight roof ratio, fenestration plan and Daylight illuminance in building construction towards energy efficiency*	✓		
20.	Any Automatic Lighting Shutoff with occupancy Sensors and Timers, Exterior / Interior lighting control facility*		✓	
21.	Have any rooms and guest suites a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles*		✓	
22.	Total electricity usage divided by total campus' population (kWh per person)	✓		

23.	The ratio of renewable energy production divided by total energy usage per year	✓		
24.	Total carbon footprint divided by total campus' population (metric tons per person)		✓	
25.	Elements of green building implementation as reflected in all construction and renovation policies	✓		
26.	Greenhouse gas emission reduction awareness programme to the stakeholders	✓		
27.	Computers, Lap tops, IPod, Dot matrix Printer, Laser printers, Xerox Machines, Scanners, Server, Fax machine, Inverter with UPS	✓		
28.	<p>Equipment, Instruments and Machineries related to Life Sciences and Biological Sciences including Biotechnology, Nanotechnology, Food Technology, etc.</p> <p>Electronic Balances, pH Meter, Hot-air-oven, Microwave oven, Laminar Air Flow, Autoclave, Microscopes, Electrophonic, Apparatus, Chromatography devices, Grinders, Mixers, Deep Freezers, BOD incubators, COD digester, Extraction apparatus, Incubators, Co2 incubators, Heating Mantle, Vacuum pump, Vortes Mixer, Magnetic stirrer, Gel rocker, Semicator, Growth chambers, Air curtains, Acrators, Spectrophotometers, Calorimeters, Turbidity meter, Colony counter water bath, Dry bath, Thermocycler, Gene gun, Gel documentation system, Trans illuminator, Ice maker, ELISA reader & Water, Aquarium, zebra fish/animal house facility, Mechanical & Orbital Shakers, cyclo mixer, Lyophilizer, Incinerators, Fermenters, Reactors, Particle size Analyser, XRD, FTR, Muffle furnace</p>		✓	
29.	<p>Chemical Sciences and Engineering Equipment/Machines</p> <p>Distillation unit, Flow through straight pipe, packed bed distillation, Roll crusher, jaw crusher, sieve analysis machine, Shell and tube heat exchangers, plate and frame filter press, Fume hood, Fluorimeter, Venturimeter, Orifice meter, Nephelometer, Membrane Filtration Apparatus, Sieve set Machine, Jar test apparatus</p>		✓	
30.	<p>Electrical, Electronics and Communication Engineering Equipment/Machines</p> <p>DC Shut motor, DC Series motor, DC Compound motor, DC Shunt motor, DC Compound generator, Dc series generator, Single phase & Three phase transformers, Loading rheostat, Single phase & threephase, inductive & capacitive load, Power electronics trainer kits, Three phase squirrel cage indication motor,</p>	✓		

	Three phase slip ring induction motor, AC generator, Stabilizers, synchronizer, Half and fully controlled converters, Buck, Boost and buck-boost converters, Single phase and three phase inverters, synchros, CRO, DS, CRO.			
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11.6. Measurement of Carbon dioxide level in the Campus

Despite a massive increase in global warming, environmental changes and human population including many commercial activities now-a-days, the amount of carbon in Earth's atmosphere is playing an important role which act as a global indicator for checking the purity of the atmosphere. Using a portable CO₂ Analyzer, the level of carbon dioxide was measured in different places across St. Xavier's College, Palayamkottai, Tamil Nadu. The observation showed that the concentration of CO₂ in the atmosphere is found to be within permissible limits and which did not exceed the critical limit of CO₂. It is further revealed that all theselected locations are having pure air with good oxygen level which are free from pollutants (Table 6).

Carbon footprint, amount of CO₂ emissions associated with all the activities of the College or other entities like building construction and anthropogenic activity by human beings includes direct emissions, such as those that result from fossil-fuel combustion from direct burning, transportation, industrial activities, as well as emissions from electricity generation. In addition, the carbon footprint alsocontributes to the greenhouse emission. College is adopting sustainable green campus for future projects.

Table 6. Measurement of CO₂ Concentration in St. .Xavier's College, Palayamkottai, Tamil Nadu

S.No.	Different locations of the Organization's campus	Carbon dioxide level (ppm)	Remarks
1.	Canteen	425	Within Permissible Limits
2.	Library	452	Within Permissible Limits
3.	Computer Lab	456	Within Permissible Limits
4.	Open Place	431	Within Permissible Limits

Reference of Set values of CO₂ level

As per ASSRAE 62 2019 standards 700 PPM for indoor and 1000 PPM form outdoor is the permissible limits

Calculation of Carbon Footprint at SXC

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.

The CO₂ emission from electricity

= (electricity usage per year in kWh/1000) x 0.84

= (394,165 kWh/1000) x 0.84 (is the coefficient to convert kWh to metric tons)

= 331.098 metric tons



CO₂ level measurement at various locations St. .Xavier's College, Palayamkottai, Tamil Nadu

11.7. Ways to reduce Carbon Footprint

Evaluating and understanding the CO₂ emission can reduce the negative impact on the environment. Tiny changes can bring good impacts like when it comes to transportation, food, clothing, waste, etc., the following tips helps in reducing the carbon footprint.

Food

- Consumption of local and seasonal products.
- Limiting the consumption of meat and beef.
- Adopting sustainable fishing.
- Avoiding plastic packaging and practising the use of reusable bags.
- Sense of buying only necessary things.

Clothing

- Taking good care of clothes.
- Buying second hand products or borrowing
- Using the clothes made from recycled products with eco label

Transport

- Adopting carpooling practice, using cycles and public transport
- Usage of No Pollution certified vehicles.

Energy and waste

- Turning down the heating.
- Short showers
- Proper usage of water while brushing teeth or cleaning the dishes
- Proper care while charging the batteries.
- Selecting star rated equipment and EU Energy labelled products
- Reduce and recycle of wastes.

11.8. Light Intensity Measurement

Light intensity or light output is used to measure whether a particular light source provides enough light for an application needed. There is a well-established light level recommendation for a wide range of applications in lighting industry and also for the type of space. Understanding the light intensity helps to properly evaluate whether the space has adequate lighting conditions or not. Light intensity is measured in terms of lumens per square foot (foot-candles) or lumens per square meter (lux). Measuring the amount of light that falls on a surface allows evaluating if the particular space has sufficient light to perform the tasks.

A light meter (lux meter) is used to measure the amount of light in a space/on a particular work surface. The light meter consists of a sensor that measures the light falling on it and provides the user with a measurable illuminance reading. Light meters are an especially useful tool for measuring light for safety or over-illumination. The light intensity is usually measured by taking initial reading, where the lightings are turned off (Baseline measurement) and the final reading is taken by turning on the lights in the particular space (illuminated level). Subtracting the baseline measurement from illuminated level gives the light intensity of the particular room/ space.

