



ST. ANN'S COLLEGE FOR WOMEN

**(Affiliated to AcharyaNagarjuna University,
Recognized Under Section 2(f) of UGC Act 1956-New Delhi)
Amaravathi Road, Gorantla, Guntur – 522034 (A.P)
Email: st_anns_coll@yahoo.co.in Website:www.stannscollegeforwomen.org**

Criterion: VII

Metric –7.1.2



Criterion – VII

7. 1. 3: Quality audits on environment and energy regularly under taken by the Institution.

Green Audit / Environmental Audit Reports



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Criterion: VII

Metric –7.1.3

Green audit / Environmental audit Report from recognized bodies

TECHNICAL REPORT OF GREEN CAMPUS AUDIT



Submitted to

**ST. ANN'S COLLEGE FOR WOMEN
GUNTUR – 629 302, ANDHRA PRADESH**

Date of Audit : 07.08.2023

Valid till : 08.08.2025

Submitted by



NATURE SCIENCE FOUNDATION

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

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

Green Campus Audit ensures the Organization’s campus should be greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilisation and maintenance of natural topography and vegetation (Gowri and Harikrishnan, 2014, Aruninta *et al.*, 2017). 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; Rajalakshmi *et al.*, 2022).

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 issues (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. 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. 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 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 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.
- 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 (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. 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 National Building Code 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
- 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.
- 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 of 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.
- Operation of water irrigation methods such as drip and sprinkler irrigation to improve the effective usage of water.
- 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, ornamental, economic and food values of plant varieties.
- MoU may be signed with Government and non-Governmental Organizations 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.
- 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.
- 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.
- 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 eco-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 the campus atmosphere.

8. About the Organization

8.1. ST. ANN'S COLLEGE FOR WOMEN

St. Ann's college for women was established in 1997 to uplift the rural women, impart intellect and spiritual integrity into the young lives and serve them for overall development. It is affiliated to Acharya Nagarjuna University and ever since its inception it has been emerging as a universal cosmopolitan and prestigious college in Guntur. Initially the college had only B.Sc (M.B.C), B. Sc (M.P.Cs) and B.Com (General) courses. In 1998, B. C. A course & B.Sc (M.S.Cs) were introduced. Keeping in pace with the emerging needs of the society, additional course of B. Com (Res) was added in 1999. Seeing the aptitude for research in Biology, the courses were again streamlined in 2003 with the introduction of Biotechnology (B.B.C). To bridge the gap of previous value-based education and the present-day job-oriented education, a Post Graduate course of M.C.A was installed into College Academics in 2003. During the Academic year 2007 – 2008, to be in par with the professionalism, M.B.A course was introduced and the college grew to the heights of excellence in educational ladder and thus reached the status of Post Graduate College.

Vision

To provide the value-based education to the women, enrich them with innovative and unique skills and transforming them into socially useful citizens.

Mission

By inducing the novel techniques to achieve excellence in education, enhance ethical values for the holistic development of the students, the college aims to brighten the lives of the rural women by providing ideal and diversified learning environment.

Table 1. The St. Ann's College for Women Campus facility details

S.No.	Details of Area	Total area
1.	Total Campus area	14486 sq mts
2.	Total Built up area	2299 sq.mts
3.	Forest vegetation	25 %
4.	Planted vegetation	45%

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 (Table 2).

Table 2. 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"> ● GBCRS - Green Building Code and Green Ratings Systems ● GRIHA – Green Rating for Integrated Habitat Assessment 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan
Energy Audit	<ul style="list-style-type: none"> ● BEE - Bureau of Energy Efficiency ● LEED - Leadership in 	<ul style="list-style-type: none"> ➤ Er. D. Dinesh kumar ➤ Er. N. Shanmugapriyan ➤ Dr. N. Balasubramaniam

	<p>Energy and Environmental Design</p> <ul style="list-style-type: none"> ● CII-GreenCo – GreenCo Rating System Felicitator 	<ul style="list-style-type: none"> ➤ Dr. P. Thirumoorthi ➤ Dr. G. Murugananth
Environment Audit	<ul style="list-style-type: none"> ● ASSOCHAM - Associated Chambers of Commerce and Industry of India ● FSRS – Fire Safety & Rescue Services 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Dr. R. Mary Josephine ➤ Dr. B. Mythili Gnanamangai ➤ Er. N. Shanmugapriyan
Hygiene Audit	<ul style="list-style-type: none"> ● FSMS – Food Safety Management System ● Occupational Safety & Health (ISO 22000:2018) ● SBICM - Swatch Bharath under India Clean Mission 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R, Sudhakaran ➤ Dr. N. Saranya
Waste Management Audits	<ul style="list-style-type: none"> ● Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit as per the Checklist of NSF 	<ul style="list-style-type: none"> ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R, Sudhakaran ➤ Er. N. Shanmugapriyan
ISO Certification	<ul style="list-style-type: none"> ➤ QMS (9001:2015), ➤ EMS (14001:2015), ➤ OHS (45001: 2018), ➤ ISMS (27001:2018), ➤ FSMS (22000:2018), ➤ QMSMD (13485: 2016), ➤ EnMS (50001: 2018) 	<ul style="list-style-type: none"> ➤ Dr. S. Rajalakshmi ➤ Dr. A. Geetha Karthi ➤ Mrs. Gaanaappriya Mohan ➤ Dr. R. Mary Josephine

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.

9. Audit Details

Date / Day of Audit	: 07.08.2023
Venue of Audit	: St. Ann's College for Women , Guntur – 629 302, Andhra Pradesh
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Environment Audit
Name of the Auditing Chairman	: Dr. S. Rajalakshmi, ISO QMS, EMS, OHSMS and EnMS Auditor Founder & Chairman of NSF
Name of the Auditing Team Leader	: Dr. D. Vinoth Kumar, ISO QMS, EMS and EnMS Auditor Joint Director of NSF.
Name of the Lead Auditor	: Er. D. Dinesh Kumar, Certified BEE, IGBC, ASSOCHEM, GRIHA & LEED Auditor
Name of the Energy Auditor	: Dr. N. Balasubramanian, Bureau of Energy Efficiency
Name of Subject Expert	: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of the Eco Auditor	: Er. S. Srinivash, Tamil Nadu Fire and Rescue Services, Coimbatore.
Name of Eco & Green Officer	: Ms. R. S. Thulaja, ISO QMS and EMS Auditor Programme Officer of 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. Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of Green campus Lead Auditors and Botanists / Zoologists / Biotechnologists were selected to conduct the Green campus audit process.

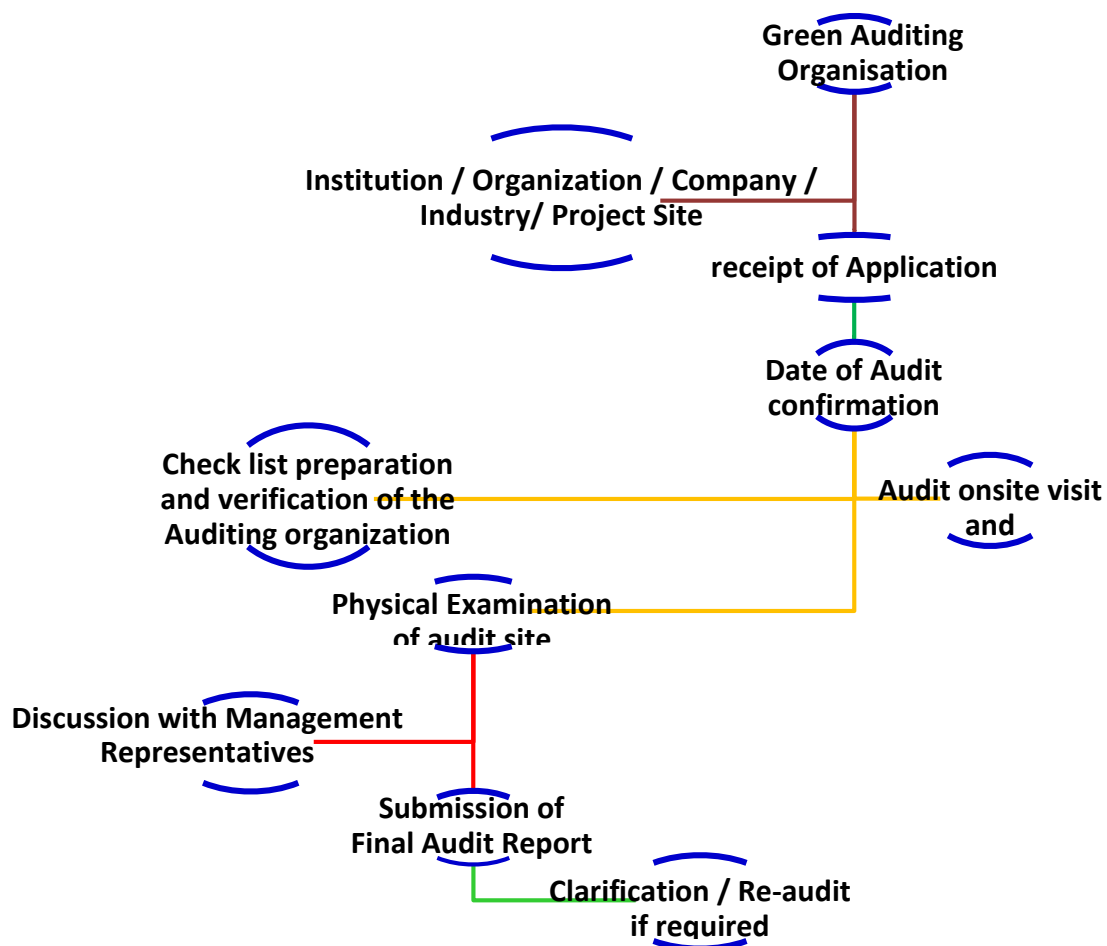
During the audit, the nature of plants and animals / birds species thriving within the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal garden / aquarium and aquatic (hydrophytes) plants in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

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering for plantations in the campus were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto were recorded (Venkataraman, 2009). Conduct of outreach programmes for dissemination of Green campus motto to the students and staff members including public domain and signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities for future generation were noted. 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

scrutiny 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. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of Green campus 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 National Building Code and Associated Chambers of Commerce and Industry of India, New Delhi.

Plate 1. Opening meeting with the Principal, IQAC Coordinator and Management Responsibilities of the St. Ann's College for Women and Audit Team of the Nature Science Foundation



10.2. 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 campus and required photographs were taken then and there for preparing the audit report.
3. During the onsite visit, it is vivid how the various facilities made by the Management of the Institution 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.

Plate 2.



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 areas listed in the Green audit process in which a few are taken into consideration as per the Indian scenario. 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 besides rain harvesting system.

10.4. Flora and Fauna diversity of study area



The St. Ann's College for Women is located in Guntur district, Andhra Pradesh, India. It is located about 16 min (5.5 km) via Amaravathi Rd/Guntur Amaravathi Rd. At present, the campus is quite clean, green and with much less pollution when compared to the rest of the city. Dicot and monocot plants can be found on the campus considerably. In contrast, the campus is harboured to a wide variety of birds and animals.

10.4.1. Geology, Topography and Soil condition

The area is underlain by various geological formations of different age groups ranging from Archaean to Recent. The Archaean basement complex comprising the granite-gneisses, Schists, Khondalites, Charnockites and basic dykes of dolerites form the predominant rock types in the central part. The fringe of the Archaeans in the central part is represented by Cuddapah basin, namely Nallamalai group of Upper Cuddapahs. In a sequential order, the younger Kurnools occurring in the Cuddapahs and those in the western parts of the district are thrust over by the Cuddapahs and these in turn by the Archaean granite-gneisses. The Upper Gondwana group of sandstones and shales out crop are seen at places between Guntur and Tenali. The youngest rock types of the district appear to be of Mio- Pliocene age followed by the Alluvial deposits of Recent to Sub-Recent age. Geomorphologically the district is classified into three units based on relief, slope factor and soil. (Table.3)

Table 3. Soil edaphic and environmental parameters of the Campus

S. No	Details of Parameters	Data collected
Soil Edaphic parameters		
1.	Soil pH	6.5 – 7.5
2.	Soil type	Black cotton soils, Red loamy soils, and sandy loam
3.	Total Organic carbon	Medium (0.5-0.7)

4.	Electrical conductivity	Normal (0-2)
5.	Water holding capacity	1.35"/ft
6.	Total Nitrogen	Low (140-280 kg/ha)
7.	Available Phosphorous	High (25-45 kg/ha)
8.	Exchangeable Potassium	High (290-570 kg/ha)
9.	Available Mg and Mn contents	Mg- 5 g/kg, Mn (2.0 kg/ha)
10.	Available Zn and Fe contents	Zn- 13.8 kg/ha, Fe- (0.4-5.7 kg/ha)
Environmental parameters		
1.	Minimum Temperature	27 ⁰ C (72 ⁰ F)
2.	Maximum Temperature	34 ⁰ C (95 ⁰ F)
3.	Minimum Relative humidity	62%
4.	Maximum Relative humidity	92%
5.	Annual Average Rainfall	889.1 mm
6.	Annual Average Sunshine	12.2 hr
7.	Wind speed	18.8 kph (11.7 mph)

10.4.2. Climatic conditions

The average annual rainfall of the district is 864 mm, which ranges from nil rainfall in January to 160 mm in August. August is the wettest month of the year. The mean seasonal rainfall distribution is 547mm in southwest monsoon (June-September), 235 mm in northeast monsoon (Oct-Dec), 8 mm rainfall in Winter (Jan-Feb) and 74 mm in summer (March – May). The season-wise percentage distribution of rainfall is 63% in southwest monsoon, 27 % in northeast monsoon, 1 % in winter and 9 % in summer. The annual and seasonal rainfall distribution with its departure from mean along with percentage distribution.

11. Identification of Plant Species

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across the campus and subjected to botanical identification (botanical name, family, habitat, and economic importance) and anthropogenic disturbances to the natural vegetation in the campus. Plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using “The Flora of the Tamil Nadu Carnatic” (Matthew, 1983). Further, their identification was confirmed by matching with authentic specimens in the Botanical Survey of India (BSI), Southern Circle, Coimbatore, Tamil Nadu, and India.

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

Lichen specimens were collected from the 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. 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).

11.2.2. 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 while auditing. 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 4. Qualitative Measurements of Green Auditing

S. NO.	Part 11 clause as per National Building Code	Audit Checklist with weightage	Response	
			Yes	No
1.	6.2.4. Reduced Building footprint in Multi-storeyed Building designs	Maintenance of 30% of open spaces as softscapes (Vegetative area) its gross total area appropriately.		✓
2.	7.1.1. Landscape design	If any landscaping activities to reduce the carbon by planting trees and other vegetation.	✓	
3.	7.1.1.2. External Noise reduction / mitigation practices	Assessing the appropriate measures taken for reducing noise level like quieter pavement (Traditional Method), earth berms (raised barrier made up of compacted soil)		✓
4.	7.1.13. Building shadow considerations on landscapes	What are energy consumption activities performed <i>via</i> vegetation?	✓	
5.	7.1.3.1.Preserving Top Soil	Reviewing on whether the site follows healthy soil maintenance (soil test, use of vermicompost, organic/green manure)	✓	
6.	7.1.3.2.Ecological Design / Conserving biodiversity	Whether the transplantation of matured trees is followed in the case of vegetation clearing is necessary for construction.		✓
7.		Use of vegetation that promotes regional identity (native plants) and a sense of place (geographical condition).	✓	
8.		Action plan for conservation of native endangered species through awareness programmes and demonstrations.	✓	
9.		Are any biofertilizers, organic manures, farmyard manures, vermicompost, green manures are applied to avoid the use of chemical fertilizers for maintaining plants?	✓	
10.		Sufficient number of trees, shrubs, herbs and lawns available in the campus	✓	
11.		Projects and Dissertation works and Scholarly publications related to flora and fauna by students, scholars and staff members – specify & show the records.		✓
12.	7.1.3.4. Vertical Landscaping and roof system	Whether the campus had roof/kitchen/zodiac/ornamental/medicinal	✓	

		garden/ and green walls or vertical landscaping (vertical garden)		
13.	7.3.2. Water Conservation and Irrigation Purposes	Availability of water drip and sprinkler irrigation systems in the campus to reduce the operation costs under energy and water conservation methods	✓	
14.	9.1.2. Minimizing Green House Gas (GHG) Emission	What are the alternative materials, methods that considerably reduce energy and CO ₂ emissions (Indoor plants)		✓
15.		Oxygen and carbon di oxide levels in the campus atmosphere will be measured using oxygen and carbon di oxide meters at the time of onsite audit.	✓	

13.2. Table 5. Quantitative Measurements of Green Auditing

S.No.	Details of Plant and Animal species	Numbers
1.	Total number of Flowering plant species inside the Campus	125 species belonging to 110 Genera under 90 families
2.	Total number of Non-Flowering plant species inside the Campus	05 species belonging to Lichens, Pteridophytes, Bryophytes and Mycoflora
3.	Total number of living Animals inside the Campus	05 such as Cats, Mice and Dog
4.	Total number of visiting Animals inside the Campus	10 Species belonging Rabbit, Squirrel and Monkey
5.	Total number of living Birds inside the Campus	20 species belonging Common Myna, House Sparrow, King- crow, House Crow, Jungle Babbler, , Honey bird
6.	Total number of visiting Birds inside the Campus	20 species belonging Mangrove heron, Common Wood shrike, Peacock.
7.	Total number of Aquarium	-
8.	Total number of Aquatic (hydrophytes) plant species	-
9.	Percentage of Forest Vegetation	32 %
10.	Percentage of Planted Vegetation	55%
11.	Percentage of Water consumption to total human population	NA
12.	Percentage of Water consumption to total flora and fauna	NA

13.3 Flora and Fauna diversity in the Campus

13.3.1. Flora diversity in the Campus

13.3.1.1. Flowering plants diversity in the 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 campus has more than 35-45% of wild, 50-60% native plant species and the other 30-35% 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 45% of the wild traits are leveraged for the native animals and birds. The most probable natural vegetation of campus is the dry deciduous type. The remnants of this past vegetation are found in the campus

The most plants recorded are *mangifera indica* L., Java Plum, *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 *Solanum melongena*, *Plumeria alba*, *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*, *Asparagus racemosus* Wild., and *Commelina benghalensis* L.

Most of the species found are common in the campus, some of the species *Cucumis dipsaceus* Ehrenb, *Hybanthus*, 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 Wild tamarind *Leucaena leucocephala* 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., *Psidium guajava* L., Java plum, *Cucumis sativus*, *Phyllanthus emblica* L. , *Artocarpus heterophyllus* (Jack fruit), *Phyllanthus acidus* (Amla) and Species such as *Bougainvillea glabra*, *Ixora coccinea* are exploited for their attractive flowers.

The biodiversity of St. Ann's College for Women Campus comprises a sum of 200 species belonging to 100 genera under 90 families besides the lichens, mycoflora, pteridophytes and bryophytes (Plate 1, 2 & 3). Among the documented higher plants, Dicots are dominating with 61.5 families followed by monocots (38.5 families)(Fig.1) Over all analysis revealed that trees were dominating flora (46.35%) followed by herbs, shrubs and climbers which accounts 15.50 %, 23.30 % and 14.90%, respectively (Fig.2).Among the documented dicots, Polypetalae formed a major proposition with 30 families, 40 genera and 66 species; Gamopetalae with 22 families, 31 genera and 63 species while Monochlamydeae with 20 families, 24 genera and 47 species. In monocots 18 families are spreading over 20 genera belonging to 40 species. Poaceae is first dominant family and followed, fabaceae, Euphorbiaceae, Rubiaceae, Acanthaceae, Apocynaceae and Amaranthaceae with 19, 16, 10, 8, 7, 6, and 5 species respectively (Fig.3). At the time of green campus audit at St. Ann's College for Women Campus, a total of 1 invasive floral species were recorded. This clearly specified the disturbances to the natural setting in the vegetated sector.