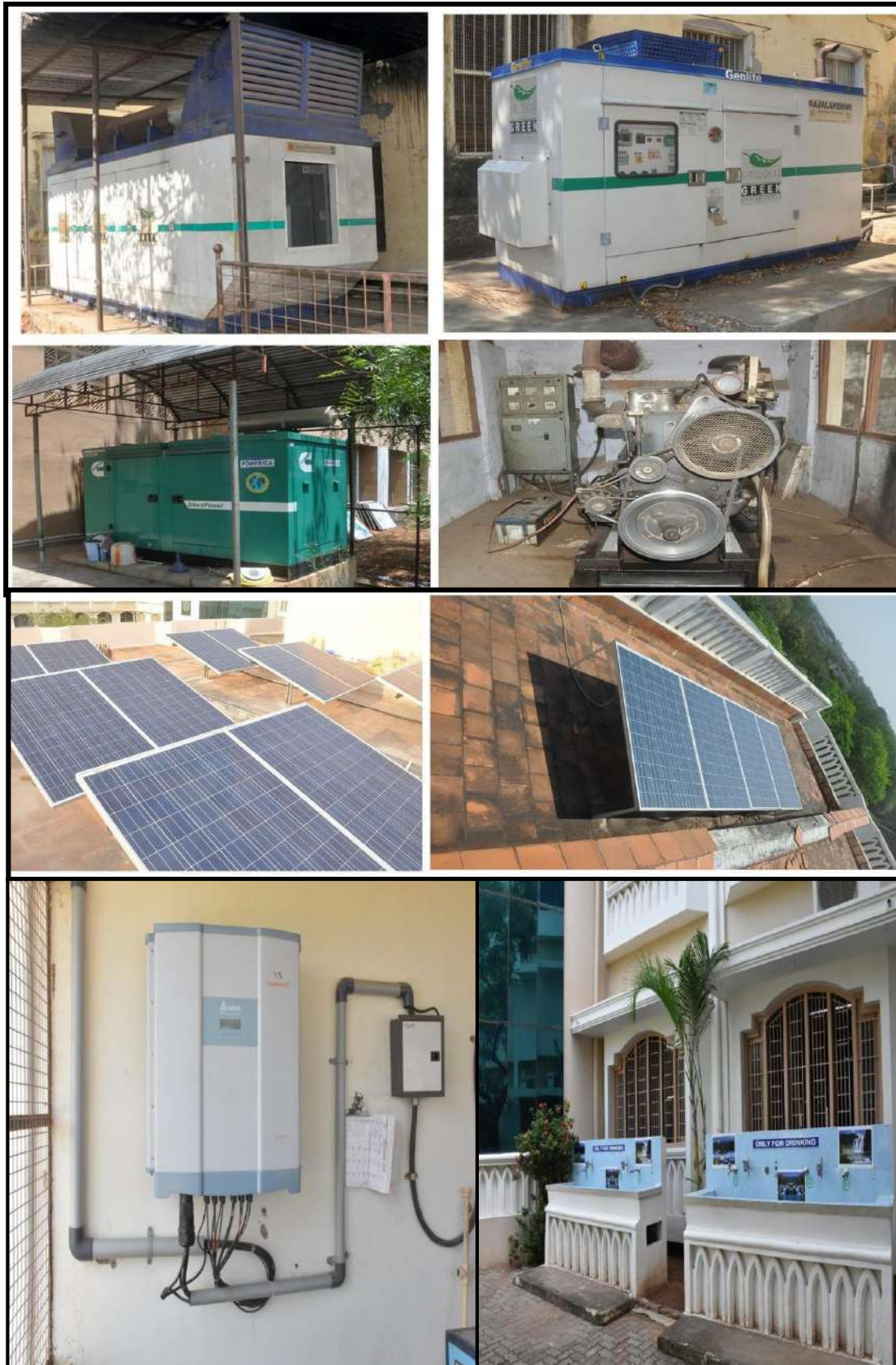
Table 7. Light Intensity Measured at various locations of St. .Xavier’s College, Palayamkottai, Tamil Nadu.

Sl.No	Locations	Light Intensity (Lux)	Recommended Level (as per NBC 2016) (Lux)
1.	Canteen	334-475	200 – 500
2.	Library	211-345	150 – 300
3.	Computer Lab	256-425	200 – 500
4.	Open Place	399-456	200– 500

12. Best Practices being followed in the SXC

- Lux level are merely average at all places
- In classrooms thin films were pasted in order to avoid heat inside the classrooms.
- Transformer, Generators and UPS are protected properly with fencing and kept awareness boards on ‘_Dangers’ and ‘_Warnings’.
- Most of places, 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.
- Power factor is maintained near to unity with APFC.
- Replaced old generation computers and TVs with LED monitors.

- Establishment of a system of carpooling among the staff members and students to reduce the number of four wheelers coming to the College.
- Discouraging the students and research scholars using two wheelers for their commutation in the campus.
- Switching off the lights, fan, air conditioners, equipment and instruments when they are not in use.
- Systematic representation chart of power flow was placed in the Power house
- First Aid box and Electric Treatment Boards for electroshock treatment was placed in Powerhouse
- Emergency numbers of nearby doctor, Hospitals and Fire extinguisher number were placed at the Power house
- Date of installation, warranty date, battery warranty date had been mentioned upon UPS
- Library building was built with Natural Light
- Warning and Danger sign boards were placed in all power house room, UPS room.
- Natural Light is illuminated in the campus, labs, corridors and in the stairs.
- Fire Extinguisher were placed in the power house and in the Ups room
- Sub metering for individual buildings most of the roof with 100-150 KW with net metering in block B were under proposal.