Fig.1. Systematic groups of the plants in the campus

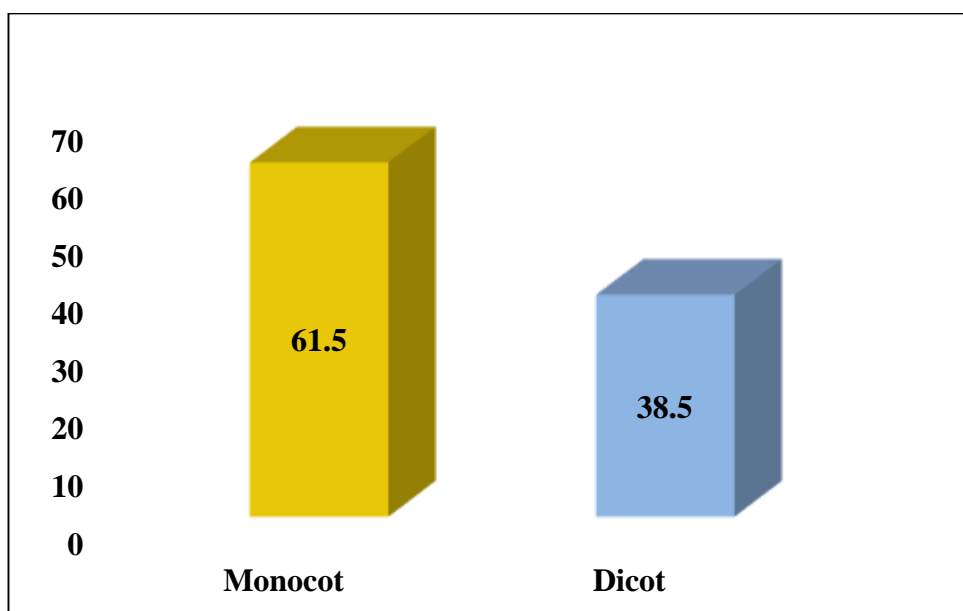


Fig.2. Analysis of habit-wise distribution of plant species in the campus

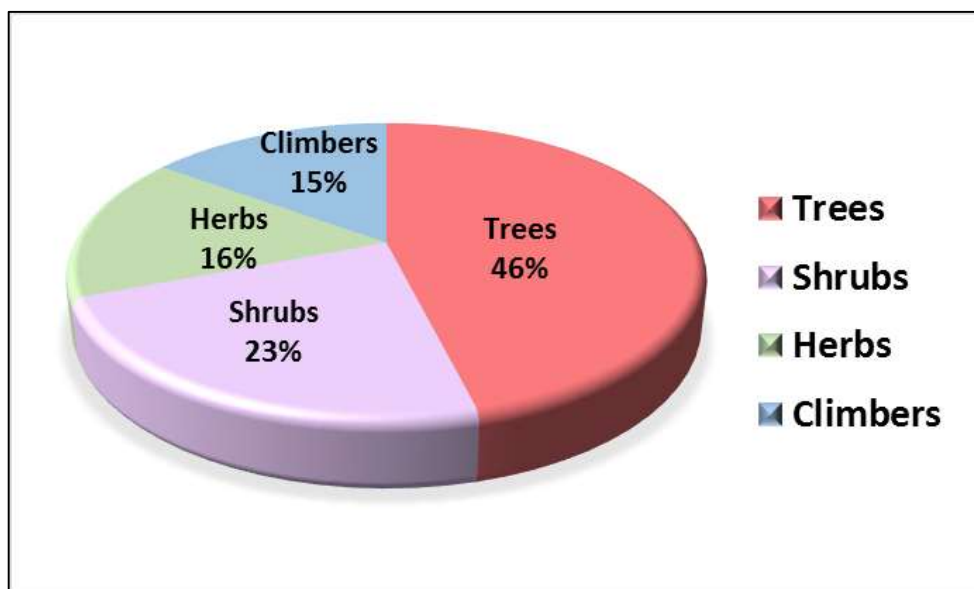


Fig.3. Plant families with higher number of species in the campus area

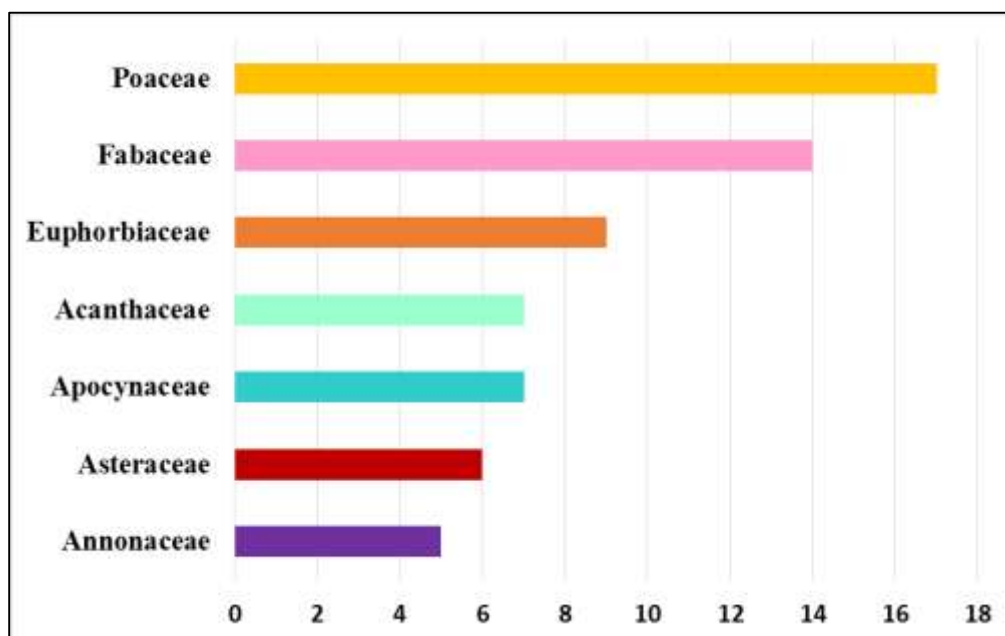


Table 6. List of Flowering plants in the Campus

S.No	Common Name	Scientific Name	Family	Habitat
1.	Monkey Bush	<i>Abutilon Indicum</i>	Malvaceae	Herbs
2.	Black Wattle	<i>Acacia Mangium</i>	Leguminosae	Tree
3.	Copper Leaf	<i>Acalypha Wilkesian</i>	Euphorbiaceae	Shrub
4.	Knot Grass	<i>Aerva Lanata</i>	Amaranthaceae	Herb
5.	Goat Weed	<i>Ageratum Conyzoides</i>	Asteraceae	Herb

6.	Blue Weed	<i>Ageratum Houstonianum</i>	Asteraceae	Shrub
7.	White Siris	<i>Ailanthus Integrifolia</i>	Simaroubaceae	Tree
8.	Cake Tree	<i>Albizia Amara</i>	Fabaceae	Tree
9.	Aloe Vera Sis	<i>Aloe Barbaden</i>	Liliaceae	Shrub
10.	Sessile Joyweed	<i>Alternanthera Sessilis</i>	Amaranthaceae	Herb
11.	Spiny Amaranth	<i>Amaranthus Spinousus</i>	Amaranthaceae	Herb
12.	Slender Amaranth	<i>Amaranthus Viridis</i>	Amaranthaceae	Herb
13.	Annual Ragweed	<i>Ambrosia Artemisiifolia</i>	Compositae	Herb
14.	False Indigo Bush	<i>Amorpha Fruiticosa</i>	Fabaceae	Shrub
15.	Cashew Nut	<i>Anacardium Occidentale</i>	Anacardiaceae	Tree
16.	King Of Bitters	<i>Andrographis Paniculata</i>	Acanthaceae	Herb
17.	Beard Grass	<i>Andropogon Pumilus</i>	Acanthaceae	Herb
18.	Soursop	<i>Annona Muricata</i>	Annonaceae	Tree
19.	Sugar Apple	<i>Anona Squamosa</i>	Annonaceae	Tree
20.	Flamingo Flower	<i>Anthurium Andraeanum</i>	Araceae	Herb
21.	Monkey Puzzle Tree	<i>Araucaria Araucana</i>	Araucariaceae	Tree
22.	Oosi Pullu	<i>Aristida Adscensionis</i>	Poaceae	Herb
23.	Common Needle Grass	<i>Aristida Pinnata</i>	Poaceae	Herb
24.	Jack Fruit Tree	<i>Artocarpus Heterophyllus Lam.</i>	Moraceae	Tree
25.	Asparagus	<i>Asparagus Officinalis</i>	Asparagaceae	Herb
26.	Ganges Primrose	<i>Asystasia Gangetica</i>	Acanthaceae	Herb
27.	Jack Fruit	<i>Atrocarpus Heterophyllus</i>	Moraceae	Tree
28.	Neem Tree	<i>Azadiracta Indica</i>	Meliaceae	Tree
29.	Bamboo	<i>Bambusa Vulgaris</i>	Poaceae	Tree
30.	Butterfly Tree	<i>Bauhinia Purpurea</i>	Fabaceae	Tree
31.	Toddy Palm	<i>Borassus Flabellifer</i>	Arecaceae	Tree
32.	Paper Flower	<i>Bougainvillea Glabra Choisy</i>	Nyctaginaceae	Climber
33.	Devil's Backbone	<i>Bryophyllum Daigremontianum</i>	Cassulaceae	Herb
34.	Flame Of The Forest	<i>Butea Monosperma</i>	Fabaceae	Tree
35.	Peacock Flower	<i>Caesalpinia Pulcherima</i>	Caesalpinaceae	Shrub
36.	Surinamese Stick	<i>Calliandra Surinamensis</i>	Leguminosae	Tree
37.	Red Powder Puff	<i>Calliandra Haematocephala</i>	Fabaceae	Tree
38.	Bottlebrushes	<i>Callistemon Lanceolatus</i>	Myrtaceae	Tree
39.	Bottlebrushes	<i>Callistemone</i>	Myrtaceae	Tree
40.	Dogbane	<i>Calotrophis Gigantea</i>	Apocynaceae	Shrub
41.	Indian Shot	<i>Canna Indica</i>	Cannaceae	Herb
42.	Papaya	<i>Carica Papaya</i>	Caricaceae	Tree
43.	Wine Palm	<i>Caryota Urens</i>	Areaceae	Tree
44.	Golden Shower	<i>Cassia Fistula L.</i>	Fabaceae	Tree
45.	Bright Eyes	<i>Catharanthus Roseus L.</i>	Apocynaceae	Herb
46.	Veld Grape	<i>Cissus Quadrangularis</i>	Vitaceae	Creeper
47.	Lemon	<i>Citrus Limon (L.) Osbeck</i>	Rutaceae	Shrub

48.	Asian Spider Flower	<i>Cleome Viscosa</i>	Capparaceae	Herb
49.	Aparajita Climbing Vine	<i>Clitoria Ternatea</i>	Fabaceae	Climber
50.	Cocunut	<i>Cocos Nucifera L.</i>	Areaceae	Tree
51.	Variegated Croton	<i>Codiaeum Variegatum</i>	Euphorbiaceae	Shrub
52.	Indian Cherry	<i>Cordia Dichotoma</i>	Boraginaceae	Tree
53.	Broadleaf Palm-Lily	<i>Cordyline Fruticosa</i>	Asparagaceae	Shrub
54.	Corriander	<i>Coriandrum Sativum L.</i>	Apiaceae	Herb
55.	Purging Croton	<i>Croton Tiglium</i>	Euphorbiaceae	Shrub
56.	Rubber Vine	<i>Cryptostegia Grandiflora</i>	Apocynaceae	Shrub
57.	Mexican Heather	<i>Cuphea Hyssopifolia</i>	Lythraceae	Shrub
58.	Mexican Heather	<i>Cuphea Hyssopifolia</i>	Lythraceae	Shrub
59.	Cycas	<i>Cycas Beddomei</i>	Cycadaceae	Tree
60.	Queen Sago	<i>Cycas Circinalis L.</i>	Cycadaceae	Tree
61.	Cycas	<i>Cycas Indica</i>	Cycadaceae	Tree
62.	King Sago	<i>Cycas Revoluta</i>	Cycadaceae	Tree
63.	Palm Rose	<i>Cymbopogon Martimii</i>	Poaceae	Herb
64.	Scutch Grass	<i>Cynodon Dactylon L.</i>	Poaceae	Herb
65.	Gulmohar	<i>Delonix Regia</i>	Leguminosae	Tree
66.	Golden Dewdrops	<i>Duranta Erecta L.</i>	Verbenaceae	Shrubs
67.	Areca Palm	<i>Dypsis Lutescenes</i>	Arecaceae	Tree
68.	Yard-Grass	<i>Eleusine Indica</i>	Poaceae	Herb
69.	Money Plant	<i>Epipremnum Aureum</i>	Araceae	Climber
70.	Dragon-Tail	<i>Epipremnum Pinnatum</i>	Araceae	Tree
71.	Asthma Weed	<i>Euphorbia Hirta L.</i>	Euphorbiaceae	Herb
72.	Weeping Fig	<i>Ficus Benjamina</i>	Moraceae	Tree
73.	Curtain Fig	<i>Ficus Microcarpa</i>	Moraceae	Tree
74.	Creeping Fig	<i>Ficus Pumila L.</i>	Moraceae	Climber
75.	Bodhi Tree	<i>Ficus Religiosa</i>	Moraceae	Tree
76.	Silky Oak	<i>Grevillea Robusta</i>	Proteaceae	Tree
77.	Firebush	<i>Hamelia Patens</i>	Rubiaceae	Shrub
78.	Jerusalem Artichoke	<i>Helianthus Tuberosus</i>	Astraceae	Herb
79.	Redivy	<i>Hemigraphis Alternata</i>	Acanthaceae	Herb
80.	Hogweed	<i>Heracleum Sphondylium</i>	Apiaceae	Herbs
81.	Black Spear Grass	<i>Heteropogon Contortus</i>	Poaceae	Herbs
82.	Hibiscus	<i>Hibiscus Rosa-Sinensis</i>	Malvaceae	Shrub
83.	Saramollagrass	<i>Ischaemum Dispar</i>	Poaceae	Herb
84.	Indian Murainagrass.	<i>Ischaemum Indium</i>	Poaceae	Herb
85.	Scarlet Jungle Flame	<i>Ixora Coccinea</i>	Rubiaceae	Tree
86.	Common Jasmine	<i>Jasminum Officinale</i>	Oleaceae	Climbers
87.	Common Lantana	<i>Lantana Camara</i>	Verbenaceae	Shrub
88.	Mango Tree	<i>Mangifera Indica L.</i>	Anacardiaceae	Tree

89.	Bullet Wood	<i>Manilkara Elengi</i>	Sapotaceae	Tree
90.	Sapota	<i>Manilkara Zapota</i>	Sapotaceae	Tree
91.	Arrowroot	Maranta Arundinacea	Marantaceae	Herb
92.	Chinaberry Tree	<i>Melia Azedarach</i>	Meliaceae	Tree
93.	Spearmint	<i>Mentha Spicata</i>	Lamiaceae	Herb
94.	Champak	<i>Michelia Champaca</i>	Magnoliaceae	Tree
95.	Spanish Cherry	<i>Mimusops Elunji</i>	Sapotaceae	Tree
96.	Four -O'clock	<i>Mirabilis Jalapa</i>	Nyctaginaceae	Tree
97.	Indian Mulberry	<i>Morinda Citrifolia</i>	Rubiaceae	Tree
98.	Jamaican Cherry	<i>Muntingia Calabura</i>	Muntingiaceae	Shrub
99.	Curry Leaf Tree	<i>Murraya Koenigii</i>	Rutaceae	Tree
100.	Banana	<i>Musa Cultivars L.</i>	Musaceae	Tree
101.	Arali	<i>Nerium Oleander L.</i>	Apocyanaceae	Shrub
102.	Common Basil	<i>Ocimum Basilicum</i>	Lamiaceae	Herb
103.	Pineapple Palm	Phoenix Canariensis	Arecaceae	Tree
104.	Canary Island Date Palm	<i>Phoenix Canariensis</i>	Arecaceae	Tree
105.	Miniature Date Palm	<i>Phoenix Roebelenii</i>	Arecaceae	Tree
106.	Gooseberry	<i>Phyllanthus Acidus L.</i>	Phyllanthaceae	Tree
107.	Indian Gooseberry	<i>Phyllanthus Emblica L.</i>	Phyllanthaceae	Tree
108.	Stone Breaker	<i>Phyllanthus Niruri Schumaach & Thonn</i>	Phyllanthaceae	Tree
109.	Pagoda-Tree	<i>Plumeria Alba</i>	Apocynaceae	Tree
110.	Asoka Tree	<i>Polyalthia Longifolia</i>	Annonaceae	Tree
111.	Pungai	<i>Pongamia Pinnata</i>	Fabaceae	Tree
112.	Moss Rose	<i>Portulaca Grandiflora</i>	Portulacaceae	Herb
113.	Almond	<i>Prunus Amygdalus</i>	Rosaceae	Tree
114.	Common Guava	<i>Psidium Guajava</i>	Myrtaceae	Tree
115.	Four Leaf Devil Plant	Rauwolfia Tetraphylla	Apocynaceae	Shrub
116.	The Rain Tree	<i>Samanea Saman</i>	Mimosaceae	Tree
117.	Sandal Wood	<i>Santalum Album</i>	Santalaceae	Tree
118.	Ashoka Tree	<i>Saraca Asoca</i>	Leguminosae	Tree
119.	Turkey Berry	<i>Solanum Torvum</i>	Solanaceae	Shrub
120.	Black Plum	<i>Syzygium Cumini</i>	Myrtaceae	Tree
121.	Caribbean Trumpet Tree	<i>Tabebuia Aurea</i>	Bignoniaceae	Tree
122.	Tamarind	<i>Tamarindus Indica L.</i>	Fabaceae	Tree
123.	Yellow Balls	<i>Tecoma Stans L.</i>	Bignonaceae	Shrub
124.	Teak	<i>Tectona Grandis</i>	Lamiaceae	Tree
125.	Almond Tree	<i>Terminalia Catappa L.</i>	Combretaceae	Tree

Plate.1. Plants found in the Campus



Dypsis lutescens



Anthurium andraeanum



Tectona grandis



***Azadiracta indica* L.**



Cesalpinia pulcherrima



***Calophyllum inophyllum* L.**



Dypsis lutescens



***Vinca rosea* L.**



***Ixora Coccinea* L.**



Mimosops elengi



***Syzygium jambos* (L.) Alston**

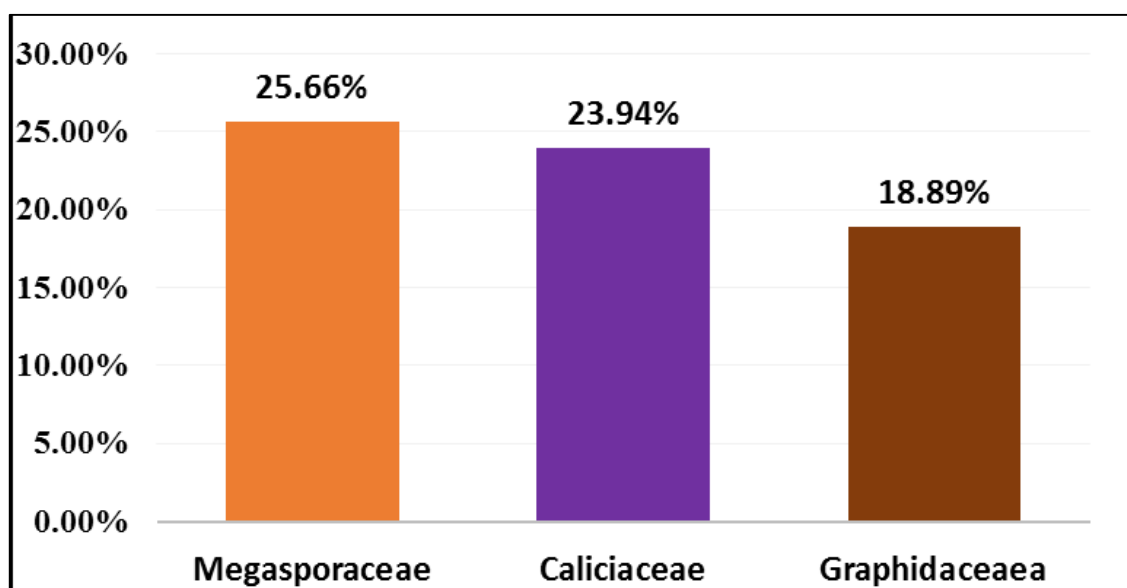


***Terminalia catappa* L.**

13.3.1.2. Lichen diversity in the 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.

Fig.4. Lichen Diversity of the Campus



Lichen diversity recorded in the St. Ann's College for Women campus showed a total of 5 different lichens species representing 2 genera and 2 families (fig.7). Three species accounted for 5% of total available lichens in the campus. 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 2 types of foliose lichens belonging to the genus, *Dimeralla*,

Graphis were accounted. About 2% lichens were found to be one single species in each genus of crustose and fruticose lichens (fig.5).