**Walk through Audit at different Places of St. Xavier's College,
Palayamkottai, Tamil Nadu**



Best Practice Followed by the Institutions

13. Recommendations for improving the energy efficiency and energy conservation in the Organization

- The energy audit included suggestions for energy cost reduction, preventive maintenance, and quality control activities, all of which are critical for utility operation in the audit sites..
- Procurement of equipment with energy efficiency (4-5 star rated equipment) during replacement may be considered.
- Optimal water usage and temperature settings may be used which are coming under automatic process towards energy savings.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- LED lights can be used in SXC Cafe in future
- Motion sensors can be implemented in future for the possibilities of reduction of light consumption for individual cabins
- In parking areas the charging stations for bicycles and bikes can be provided
- Green signing boards with energy saving efficiency can be encouraged at campus

- Solar street lights can be recommended in future where possible
- Use computers and electronic equipment in power saving mode.
- Automatic switches with occupancy sensors in common areas.
- Regular monitoring of equipment in all laboratories and immediate rectification of any problems.
- Internal energy policy such as preventive maintenance and breakdown maintenance policy should be implemented.
- Plan for diesel consumption need to be implemented.
- Energy meter in each building to be implemented.
- Albedo Painting can be recommended at the roof top.
- Solar Panel in future can be recommended to lower the energy consumption
- In UPS room At EEE department Ventilation may be provided properly
- In Future tube lights can be replaced with LED lights.
- Gas type Fire Extinguisher shall be used at Power house and in UPS room.
- Water Tank delivering pump can be replaced with high efficiency star rated one
- The generator can be replaced with the high efficiency in future.

14. Recommendations on Carbon Footprint in the Organization

- Encourage students and staff members to use bicycles and battery operated vehicles to reduce fuel consumption and carbon emission.
- Establish a more efficient cooking systems like biogas operated machineries to save fossil gas in hostel kitchen and canteen.
- More use of generators, inverters, and UPS every day should be discouraged which could save electrical energy.
- Large number of ventilation and exhaust systems may be placed in auditorium, seminar and conference halls to reduce the carbon dioxide level among the participating students, scholars and staff members.

15. Conclusions

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial. 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 St.Xavier's College, palayamkottai, Tamil Nadu 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 places, 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. Few recommendations, in addition, can further improve the energy savings of the Organization. This may lead to the prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.



Closing Meet of the Audit

16. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Management Committee Members: Rev. Dr. Mariadoss, S.J.(Principal) **St.Xavier's College, Palayamkottai, Tamil Nadu** for providing us the grateful opportunity to conduct audit in their campus. We are grateful to Dr. Azhaguraj. R. IQAC Cordinaor, for providing us able guidance through which our audit would not have been successful. We are also thankful Coordinators of Energy, who had extended full support in conducting the audit and making it a grand success.

17.References

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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:

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


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 INCOMETAX DEPARTMENT
 OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
 Ayyakar 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
Rajesh S. Ponnappa
17/07/19
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. **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, LR.5)
 Commissioner of Income Tax (Exemptions)
 Chennai.

Copy to:

- ✓ 1. The applicant
2. Guard File
3. 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	Coinbatore South
	Area/Locality	CODMBATORE
	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 Energy Auditors

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Founder & Chairman of NSF.
2. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
3. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, and Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.
4. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dinesh Kumar, Energy Auditor of NSF.
5. ISO Energy Management System (50001:2018) of Dr. D. Vinothkumar, Joint Director 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 ISO 14001:2015 Management Systems for compliance with standards. This certificate remains in force as long as this certificate is recognized by Exemplar Global. For any information and assistance, please write to: Mail: info@isoindia.co







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 (i) 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**

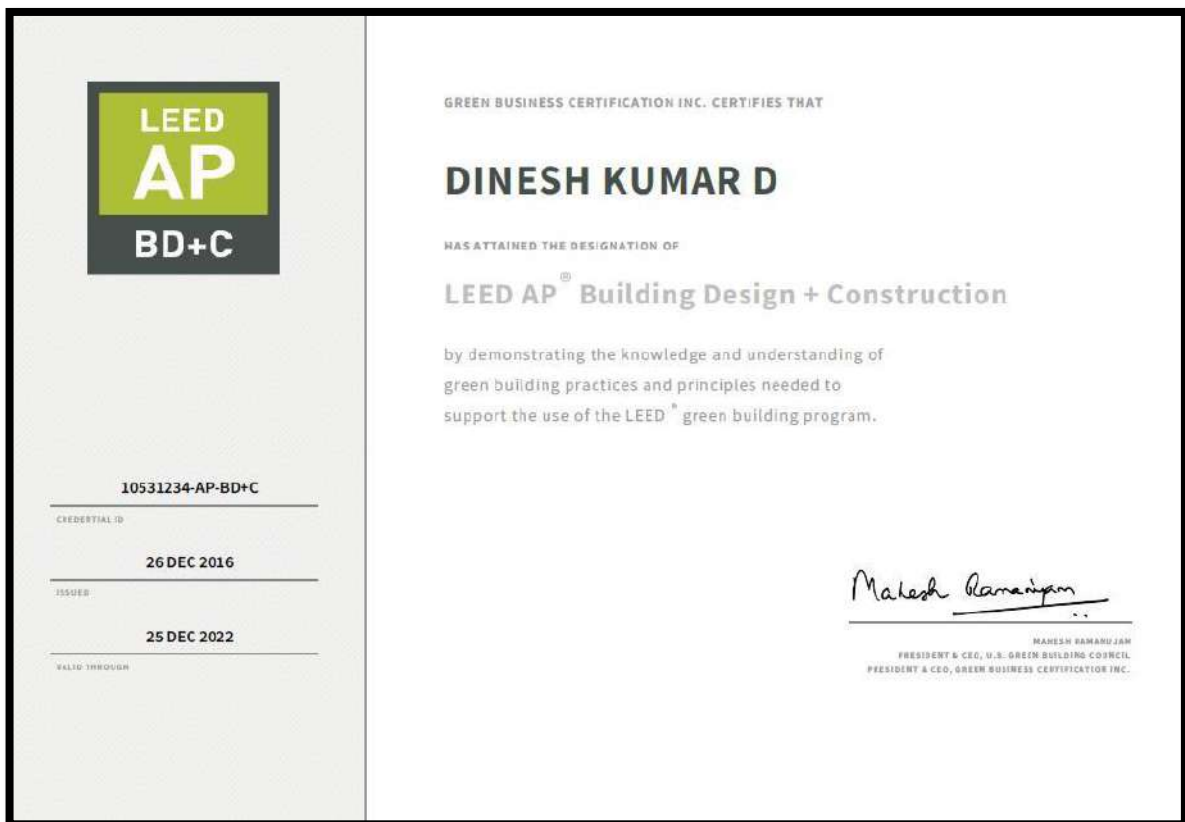
Secretary
Bureau of Energy Efficiency
New Delhi