Fig.5. Lichen growth diversity in the campus

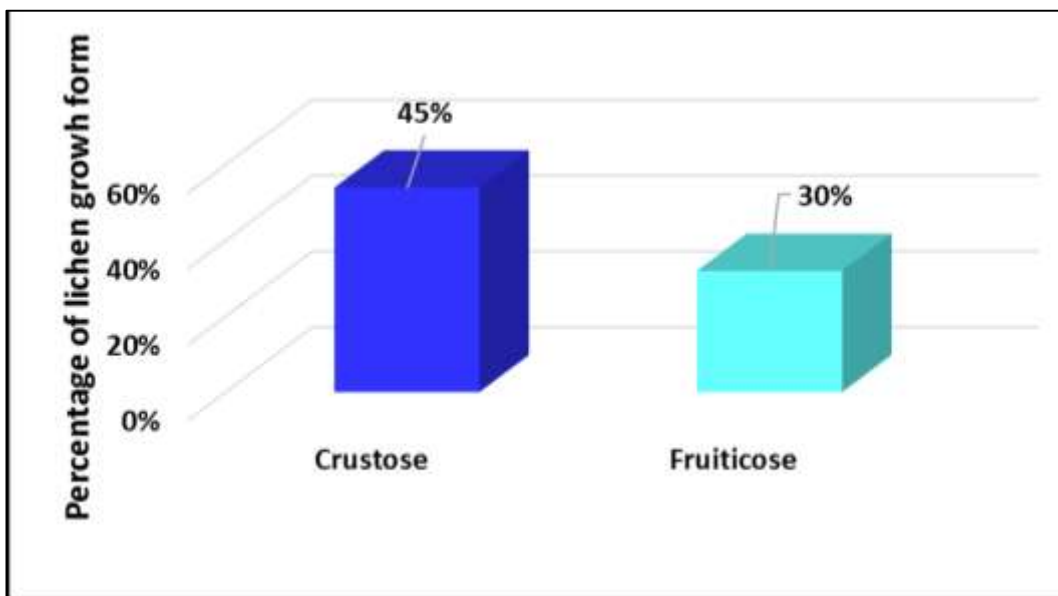


Table 7. Lichen diversity of the St. Ann's College for Women campus with respect to family, substratum and growth forms in genus and family wise classification

S.No	Lichen diversity of the 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>Usnea coralline</i> Mot	Parmeliaceae	Furticose

13.3.3. Algal diversity in the campus

Oscillatoria, *Spirogyra*, *Scytonema* and *Cladophora spp.* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae are the predominant species found in the campus. The family Chlorellaceae was 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 campus ecosystem has high amount of organic nutrients in soil and rock along with conducive favourable environmental conditions.

13.3.1.3. Mushrooms diversity in the 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 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*).

13.3.2. Fauna Diversity in the campus

13.3.2.1. Birds Diversity in the campus

The observations on fauna diversity indicated that the campus has a large number of living as well as visiting birds. 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, Black-rumped flameback and Peacock (Tables 8 & 9).

Table 8. Birds Diversity in the campus

S.no	Scientific name	Common name
1.	<i>Accipiter</i>	shikra
2.	<i>Acridotheres tristis</i>	common myna
3.	<i>Anthusrufulus</i>	black kite
4.	<i>Athenebrama</i>	spotted owlet
5.	<i>Bubulcus ibis</i>	Cattle egret
6.	<i>Coraciasbenghanlensis</i>	Indian roller
7.	<i>Corvus splendens</i>	House crow
8.	<i>Dicruridaemacrocerus</i>	black drongo
9.	<i>Egrettaagarzetta</i>	Little egret
10.	<i>Eudynamysscolopaceus</i>	Asian koel
11.	<i>Haliasturindus</i>	brahminy kite-
12.	<i>Leptocoma zeylonica</i>	Purple-rumped sunbird
13.	<i>Megalaima zeylanic</i>	Brown-headed barbet
14.	<i>Merops orientalis</i>	Green bee-eater
15.	<i>Motacilla</i>	Indian robin
16.	<i>Passeridae</i>	Sparrow

17.	<i>Pavo cristatus</i>	Peacock
18.	<i>Columbidae</i>	Dove

Table 9. Total number of visiting birds in the campus

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



13.3.2.2. Butterflies diversity in the campus

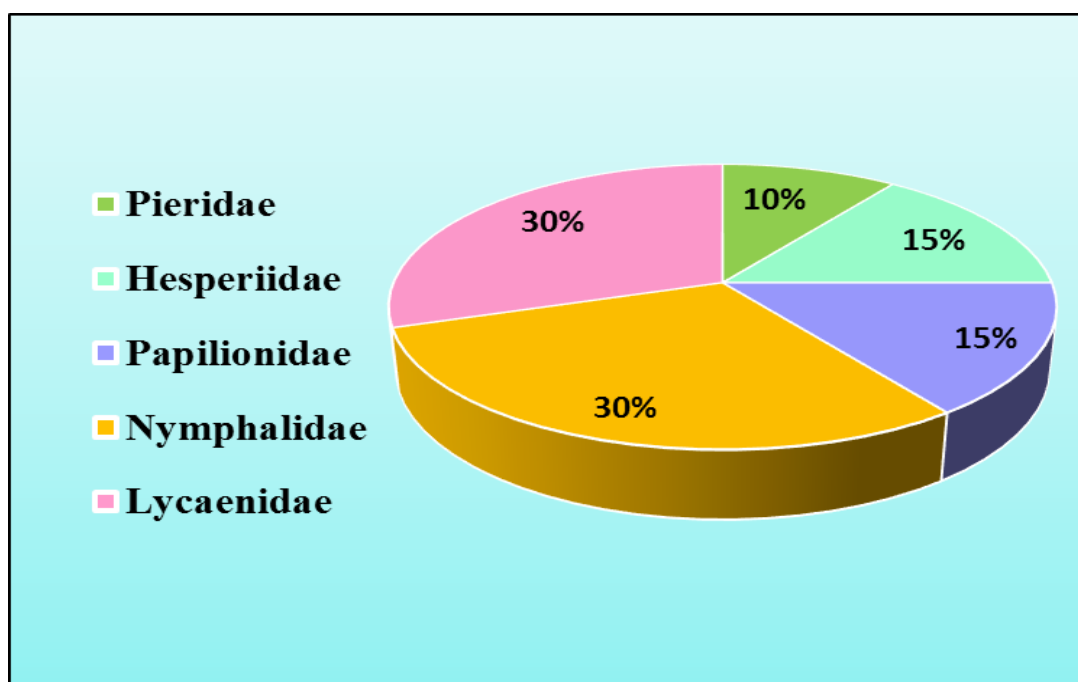
The campus has five family level diversities such as Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperidae in which Common butterflies species such as Mormon, Rose, Birdwing, Emigrant, Grass yellow, Gull Wanderer, Small Orange Tip, Plain Orange Tip, White Orange Tip, Yellow Orange Tip, Pioneer Chocolate, Pansy, Baron, Palmfly, Bush, Brown, Eggfly, Leopard, Sailer, Evening and Grey are commonly found (Table 10; Plate 4).

Table 10. List of Butterflies recorded in the 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.	Tamil yeoman	<i>Cirrochroa thais</i>	Nymphalidae

6.	Rustic	<i>Cupha erymanthis</i>	Nymphalidae
7.	Plain tiger	<i>Danaus chrysippus</i>	Lycaenidae
8.	Tiger	<i>Danaus genutia</i>	Nymphalidae
9.	Common crow butterfly	<i>Euploea core</i>	Papilionidae
10.	African Marbled Skipper	<i>Gomalia elma</i>	Hesperiidae
11.	Tailed jay	<i>Graphium agamemnon</i>	Papilionidae
12.	Common banded	<i>Hasora chromus</i>	Hesperiidae
13.	Yellow Orange Tip	<i>Ixias pyrene</i>	Pieridae
14.	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae
15.	Red Pierrot	<i>Talicauda nyseus</i>	Lycaenidae
16.	Common Grass Dart	<i>Taractrocera maevius</i>	Hesperiidae
17.	Blue tiger	<i>Tirumala limniace</i>	Nymphalidae
18.	Dark blue tiger	<i>Tirumala septentrionis</i>	Nymphalidae
19.	White hedgege	<i>Udara akasa</i>	Lycaenidae
20.	Painted lady	<i>Vanessa cardui</i>	Nymphalidae

Plate 4. Butterfly Diversity in the campus



13.3.2.3. Mammals diversity in the 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. Ann's College for Women 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.11)

Table11. List of Mammals diversity in the campus

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

13.3.2.4. Amphibians diversity in the 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 Campus indicated that around 6 species are Amphibians are commonly distributed.

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

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

13.3.2.5. Grasshopper diversity in the 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 the campus on diversity of Grasshoppers demonstrated that 4 species are Amphibians are commonly distributed which includes *Eyprepocnemis alacris*, *Cyrtacanthacris tartarica*, *Crucinotacris decisa* and *Aulacobothrus luteipes*.

13.3.2.6. Termites Diversity in the 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. Ann's College for Women and they are belonging to the Genera *Odontotermes*, *Trivitermes* and *Nasutitermes*.

13.4. An account of more Oxygen releasing and Carbon dioxide assimilating plants in the 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. Ann's College for Women 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*, *Epipremnum aureum* and Medicinal garden is also available in the campus (Table. 11).



Oxygen releasing and Carbon dioxide assimilating plants in the St. Ann's College for Women Campus

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

S.No	Plant Name (Tamil)	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

13.4.1. 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. 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.

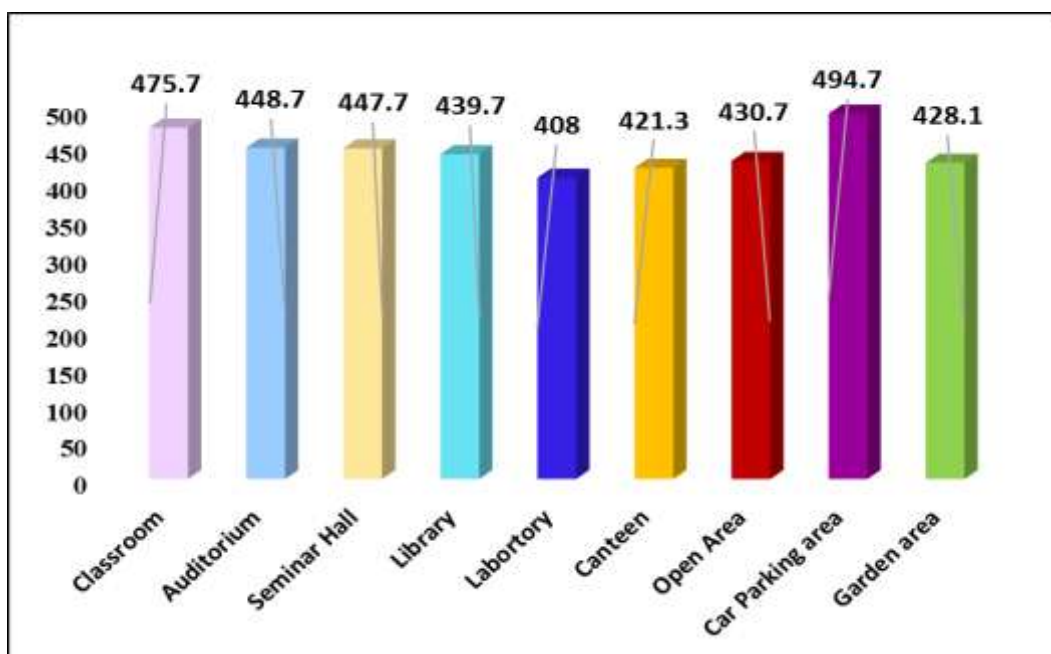
The observation showed that the concentration of CO₂ in the atmosphere is found to be optimal which did not exceed the critical limit of CO₂. It is further revealed that all the selected locations are having pure air without any air contaminants with good air exchange/circulation in the campus. Some of the places like Canteen, Class Rooms, 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 12).

Table. 12. Measurement of CO₂ concentration in the College Campus

S.No.	Different locations of the Organization's Campus	Carbon dioxide level (ppm)*	Remarks
1.	Classroom	475.7 ± 10.0	Within permissible limits
2.	Auditorium	448.7 ± 15.9	Within permissible limits
3.	Seminar Hall	447.7 ± 8.5	Within permissible limits
4.	Library	439.7 ± 8.0	Within permissible limits
5.	Labortory	408.0 ± 2.6	Within permissible limits
6.	Canteen	421.3 ± 2.5	Within permissible limits
7.	Open Area	430.7 ± 4.5	Within permissible limits
8.	Car Parking area	494.7 ± 1.5	Within permissible limits
9.	Garden area	428.1 ± 3.0	
	Mean		402.85%
	SEC ±		2.07
	CD at P=0.05%		3.69

***Average of 3 Observations**

Plate 5. Measurement of CO₂ concentration in the College Campus



Reference of Set values of CO₂ level

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

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

13.4.2. 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. 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. The atmosphere contains 18-21% oxygen concentration, 75-78.5% nitrogen and 2-3% other gases like carbon dioxide, neon, and hydrogen. The amount of oxygen level in the atmosphere is determined by abiotic factors like altitude, latitude and longitude and biotic factors like plantations in the surroundings. If oxygen level is low in the atmosphere lead to headaches and shortness of breath to human beings. If it excess, it causes oxygen toxicity and oxygen poisoning by creating coughing, breathing trouble and damage the lungs to human beings. The Oxygen level of different places at the campus are monitored and presented (Table 13 & Plate 6)).

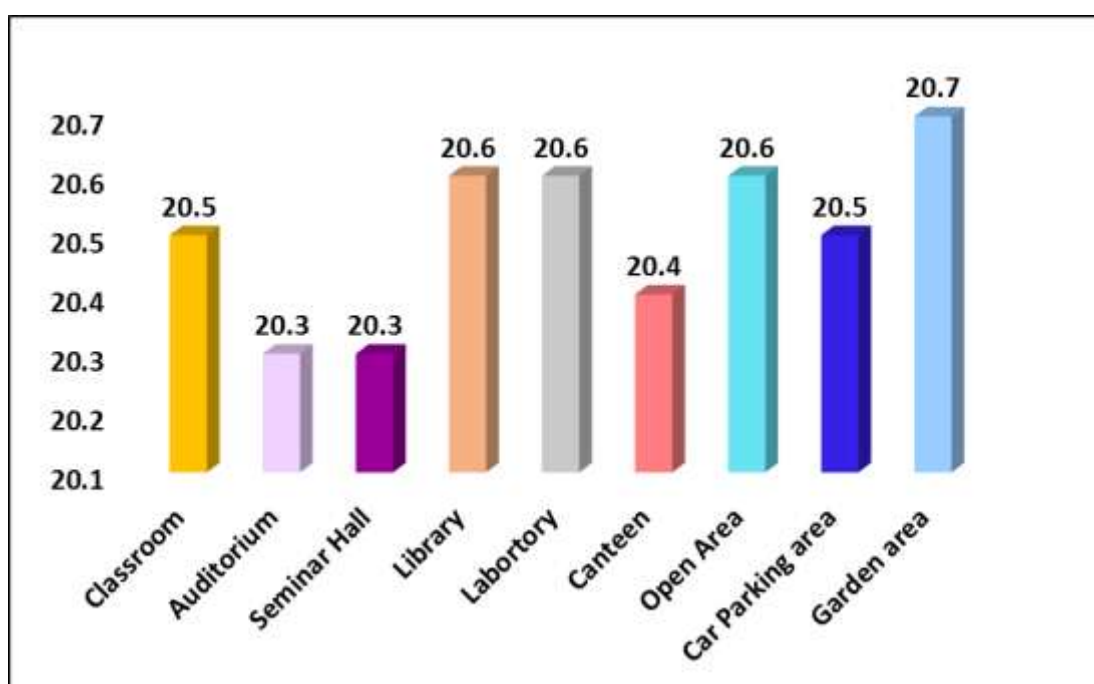
Table 13. The Oxygen concentration in the St. Ann's College for Women

S. No	Location	Oxygen Level (%)*	Remarks
1.	Classroom	20.5 ± 0.2	O ₂ level is good
2.	Auditorium	20.3 ± 0.2	O ₂ level is good
3.	Seminar Hall	20.3 ± 0.3	O ₂ level is good
4.	Library	20.6 ± 0.2	O ₂ level is good

5.	Laboratory	20.6 ± 0.4	O ₂ level is good
6.	Canteen	20.4 ± 0.3	O ₂ level is good
7.	Open Area	20.6 ± 0.1	O ₂ level is good
8.	Car Parking area	20.5 ± 0.1	O ₂ level is good
9.	Garden area	20.7 ± 0.1	O ₂ level is good
	Mean	20.5 %	
	SEC ±	0.21	
	CD at P=0.05%	0.38	

***Average of 3 Observations**

Plate 6. Measurement of O₂ concentration in the College Campus



13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in the 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 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 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 campus. The predominant species of herbs available in the Insitution are *Tradescantia spathaceae* (Croton) and *Vinca rosea* (Bright eyes).

The existence of climber, creepers, twiners and lianas species available which accounted more than seven species in the campus is Amirtaval (*Tinospora cordifolia*). The major grasses are Arugam Pullu (*Cynodon dactylon*), Korai Pullu (*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 campus.

13.6. Establishment of different Gardens in the 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 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 the campus, they are planted ornamental plants for the display of appealing characteristic features including: varying types of leaves and their texture, flowers and their fragrance, fruit, stem and bark. In some places, plants unusual features also planted to be of interest, such as the prominent thorns of cactus and snake cactus. There are many varieties of ornamentals plants are maintaining surrounding of the college campus. In front of principal's room, cafeteria, college grounds and many places planted ornamentals plants. Nearly 100 plants in different places. These plants are making the college campus pleasantly and decoratively. 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 pleasant and lively.



13.7. Natural Topography and Vegetation

Natural topography means the original geographical features of the campus, around 60-65% of the organization should have the natural features like rocks, water resources, slopes, landscape, pathways, etc. and the altered topography can be accounted for, it is facilitated. The vegetation in the land alone is considered as they are part of the natural topography. The vegetation in the artificially created structures are also accounted for when it is reported more than 70% of the claimed green campus audit site. Vegetation is the cultivation of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. Natural topography is better appreciated with wild vegetation than the artificially created topography like pathways and parking areas. The observation at the campus indicated that more than 25% natural topography and vegetation have been maintained properly. Further, there was no anthropogenic activity in 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 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. Ann's College for Women 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. Ann's College for Women 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. Ann's College for Women 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 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. Ann's College for Women 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. Ann's College for Women to cultivate plants. Agrochemicals, chemical fertilizers (urea,

urate 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 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 campus has well developed NCC/Student Force, NSS, Swatch 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 Andhra Pradesh. The St. Ann's College for Women 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. Ann's College for Women has taken sufficient attempts to disseminate the green campus motto and green pledge such as 'Don't cut trees', 'Don't use plastic bags', 'Don't waste waters', 'Plastic Free Zones' and 'Preserve the Natural Resources' and etc. among the students and staff members in the campus.

The College is implemented the Government schemes (Swatch Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms to people living in Andhra Pradesh 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. Ann's College for Women is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of the target group. It provides the vocational training to marginal farmers to overcome the problem of seasonal employment. Some of areas identified are goat farming, mushroom cultivation, vermicomposting, bee keeping, ornamental fisheries, organic farming and medicinal plant cultivation.

The 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 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.

13.15. Establishment of Aquarium and Aquatic plant

Growing fishes in the small ponds will keep the environment pleasant. In the closed environment like corridors and the front offices, auditoriums and gallery classes placing the fish aquarium as well as plant aquarium will improve the scenic value of the place bringing peace to the people. The fish water waste also can be used as manure for growing potted indoor plants. Growing *Lotus*, *Lilly*, *Hydrilla* and other water plants will give a pleasant and calm environment and growing fishes like *Guppies* can keep the water clean and neat. The fountains and small ponds can be built in the frontages to

give an aesthetic look and also growing water plants in these ponds will help to maintain the aesthetic sense of the environment in greenish. The St. Ann's College for Women campus has initiated to start a good aquatic site in which aquatic plants, Fishes and birds are living generously.



13.16. Academic credentials: Projects, Dissertations and Thesis work

Project, Dissertation and Thesis works are academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches. Applied research work of the faculties, staff and student members should be implemented within the campus owing to the credential of the research. Those works indicating the significance of empowering the green campus can be implemented or adopted in other organizations. If the innovation is capable of developing into entrepreneurship, then it is highly appreciable. The Report of projects and dissertations which are productive in methodologies should be disseminated through presentation and publication in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. The St. Ann's College for Women 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. Ann's College for Women 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 25% and planted vegetation was 55%.
2. The St. Ann's College for Women campus is belonging to Andhra Pradesh 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. Ann's College for Women 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.
4. In view of floral biodiversity in the St. Ann's College for Women Campus, a sum 125 species belonging to 115 Genera under 90 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. Ann's College for Women Campus, a total of 5 living Mammals representing two Genera under two families, visiting Mammal species (5), 25 species of birds, 3 species of Grasshopper, 2 species of Termites, 3 species of Amphibians, 3 species of Reptiles, 33 species of Butterflies and Three species Mosquitos were recorded and documented.
6. The campus has a maximum number of more oxygen releasing and carbon dioxide assimilating plants such as Tulsi, *Areca* Palm, Banyan tree, Money plant, Neem tree, *Arjun* tree and *Pongam* trees including some of the shrub and herbal plants.
7. Gardens inside the college premises are found well maintained.
8. Nature Conservation is well maintained.
9. Name Board kept for each trees was found be Excellent.