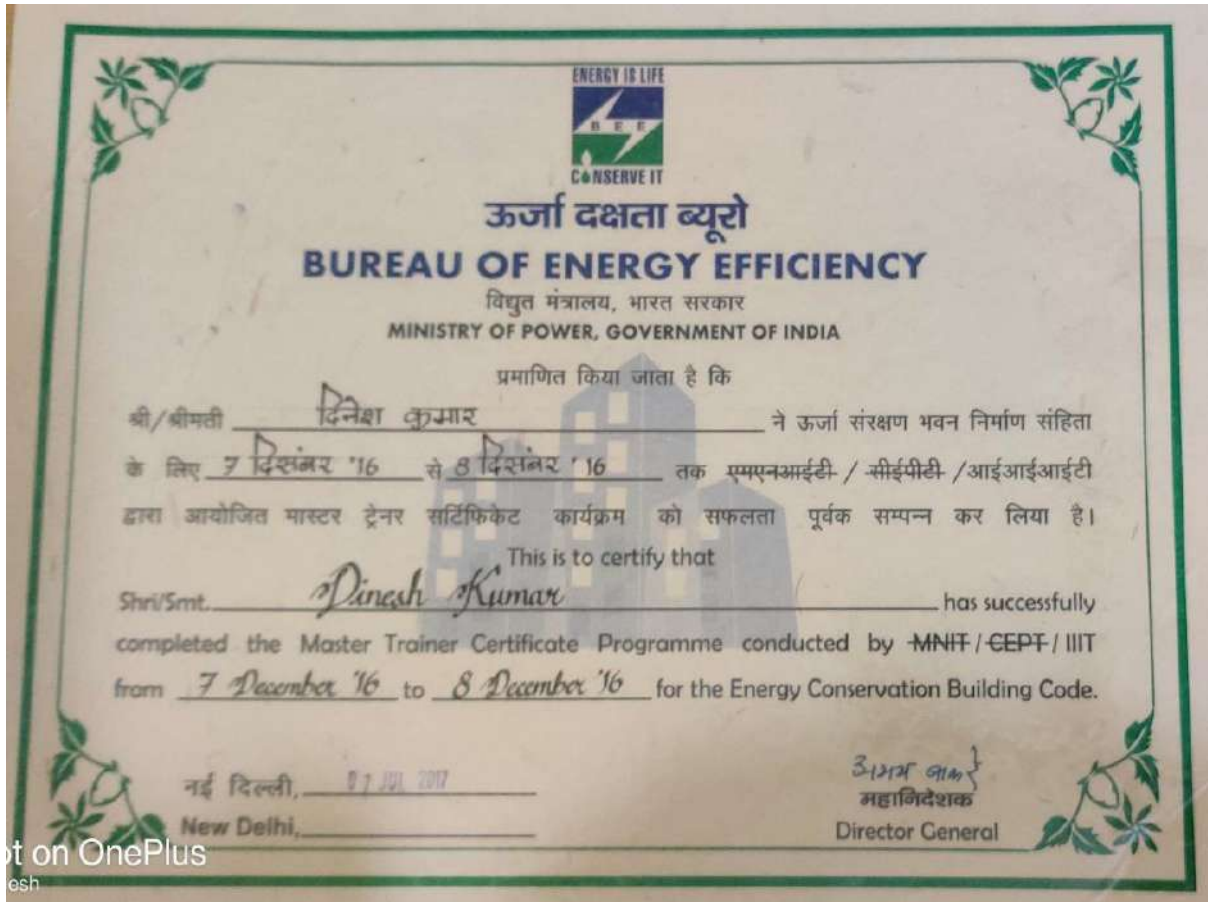
Digitally Signed: RAKESH KUMAR RAI

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			







The CPD Accreditation Office

Certificate of Successful Attainment

This is to certify that

DR. D. VINOOTH KUMAR

HAS SUCCESSFULLY COMPLETED THE FIVE DAYS (40 HOURS)

LEAD AUDITOR COURSE

BY PASSING THE WRITTEN EXAMINATION BASED ON

ISO 50001:2018

ENERGY MANAGEMENT SYSTEMS

Examination Date: 15/07/2022

Certificate issue Date: 22/07/2022

Certificate registration number: QCS/TR/C/0056

Total Course duration: 40 hours CPD Credits Earned: 32

Remarks: Roughly one hour of study time equals to 1 CPD Credit.

This certificate can be validated online from the industry wide Global Professional Register at www.qcspl.com.

Partha Bagchi
(Managing Director)

QCS MANAGEMENT PVT LTD

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Ace

TECHNICAL REPORT OF ENVIRONMENT AUDIT



Submitted to

**ST. XAVIER COLLEGE,
PALAYAMKOTTAI – 627 002, TAMILNADU**

Date of Audit: 25.07.2022

Submitted by



NATURE SCIENCE FOUNDATION

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

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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).

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. 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

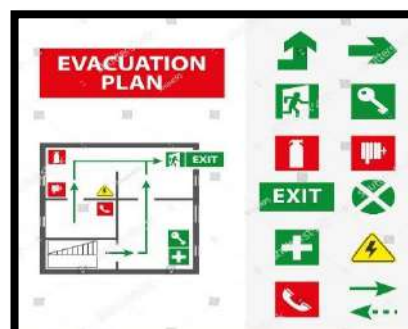
6. Environmental health and safety management system

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?



Meeting with the Principal and Management Representatives of St. Xavier College with the Audit Team of the Nature Science Foundation

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.

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.
- Maintenance of sustainable stage of improvement.

19. About the Organizations

19.1. St. Xavier's College

St. Xavier's College, which was established in 1923, celebrates its 96 years of existence at Palayamkottai, and aims at training of young men of quality to be leaders in all walks of life so that they may serve the people of our nation in truth, justice and love. Accordingly, this College is to be an agent of social change, instilling in the youth an awareness of the great need in our country of social justice based on brotherhood and dignity of the human person. Thus, it aims at making its own contribution towards a transformation of the present social conditions, so that justice, equality and the moral values enshrined in the Constitution of India may prevail in the daily life of every citizen. The aim of St. Xavier's is the sound formation (religious, intellectual, social and physical) of the young based on Christian principles.

In 1987, the college became an Autonomous Institution. The College was accredited with Five Star status by the National Assessment and Accreditation Council (NAAC) on 17th April 2000. UGC conferred on our college the status of "College with Potential for Excellence" in 2004 and for the second time in 2010. The College was re-accredited with 'A' Grade by NAAC in April 2006. In the third cycle of NAAC reaccreditation (2012), the college received 'A' grade with the CGPA of 3.50. In the year 2014, Department Biotechnology (DBT) selected our college under 'Star College Scheme' and for the second time in 2017. The National Institute Ranking Framework (NIRF) ranked our college in the 74th position in 2019.

Motto of the College

Veritate Lumen et Vita (Light and Life through Truth)

Vision of the College

To mould young men and women as leaders in all walks of life so that they may serve the people especially the poor and the oppressed of our nation in truth, justice and love.

Mission of the College

- To achieve a synthesis of academic excellence and formation of character
- To ensure social justice through equity and access
- To include the excluded for empowerment
- To equip students with global competencies
- To engage in relevant research activities
- To promote Lab to Land through Outreach Programme (STAND)

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"> ➤ Mrs. 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"> ➤ Mrs. 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) 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Er. Ashutosh Kumar Srivastava ➤ Dr. R, Sudhakaran ➤ Dr. N. Saranya

	<ul style="list-style-type: none"> • 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 ➤ Er. Ashutosh Kumar Srivastava ➤ 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"> ➤ Er. Ashutosh Kumar Srivastava ➤ Mrs. 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	58 acres
2.	Total Built up area	16,296,67 sq.ft
3.	Covered Car parking area	200 mts
4.	Forest vegetation	30%
5.	Planted vegetation	70%
6.	Total number of Girl students	1958
7.	Total number of Boy students	1979
8.	Total number of Teaching Staff	183
9.	Total number of Non-teaching staff	85
10.	Total number of College Vehicles	2



St. Xavier's College Campus Infrastructure

20. Audit Details

Date / Day of Audit	: 25.07.2022
Venue of Audit	: St. Xavier's College 21 North, High Ground Rd, Palayamkottai, Tirunelveli - 627002 Tamil Nadu
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Environment Audit
Name of Auditing Chairman	: Mrs. 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 Lead Eco Auditor	: Er. Ashutosh Kumar Srivastava, Associated Chambers of Commerce and Industry, New Delhi.
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, ASSOCHAM, 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.



Auditing Team of the Nature Science Foundation, Coimbatore, Tamil Nadu at the St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.

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. 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.

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, plumping 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	5 litre		
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*			NA
16.	Eco-friendly Refrigerants, instruments and materials use including Energy efficiency measures taken *			NA
17.	Mechanism of monitoring environmental parameters (Temperature, Relative humidity, Rainfall, Sunshine, Wind speed, dew point) *			NA
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 Nos
2.	Number of Borewell water and Open well water facility	Borewell water available, open well water not available
3.	Number of Percolation Pond and Check Dam facility	Not available
4.	Number of Wastewater treatment facility	1 No(s)
5.	Number of Solid waste management facility	1 No(s)
6.	Number of Renewable energy utilization (Solar panel and solar water heater)	100 Kw capacity, 3000 litre capacity (2 Nos)
7.	Number of Rain harvesting system and water reservoirs	1
8.	The ratio of Environment sustainability courses (Environmental Science, Engineering, Technology, Management, Monitoring, Climate change, Global warming) to total courses / subjects	4.58%
9.	Functioning of Nature club, Eco club, Association, and NSS on environment conservation, environmental pollution, nature protection and natural resources maintenance.	3 Nos
10.	Signing of MoU with Govt. and NGOs to ensure eco-friendly campus maintenance	25 Nos
11.	Implementation of Government schemes (Swachh Bharath Abhiyan under Clean India Mission) programmes conducted	1 Nos
12.	Number of composting pits and vermicompost unit for recycling of kitchen wastes and plant leaf litters degradation	Vermicomposting -1 No(s)
13.	Carbon footprint in the campus due to Electrical energy usage	857.59 metric ions
14.	Carbon footprint in the campus due to Vehicles usage	
15.	Carbon footprint in the campus due to Petroleum gas usage	NA
16.	Carbon footprint in the campus due to Human population load	NA
17.	Carbon footprint in the campus due to use of Petrol and Diesel for operating Generators for power generation	NA

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.

St. Xavier College has taken sufficient attempts not to use plastics in the campus and displayed a slogan 'say no to plastics' 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 St. Xavier College

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.

St. Xavier 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 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.



**Solid waste management facilities in St. Xavier's College,
Palayamkottai – 627 002, Tamilnadu.**

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

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 St. Xavier College 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.

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 St. Xavier College viz. Students Hostels and Staff rooms, Students Service Centre, Sports Complex and Guest rooms. A Contractor (M/s Metro Support Services, Chennai) is engaged for the collection and further process of waste generated within the campus where biodegradable wastes subjected to preparation of organic compost.

22.2.3. Disposal of E-Waste at the St. Xavier College

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 Tamilnadu State Pollution Control Board as per the E-Waste Management Rules, 2016.

22.2.4. 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. one of the innovative projects followed by the St. Xavier College, they have collected all electric waste and developed into a robotic model.

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. St. Xavier College 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. 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 : **St. Xavier's College,**
 Address of the Organization : 21 North, High Ground Rd,
 Palayamkottai, Tirunelveli – 627002,
 Tamil Nadu.
 Date of Waste Disposal : From April 2018 to March 2021
 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		--	--
2.	Aerosol Cans (Empty)	NA	--	--
3.	Agriculture Waste	NA	--	--

4.	Aluminium, Metal Cans, Tins	NA	--	--
5.	Asbestos	NA	--	--
6.	Batteries (Dry)	NA	--	--
7.	Batteries (Lead Acid)	NA	--	--
8.	Biomedical Waste	NA	--	--
9.	Car exhaust	NA	--	--
10.	Charcoal	NA	Converted into eco- friendly	Local ventors
11.	Clinical Waste	NA	--	--
12.	Cloth Materials Waste	NA	--	--
13.	Construction Waste	NA	Removed from Mother Therasa womens hostel	Local ventors
14.	Condensate Waste	NA	--	--
15.	Crude Oil	NA	--	--
16.	Descaling Acids	NA	--	--
17.	Drilling Fluids / Solids	NA	--	--
18.	Drums and Containers (Empty)	NA	--	--
19.	Effluents from major equipment	NA	--	--
20.	Electrical Waste (Wires, Switches, Fans, A/C machines, Holders, Meters, Coils, etc.)	Scrap	--	Local ventors
21.	Electronic Waste (Computer, Laptop, CD, Pen drive, Keyboards, Mouse, Printers, UPS)	Scrap	--	Local ventors
22.	Fertilizer Waste	NA	--	--
23.	Filters	NA	--	--
24.	Fluorescent Light Tubes	NA	--	--
25.	Food Waste	Piggery	Organic waste	St.Xavier campus