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. Ann's College for Women 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.
- Use of fossil fuels has to be reduced for the sake of community health.
- 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.

16. Conclusion

After the establishment of St. Ann's College for Women, Guntur, Andhra Pradesh, 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. Ann's College for Women is a well-established Private Institution in Andhra Pradesh 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. Ann's College for Women campus is maintaining more than 75% of the green cover area after building construction along with 25% of natural vegetation and 55% planted vegetation.

The natural topography and very good landscape design without disturbing the natural vegetation are being maintained by the St. Ann's College for Women. A maximum number of more oxygen releasing and carbon dioxide assimilating plants are being maintained to provide pure atmosphere to the stakeholders. The installation of a rainwater harvesting system, percolation ponds and drip irrigation system to conserve rainwater and ground water are noteworthy in the campus. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

17. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Principal and IQAC coordinator of the St. Ann's College for Women, Guntur, Andhra

Pradesh, for providing necessary facilities and co-operation extends during the Green Campus Audit. This helped us in making the audit a magnificent success. Further, we hope Concept of establishing and maintenance of Green Campus proposed by the St. Ann's College for Women Management will create Clean and Green Environment and this will be taken care of by up coming generation and propagate further.

Annexure - I

Methodology for Flora and Fauna Identification

I. Identification of Flowering Plant Species

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

Key to Plant Families Identification

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

16a. Flowers actinomorphic, placentas free- central	Caryophyllaceae
b. Flowers zygomorphic, placentas parietal	Viloiaceae
17a. Filaments of anthers more or less united	Polygalaceae
b. Filaments of anthers more or less united	18
18a. Leaves stipulate; stamens 5 or 10	19
b. Leaves exstipulate; stamens usually 8	Sapindaceae
19a. Style 5; stamen 5	Oxalidaceae
b. Style many; stamens 10	Zygophyllaceae
20a. Leaves pellucid-gland dotted	Rutaceae
b. Leaves not gland 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	Stericuliaceae
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 from 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	Caesalpiiniaceae
37a. Flowers unisexual.....	Cucurbitaceae
b. Flowers bisexual.....	38
38a. Ovary 1-celled.....	Cactaceae
b. Ovary more than 1 celled.....	39
39a. Carpels free if ultimately united the styles distinct.....	40

b. Carpels and styles united throughout.....	Myrtaceae
40a. Flowers in dichasial – polychasial cyme.....	Molluginaceae
b. Flowers in clustered, cymes or solitary.....	Aizoaceae
41a. Ovary inferior, stamens as many as the corolla lobes.....	42
b. Ovary superior, stamens numerous.....	43
42a. Anther free; ovary 2-loculed; stipulate.....	Rubiaceae
b. Anther syngenesious; ovary 1-loculed, exstipulate.....	Asteraceae
43a. Ovary 1-loculed; placentation free central.....	Plumbaginaceae
b. Ovary 2-many loculed; placentation axile or parietal.....	44
44a. Ovary 3 or more carpelled.....	Sapotaceae
b. Ovary 2-carpelled.....	45
45a. Corolla actinomorphic.....	46
b. Corolla zygomorphic.....	50
46a. Plants leafless; parasitic.....	Cuscutaceae
b. Plants leafy ; not parasitic	47
47a. Leaves opposite; stamens 2.....	--48
b. Leaves alternate; stamens 4 or more	49
48a. Leaves not scabrid, corolla tube white: fruits berry	Oleaceae
b. Leaves scabrid; corolla tube orange; fruits capsules	Nyctanthaceae
49.a. Anther inseperatable; corona present	Asclepidiaceae
b. Anther seperatable; corona absent	Apocyanaceae
50a. Corolla lobes imbricate ;fruit drupe	Boraginaceae
b. Corolla lobes plicate; fruit capsule	Convolvulaceae
51.a Ovary cells many ovulated	Solanaceae
b. Ovary cells 1-4 ovuled.....	52
52.a Carpels 2 or more ovulated ; fruits dehiscent	53
b. Carpels 1 –ovulated ; fruits indehiscent	57
53.a Fruits dehiscent; seeds supported on reticulae.....	Acanthaceae
b. Fruits indehiscent; seeds not supported on reticulae.....	54
54.a. Leaves compound; fruits elongated; seeds winged	Bignoniaceae
b. Leaves simple;fruits not elongated, seeds not winged.....	55
55.a. Ovules many on swollen placentas; seeds albuminous.....	Scropulariaceae
b. Ovules 2 lobed placenta ; seeds not albuminous.....	56
56.a Flowers solitary; axile placentation	Pedaliaceae
b. Flowers raceme; axile placentation.....	Marytiniaceae
57.a Ovary entire, style terminal	Verbinaceae
b. Ovary 4 –lobed, style gynobasic.....	Lamiaceae
58.a Flower bisexual	59
b. Flower unisexual	62
59.a. Ovary inferior	60
b. Ovary superior	61
60.a Ovary 4-6 loculated; ovules many	Aristolochiaceae
b. Ovary 1-loculated; ovules 1-4	Santalaceae
61.a Perianth not tubular	Amarathaceae
b. Perianth trubular	Nyctaginaceae
62a. Leafless trees; brachlets ribbed and joined at the nodes.....	Casuarinaceae
b. Leaves well developed ; brachlets not ribbed and not joined at the nodes.....	63

63 a. Ovary 1- loculed; ovules 1-2 in each loule.....	64
b. Ovary 2 or more loculed;ovules 1 or 2 in each locule.....	65
64a. Leaves glandular.....	Euphorbiaceae
b. Leaves eglandular.....	Urticaceae
65a. Filaments inflexed in bud with reversed anther.....	Moraceae
b. Filaments not inflexed in bud, not with reversed anther.....	Ulmaceae
66a. Terrestrial or epiphytic.....	67
b. Aquatic, marsh or riparian.....	Cyperaceae
67a. Arbrosescent 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 cyanobacteri urn	<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 otheriwse.....	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
IB. Plant pigments not contained, but diffused through protoplast -----	2
2A. Plants filamentous; cells arranged in trichomes -----	4
2B. Plants colonial, not filamentous -----	3
3A. Cells in regular rows, in multiples of four; -----	<i>Agmenellum</i>
3B. Cells somewhat evenly arranged toward periphery of spherical colony; barely visible gelatinous strands radiate from center of colony to cells ----	<i>Gomphosphaeria</i>
3C. Colony asymmetrical; cells very dense and unevenly distributed -----	<i>Anacystis</i>
4A. Filaments straight or slightly flexed -----	6
4B. Filaments curved, twisted, or spiralled -----	5
5A. Heterocysts and akinetes present -----	<i>Anabaena</i>

5B. Heterocysts absent -----	<i>Raphidiopsis</i>
6A. Heterocysts present -----	9
6B. Heterocysts absent -----	7
7A. Filaments without a sheath; cells discoid -----	<i>Oscillatoria</i>
7B. Filaments with distinct sheath -----	8
8A. Trichomes tangled; sheaths confluent -----	<i>Phormidiwn</i>
8B. Trichomes separate; sheaths not confluent -----	<i>Lyngbya</i>
9A. Heterocysts terminal -----	<i>Cylindrospermum</i>
9B. Heterocysts intercalary -----	<i>Aphanizomenon</i>
10A. Cell walls without punctae or striae -----	31
10B. Cell walls rigid, ornamented with punctae or striae -----	11
11A. Frustules adiametric, two or more times longer than wide, elongate -----	15
11B. Frustules isodiametric, generally shorter in length than in diameter, round or elliptical or ovoid or nearly so -----	12
12A. Frustules elliptical or ovoid or nearly so -----	14
12B. Frustules discoid or nearly so -----	13
13A. Valves radially punctate -----	<i>Stephanodiscus</i>
13B. Valves with two concentric regions, the inner being smooth -----	<i>Cydotella</i>
14A. Frustules with marginal keel containing a raphe -----	<i>Surirella</i>
14B. Frustules with a pseudoraphe or with a raphe not in a marginal keel ---	<i>Cocconeis</i>
15A. Frustules cylindrical arranged end to end into filament -----	<i>Melosira</i>
15B. Frustules not arranged into filaments -----	16
16A. Frustules with a raphe in at least one valve -----	21
16B. Frustules without a raphe in either valve, pseudoraphe evident -----	17
17A. Frustules united in zigzag chains -----	<i>Tabellaria</i>
17B. Frustules not in zigzag chains -----	<i>Pseudoraphe</i>
18A. Frustules united laterally -----	<i>Fragilaria</i>
18B. Frustules not united laterally -----	19
19A. Frustules united apically forming spokelike colony -----	<i>Asterionella</i>
19B. Frustules not forming spokelike colony -----	20
20A. Frustules needle shaped without costae -----	<i>Synedra</i>
20B. Frustules with prominent costae -----	<i>Diatom</i>
21A. Frustules sigmoid or "S" shaped -----	<i>Gyrosigma</i>
21B. Frustules not sigmoid -----	22
22A. Frustules longitudinally symmetrical, other than lunate in valve view -----	25
22B. Frustules with raphe in both valves, longitudinally asymmetrical, lunate -----	23
23A. Valves with transverse costae -----	<i>Epithemia</i>
23B. Valves without transverse costae -----	24
24A. Raphe a smooth curve with well defined central and polar nodules ----	<i>Cymbella</i>
24B. Raphe not a smooth curve, gibbose with marginal central nodule -----	<i>Amphora</i>
25A. Frustules with raphe in both valves -----	27
25B. Frustules with pseudoraphe in one valve and raphe in other valve -----	26
26A. Frustules wedge-shaped in girdle view and cuneate in valve -----	<i>Rhoicosphenia</i>
26B. Frustules shaped otherwise -----	<i>Achnanthes</i>
27A. Raphe extended length of valve; polar nodules; central nodules lacking -	<i>Eunotia</i>
27B. Raphe restricted to Polar Regions -----	28
28A. Raphe located in a canal -----	<i>Nitzschia</i>