26.	Furniture Items	Recycle	Stored in shed	Local ventors
27.	Garbage and Cardboards	4130 kg	--	--
28.	Glass Bottles		--	--
29.	Glassware items Waste		--	--
30.	Glycols	NA	--	--
31.	Hazardous Waste	NA	--	--
32.	Household items	NA	--	--
33.	Human Waste	NA	--	--
34.	Inert Waste	NA	--	--
35.	Laboratory Wastes	120-140kg/yr	Decomposed	Local ventors
36.	Lights and Bulbs	30-35/yr	--	--
37.	Kitchen Waste	125 kg/day	Organic compost	St.Xavier campus
38.	Metal Waste	28,110 kg	Offsite	--
39.	Napkins	Incinerated	On site	St.Xavier campus
40.	Oil Contaminated Soil	NA	--	--
41.	Oily Sludge & Rags (Used)	NA	--	--
42.	Packaging Waste	NA	--	--
43.	Paint Waste	NA	--	--
44.	Paper Waste	14130	--	Local ventors
45.	Pathological Wastes	NA	--	--
46.	Pigging Wastes	NA	--	--
47.	Plant Wastewater	NA	--	--
48.	Plastic Waste			
49.	Plasticware items waste	NA	--	--
50.	Produced Water Waste	NA	On site	Gardening purpose
51.	Radioactive Waste	NA	--	--
52.	Rinsate Waste	NA	--	--

53.	Rubber Waste	NA	--	--
54.	Salts used in Laboratories (Used & Expiry Chemicals)		--	--
55.	Sanitary Wastewater	Available	On site	Gardening purpose
56.	Scale (Pipe and Equipment)	NA	--	--
57.	Sewage Sludge	NA	--	--
58.	Solvents		--	--
59.	Sludge and allied		--	--
60.	Trash (i) Glass (ii) Metal (iii) Plastic (iv) Oils (v) General Trash			
61.	Synthetic Dyes, other items	NA	--	--
62.	Textile Waste	NA	--	--
63.	Used Engine Oil	NA	--	--
64.	Wastewaters (Liquid Waste: Detergents, Soap, Oil, etc)	Recycle	On site	Gardening purpose
65.	Wood Waste	2150 kg	Off Site	Local ventors

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 St. Xavier's College,
Palayamkottai – 627 002, Tamilnadu.**

St. Xavier 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 the St. Xavier College

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. St. Xavier College has biogas plant set up in the campus



Biogas plant set up in the St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.

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. 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. 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.



Vermicompost plant in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.

22.5. Recycling of Wastewaters at the St. Xavier College



Photos of pond, lake, water reservoir, bore well, well in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.



Drinking Water facilities in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu



R. O. Drinking water facilities in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.

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.

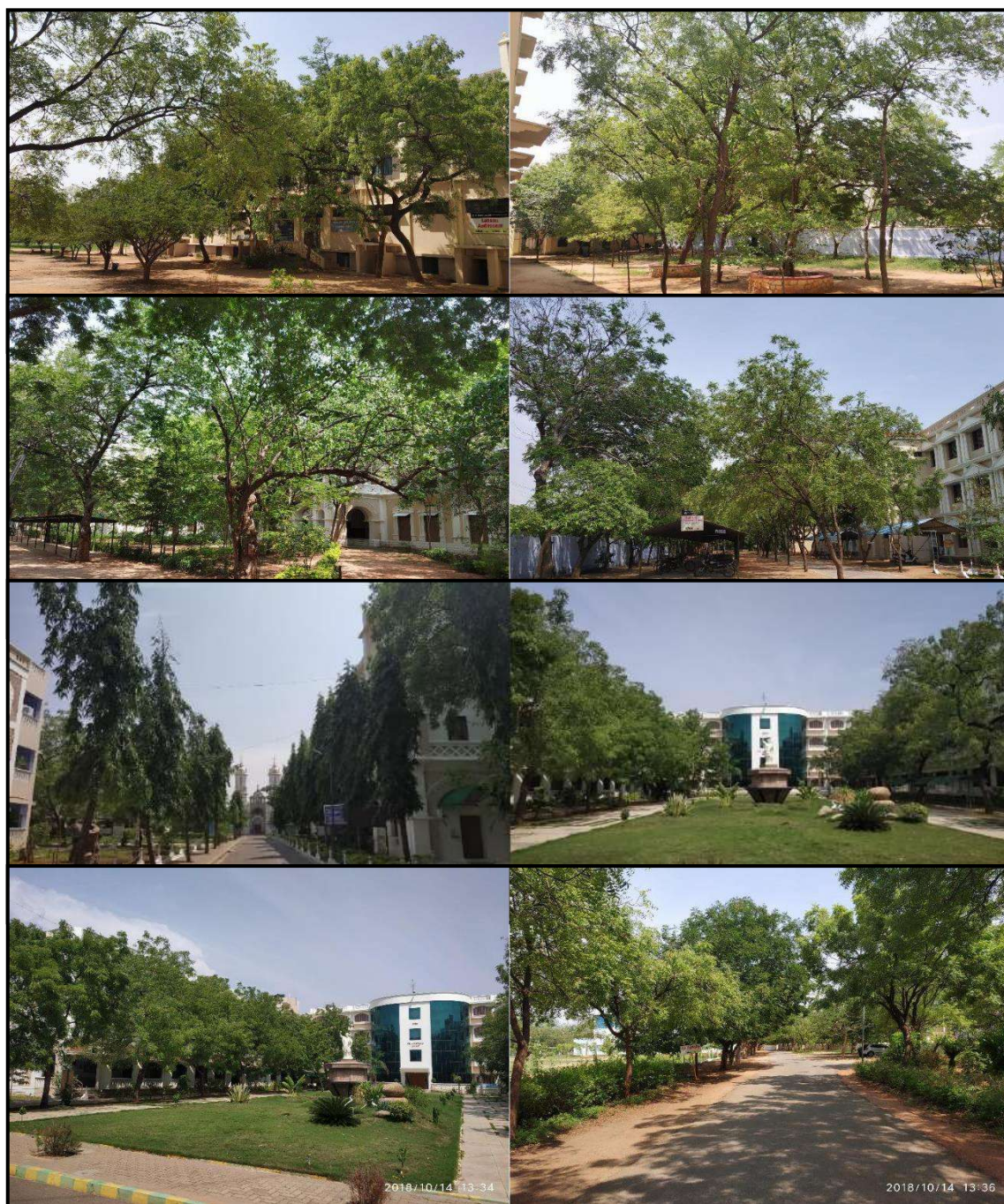
If an industry or Organization has the wastewater treatment plan, proper records on the analysis of water input and output parameters including the running time of the wastewater treatment plant; its operation cost, its maintenance and the reuse records of the treated water should be well accounted. 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.

22.6. Establishment of Eco-friendly Campus at St. Xavier College

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



Eco-friendly St. Xavier's Campus – A Greener view

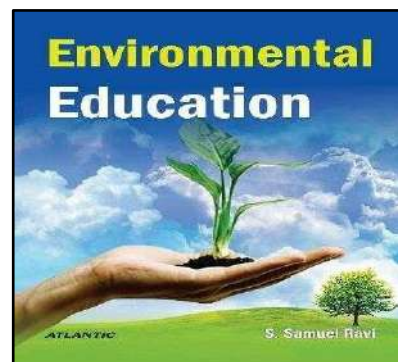
22.7. Napkin disposal facility

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.

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. It is a multi-disciplinary field integrating Biology (Botany and Zoology), Chemistry, Physics, Ecology, Environmental Science & Engineering, Earth Science, Atmospheric Science, Mathematics, and Geography.



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. College operates some 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. It is observed that staff members and students are

coming to college every day using their own vehicles (Cars and Bikes / Scooters) which accounted to be moderate in numbers. 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.



Two wheelers are parked at appropriate places in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu.

2.10. 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 stable 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 St. Xavier College has a large number of ventilators for effective air circulation.



**Ventilation and Exhaust system Facilities in St. Xavier's College,
Palayamkottai – 627 002, Tamilnadu**

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 1).

Table 6. Measurement of CO₂ concentration in the St. Xavier College

S.No.	Different locations of the Organization's Campus	Carbon dioxide level (ppm)	Remarks
1.	Canteen	425	Aspirational
2.	Computer lab	456	Within permissible limits
3.	Open place	431	Within permissible limits
4.	Library	452	Within permissible limits

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



Measurement of CO₂ level at Various places in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu

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.

Table 7. The Oxygen concentration in the St. Xavier College

S. No	Location	Oxygen Level (%)	Remarks
1.	Canteen	19.5	O ₂ level is good
2.	Library	19.4	O ₂ level is good
3.	Class Room	19	O ₂ level is good
4.	Parking area	20	O ₂ level is good
5.	Garden	21	O ₂ level is good
6.	Open Place	17.5	O ₂ level is good

**Measurement of O₂ level at various place St. Xavier's College,
Palayamkottai – 627 002, Tamilnadu**

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.

The observation on carbon footprint due to electricity usage per year at the college showed 1209.281 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 14.4 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 10.56 metric tons. The Carbon footprint due to Motorcycle's usage per year is 12 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 1246.241 metric tons which is the sum of the carbon emission from electricity plus transportation (bus, car, motorcycle) per year. The carbon footprint

Calculation of Carbon Footprint Per Year at St. Xavier College

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

$$\begin{aligned} &\text{The CO}_2 \text{ emission from electricity} \\ &= (\text{electricity usage per year in kWh}/1000) \times 0.84 \\ &= (1439620 \text{ kWh}/1000) \times 0.84 \text{ (is the coefficient to convert kWh to metric tons)} \\ &= 1209.281 \text{ metric tons} \end{aligned}$$

b. Transportation per year (Shuttle)

$$\begin{aligned} &= (\text{Number of the shuttle bus in the campus} \times \text{total trips for shuttle bus service each day} \\ &\times \text{approximate travel distance of a vehicle each day inside campus only (in kilometres)} \\ &\times 365/100) \times 0.01 \\ &= ((30 \times 2 \times 10 \times 240)/100) \times 0.01 \\ &= 14.4 \text{ metric tons} \end{aligned}$$

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)

$$\begin{aligned} &= (\text{Number of cars entering the campus} \times 2 \times \text{approximate travel distance of a vehicle} \\ &\text{each day inside campus only (in kilometres)} \times 365/100) \times 0.02 \\ &= ((22 \times 2 \times 5 \times 240)/100) \times 0.02 \\ &= 10.56 \text{ metric tons} \end{aligned}$$

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)

$$\begin{aligned} &= (\text{Number of motorcycles entering the campus} \times 2 \times \text{approximate travel distance of a} \\ &\text{vehicle each day inside campus only (in kilometres)} \times 365/100) \times 0.01 \\ &= ((50 \times 2 \times 5 \times 240)/100) \times 0.01 \\ &= 12 \text{ metric tons} \end{aligned}$$

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

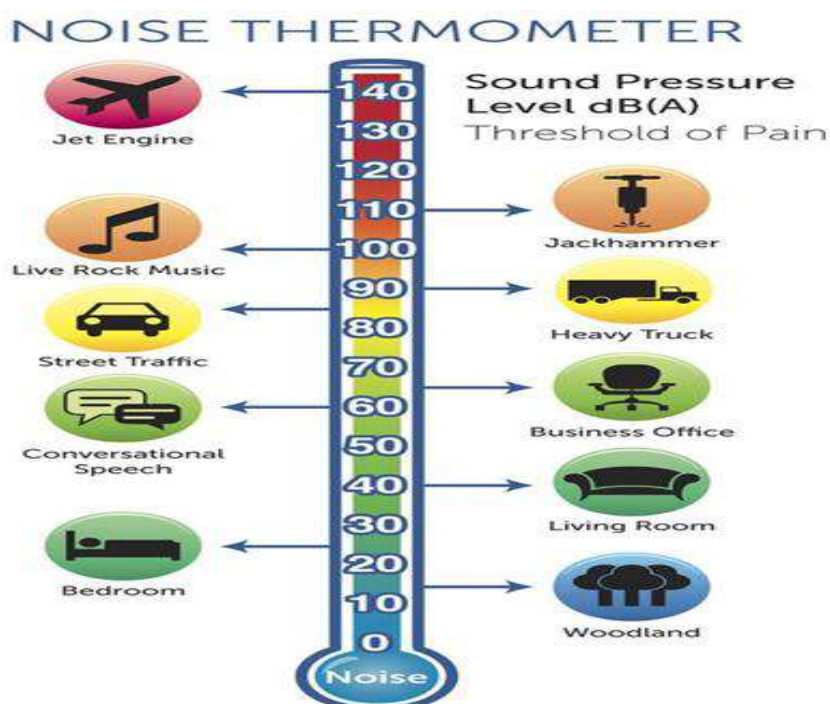
$$\begin{aligned}
 &= \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\
 &= ((1209.281 + (14.4 + 10.56 + 12)) \\
 &= 1246.241 \text{ metric tons}
 \end{aligned}$$

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. Classroom noise levels are supposed to be around 50 db. From the graph above, it is evident that most of the noise level values across campus are above the normal permissible range. Near the chapel however noise levels are within range and lowest at 55.4 db. This is because minimum people are present near the chapel. 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.



Level of noise in various locations and working place

Table 8. Noise level at the St. Xavier College

S. No	Locations	Measurements (dB)	Major Noise Sources	Remarks
1.	Parking area	52	Celling and exhaust fans	No Noise Pollution
2.	Open place	55	Noise from people around	No Noise Pollution
3.	Library hall	28	Students and staff members	No Noise Pollution
4.	Conference hall	42	Speakers	No Noise Pollution
5.	Class Rooms	55	Students	No Noise Pollution
6.	Staff Rooms	53	Staff members	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 St. Xavier College

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



Irrigation facilities in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu

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.

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



Rainwater harvesting units in St. Xavier's College, Palayamkottai – 627 002, Tamilnadu

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.

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. Water consumption for various purposes at the St. Xavier College

S. No	Types of Consumption	Normal Range (lit/capita/day)	Average	Percentage
1.	Domestic Consumption at Hostel and Canteen	772 students, 200L/Student/Day	155KLD	23.2%
2.	Industrial and Commercial Demand at Laboratories	NA		

3.	Public Uses including Fire Demand, Transport washes	7824	2.78KLD	0.5%
4.	Losses and Waste as routine consumption	7824	60.8 KLD	9%
5.	Daily use (Day-to-day use)	7052, 50L/Student/Day	450KLD	67.3%

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. Water requirements calculation

S. No	Educational Institutions water requirements	Domestic use (lphd)	Flushing (lphd)	Total use (lphd)
1.	Without Boarding Facility	25	20	45
2.	With Boarding Facility	190	30	220

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. 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 are 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

$$\begin{aligned}
 &= 1.5 \times \text{average hourly demand} \\
 &= 1.5 \times \text{Maximum daily demand}/24 \\
 &= 1.5 \times (1.8 \times \text{average daily demand})/24 \\
 &= 2.7 \times \text{average daily demand}/24 \\
 &= 2.7 \times \text{annual average hourly demand}
 \end{aligned}$$

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 was 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.

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 20 and 21°C. The Chennai district experienced the annual rainfall ranging between 975 and 1014 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 the St. Xavier College

S. No	Details of Parameters	Data collected
Soil Edaphic parameters		
1.	Soil pH	8
2.	Soil type	Deep red soil , Black 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	25°C
2.	Maximum Temperature	36°C
3.	Minimum Relative humidity	63%
4.	Maximum Relative humidity	74%
5.	Annual Average Rainfall	345.00mm
6.	Annual Average Sunshine	6 hrs /day
7.	Wind speed	12 miles per hour

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. St. Xavier 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 St. Xavier's College, Palayamkottai – 627 002, Tamilnadu

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 V 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. St. Xavier College 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 City. 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.

St. Xavier College is implemented the Government schemes (Swatch 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 Institute 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 Institution 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

Awareness Campaign on “WORLD OZONE DAY” Activities in St. Xavier College, Palayamkottai – 627 002, Tamilnadu



“Go Green Club of XIBA Sapling Plantation” In St. Xavier College, Palayamkottai – 627 002, Tamilnadu



Anti-Plastic Awareness Rally in St. Xavier College, Palayamkottai – 627 002, Tamilnadu



Exhibition On The Hand Made Items By St.Xavier Students



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 St. Xavier College

5. The College is providing bicycle for campus students to maintain eco-friendly atmosphere in the campus and to reduce carbon-di-oxide.
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. 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.
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 Namakal District.
9. 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.
10. 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. To reduce the CO₂ level inside the College campus battery cars are initiated for internal mobility for all stakeholders.
11. Best practices followed by the institute includes, impactful university program, Organic Garden initiative program, Outreach programmes conducted for dissemination of green campus motto, Awareness Campaign on “WORLD OZONE DAY” Activities , “Go Green Club of XIBA Sapling Plantation”, Anti-Plastic Awareness Rally, Exhibition On The Hand Made Items.

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.
- The treated effluent from biogas plant may be diverted to the STP for storage and utilized for irrigation 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.
- A commitment to keeping students in conducting various competitions *viz.*, painting, pencil sketching, rangoli, paste the picture, wealth out of waste, debate on environmental days, essay writing, card making, etc., for the noble cause of environmental protection and nature conservation.
- To ensure Miyawaki Forest system, one student one plant concern to enrich the campus Green which provide an eco-friendly campus to the stakeholders.

25. Conclusion

St. Xavier College, Palayamkottai, Tamilnadu is a well-established Institute 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, Tamilnadu. 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 institute 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.

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27. References

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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. MSME Certificate
5. NGO Darpan NITI Aayog Certificate
6. 12A Certificate
7. 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	
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, 35, 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



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




DIRECTOR

ROHS Certification Pvt. Ltd.

B-7, 1st Floor, Sector-2, DLF, Gurgaon, Haryana, India. CP-202330

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

The Registration is not a Product Quality Certificate. *Subject to successful completion of surveillance audits. Valid for registration as per the certification of certificate in the interests of ISO9001 and services 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
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.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

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,3669 Name of Premises/ Building GANDHIMAA NAGAR Village/Town Gandhimsanagar S.O. Block LIG-II Road/Street/Lane Peelmada 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>S.No.</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>		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
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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 Min 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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Follow us @minmsme & @msmechampions

BE A CHAMPION with the Ministry of MSME

The screenshot shows the top section of the NGO DARPAN website. At the top left, there are three logos: the Government of India emblem, the NGO logo, and the DARPAN logo. To the right, it says "NITI Aayog, Government of India". Below this is a dark navigation bar with links: Home, About Us, NGO Directory (with a dropdown arrow), Search NGOs, Report, Guidelines, Circulars, Help (with a dropdown arrow), Apply Grant, and Blacklisted NGOs. On the far right of this bar is a "Login/Register" link with a user icon. Below the navigation bar is a large banner image showing a group of people in a rural setting. Overlaid on the banner is the text "NGO DARPAN" in large white letters, and below it, a smaller white text box with a blue border that reads: "In order to strengthen services of the portal, Government has decided to make PAN Number of VOs/NGOs mandatory." Below the banner are three horizontal bars: a light blue bar with the text "Please Update Your Profile", a teal bar with the text "Welcome, Nature Science Foundation", and a light blue bar with the text "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. Bannet
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//

(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 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, and Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.
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
(Pragya Singh)

This course is certified by Exemplar Global vide registration number TN006669

Note: The course conforms to the principles and practice of ISO 14001:2015 Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For certification of any 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









BUREAU OF ENERGY EFFICIENCY



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

Certificate Registration No. : **9176**

[Handwritten Signature]

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 (7) 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**

[Handwritten Signature]

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

Secretary
Bureau of Energy Efficiency
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019	<i>[Handwritten Signature]</i>		

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
fulfilment 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

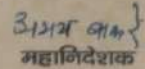
प्रमाणित किया जाता है कि

श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता
के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक एम्पनआईटी / सीईपीसी / 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 / IIT
from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 07 JUL 2017
New Delhi, _____


महानिदेशक
Director General