28B. Raphe not located in a canal -----	29
29A. Frustules with symmetrical valves -----	30
29B. Frustules with valves symmetrical but asymmetrical -----	<i>Gomphonema</i>
30A. Valves with transverse costae -----	<i>Pinnularia</i>
30B. Valves with transverse punctae -----	<i>Navicula</i>
31A. Cells solitary -----	45
31B. Cells colonial or grouped -----	32
32A. Cells enclosed in conical to cylindrical lorica; joined lorica have treelike appearance -----	<i>Dinobryon</i>
32B. Cells and lorica without treelike appearance -----	33
33A. Colony discoid, one cell in thickness; cells in concentric rings -----	<i>Pediastrum</i>
33B. Colony not discoid -----	34
34A. Colonies spherical or globose -----	40
34B. Colonies not spherical -----	35
35A. Colony with elongate cells radiating from common center -----	<i>Actinastrum</i>
35B. Colony with cells not radiating from common center -----	36
36A. Colony with four to eight cells positioned in linear series -----	<i>Scenedesmus</i>
36B. Colony with cells not in linear series -----	37
37A. Colony with arcuate to lunate cells with apices acutely -----	<i>Selenastrum</i>
37B. Colony with spherical to broadly ellipsoidal cells -----	38
38A. Cells without spines or setae -----	<i>Crucigenia</i>
38B. Cells with spines or setae -----	39
39A. Cells quadrate, closely apposed; free face of each cell with spines ----	<i>Tetrastrum</i>
39B. Cells quadrate and united; free face cell with long delicate setae ---	<i>Micractinium</i>
40A. Colony with biflagellated cells -----	<i>Pandorina</i>
40B. Colony with nonflagellated cells -----	41
41A. Cells lunate to sickle shaped -----	<i>Kirchneriella</i>
41B. Cells spherical or nearly so -----	42
42A. Cells borne terminally on dichotomously branched threads ----	<i>Dictyosphaerium</i>
42B. Cells not on dichotomously branched threads -----	43
43A. Colony a hollow sphere -----	<i>Coelastrum</i>
43B. Colony not a hollow sphere -----	44
44A. Colony surrounded by gelatinized and expanded parent cell wall -----	<i>Oocystis</i>
44B. Colony with cells equidistant and toward periphery -----	<i>Sphaerocystis</i>
45A. Cells with median constriction dividing cell into two distinct halves -	<i>Cosmarium</i>
45B. Cells without pronounced median constriction -----	46
46A. Cells nonflagellated -----	53
46B. Cells flagellated -----	47
47A. Cell walls without polygonal plates -----	49
47B. Cell walls with polygonal plates -----	48
48A. Cells walls of thick plates with distinct sutures -----	<i>Peridinium</i>
48B. Cells walls with faintly distinct plates and sutures -----	<i>Glenodinium</i>
49A. Cells uniflagellate -----	52
49B. Cells biflagellate -----	50
50A. Cells with two flagella of equal length -----	<i>Chlamydomonas</i>
50B. Cells with two flagella of unequal length -----	51
51A. Cells with single chromatophore -----	<i>Chroomonas</i>

51B. Cells with 2 large chromatophores -----	<i>Cryptomonas</i>
52A. Cells surrounded by distinct lorica -----	<i>Trachelomonas</i>
52B. Cells without lorica; fusiform to acicular shaped; posterior end -----	<i>Euglena</i>
53A. Cells acicular to fusiform with ends tapering into long spines -----	<i>Schroederia</i>
53B. Cells without ends tapering into long spines -----	54
54A. Cells without setae -----	56
54B. Cells with setae -----	55
55A Cells with subpolar or both subpolar and equatorial long setae -----	<i>Chodatella</i>
55B Cells with multiple peripheral long delicate setae -----	<i>Golenkinia</i>
56A Cells long, slender, and tapered at both ends -----	<i>Ankistrodesmus</i>
56B Cells flattened or isodiametric, triangular, quadrangular -----	<i>Tetraedron</i>

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 -----	<i>Mycotrophs</i>
2. Growing shelflike on wood (or, if not, then gills <i>concentric</i> rather than radial); mushroom <i>very</i> 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 -----	<i>Polypores</i>
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 <i>not</i> growing on wood -----	<i>Chanterelles and Trumpets</i>
4. Gills not as above; mushroom growing on wood or elsewhere ----	<i>Gilled Mushrooms</i>
5. Stem absent--or, if present, lateral, Flesh in stem tough-----	<i>Polypores</i>
6. Raphe a smooth curve with well defined central and polar nodules -----	<i>Cymbella</i>
7. Raphe not a smooth curve, gibbose with marginal central nodule -----	<i>Amphora</i>
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 -----	<i>Scenedesmus</i>
12. Colony with cells not in linear series -----	37
13. Colony with arcuate to lunate cells with apices acutely-----	<i>Selenastrum</i>
14. Cells acicular to fusiform with ends tapering into long spines -----	<i>Schroederia</i>
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 -----	<i>Chodatella</i>
19. Raphe extended length of valve; polar nodules; central nodules lacking ----	<i>Eunotia</i>
20. Raphe restricted to Polar Regions -----	28
21. Raphe located in a canal -----	<i>Nitzschia</i>
22. Filaments with distinct sheath -----	8
23. Trichomes tangled; sheaths confluent -----	<i>Phormidiwn</i>
24. Trichomes separate; sheaths not confluent -----	<i>Lyngbya</i>

25. Heterocysts terminal -----*Cylindrospermum*
 26. Heterocysts intercalary -----*Aphanizomenon*
 27. Cell walls without punctae or striae -----31
 28. Cell walls rigid, ornamented with punctae or striae ----- 11
 29. Frustules adiametric, two or more times longer than wide, elongate -----15
 30. Frustules isodiametric, generally shorter than round or elliptical or ovoid ----- 12
 31. Frustules elliptical or ovoid or nearly so -----14
 32. Frustules discoid or nearly so -----13
 33. Valves radially punctate -----*Stephanodiscus*
 34. Valves with two concentric regions, the inner being smooth -----*Cydotella*
 35. Frustules with marginal keel containing a raphe -----*Surirella*
 36. Frustules with a pseudoraphe or with a raphe not in a marginal keel -----*Cocconeis*
 37. Cap round in outline; pore surface not running down the stem, or only slightly running down the stem; spore print not white -----*Boletes*
 38. Mushroom with spines or "teeth"--either on the underside of a cap, or hanging from a branched structure, or clumped in an indistinct mass -----*Toothed Mushrooms*
 39. Mushroom covered in some part with a foul-smelling slime; arising from a soft underground "egg"; variously shaped (like a club or stick, like crab claws, like a lantern, like a Wiffle ball, etc.); frequently found in woods----- *Stinkhorns*
 40. Mushroom more or less shaped like a ball, or like a ball raised up on a stem, or like a ball set on a starfish----- *Puffballs*
 41. Cap shape convex to centrally depressed or vase-shaped; undersurface, smooth, wrinkled, or gill-like; fruiting embedded -----*Chanterelles*
 42. Cap shape oval, pointed, lobed, saddle-shaped, irregular, or thimble-like (never vase-shaped or convex); undersurface absent, or hard to see or define; many (but definitely not all) species fruiting----- *Trumpets*
 43. Stem completely hollow, or hollow with cottony fibers inside; cap with pits and ridges, or longitudinally wrinkled, or fairly smooth (never lobed or convoluted); without reddish or reddish brown shades; found in spring----- *Morels & Verpas*
 44. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black; stem surface ribbed or "pocketed" in some species -----*Saddles*
 45. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, greyish, brownish, or black -----*Oddballs & Misfits*

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

UDYAM REGISTRATION NUMBER		UDYAM-TN-03-0073706																					
NAME OF ENTERPRISE		M/S NATURE SCIENCE FOUNDATION																					
TYPE OF ENTERPRISE *		MICRO																					
MAJOR ACTIVITY		SERVICES																					
SOCIAL CATEGORY OF ENTREPRENEUR		GENERAL																					
NAME OF UNIT(S)		<table border="1"> <thead> <tr> <th>S.No.</th> <th>Name of Unit(s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Green Campus, Energy and Environment Management Audits</td> </tr> </tbody> </table>		S.No.	Name of Unit(s)	1	Green Campus, Energy and Environment Management Audits																
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Mobile	9566777255	Email:	chairmannof@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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DATE OF UDYAM REGISTRATION		26/02/2022																					

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

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

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)
2. MSME-DI: CHENNAI (TAMIL NADU)

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MSME

The screenshot shows the homepage of the NGO DARPAN portal. At the top left, there are logos for the Government of India, the NGO logo, and the DARPAN logo. To the right, it says "NITI Aayog, Government of India". Below this is a navigation menu with links: Home, About Us, NGO Directory, Search NGOs, Report, Guidelines, Circulars, Help, Apply Grant, and Blacklisted NGOs. A "Login/Register" button is located in the top right corner. The main banner features a photograph of a group of people, with the text "NGO DARPAN" overlaid. Below the banner, a message states: "In order to strengthen services of the portal, Government has decided to make PAN Number of VOs/NGOs mandatory." Below this, a light blue bar contains the text "Please Update Your Profile". A teal bar below that says "Welcome, Nature Science Foundation". At the bottom, a light blue box displays 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, Gandhima Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 26/03/2018

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

1. The above Trust/Society/Association/ Company/ others/, bearing FAN 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)
 Ayyakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URN No. 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
 Raji. S. Ramani
 17/07/2019

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

The sforesaid 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. URN No. 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:-	

	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 Dr. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarathi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Botanist and Subject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
6. Bureau of Energy Efficiency (BEE) and National Productivity Council of Er. N. 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 TN006609

Note: The course conforms to the principles and practices 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

for TÜV NORD CERT GmbH

Essen, 2019-04-26

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

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com





Medicinal Plants Farmes

1999-2000

Kuppayee Thottam, Vadugampalayam Privu,
Gobi.

ATTENDANCE CERTIFICATE
FOR INSITUTIONAL TRAINING

This is to Certify that Mr D. VINOTHKUMAR

of B.Sc., BOTANY FINAL YEAR of

Chikkaiah Naicker College, Erode-4. Has undergone institutional training in Plantation, Cultivation

and Collection of medicinal plants for 14 days from 18.12.99 to

31.12.99

at Gobi.

Station : GOBI

Date : 31.12.99



M. R. Sarvanan

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



BUREAU OF ENERGY EFFICIENCY



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

Certificate Registration No. : **9176**

[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 (f) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

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


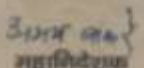
[Handwritten Signature]

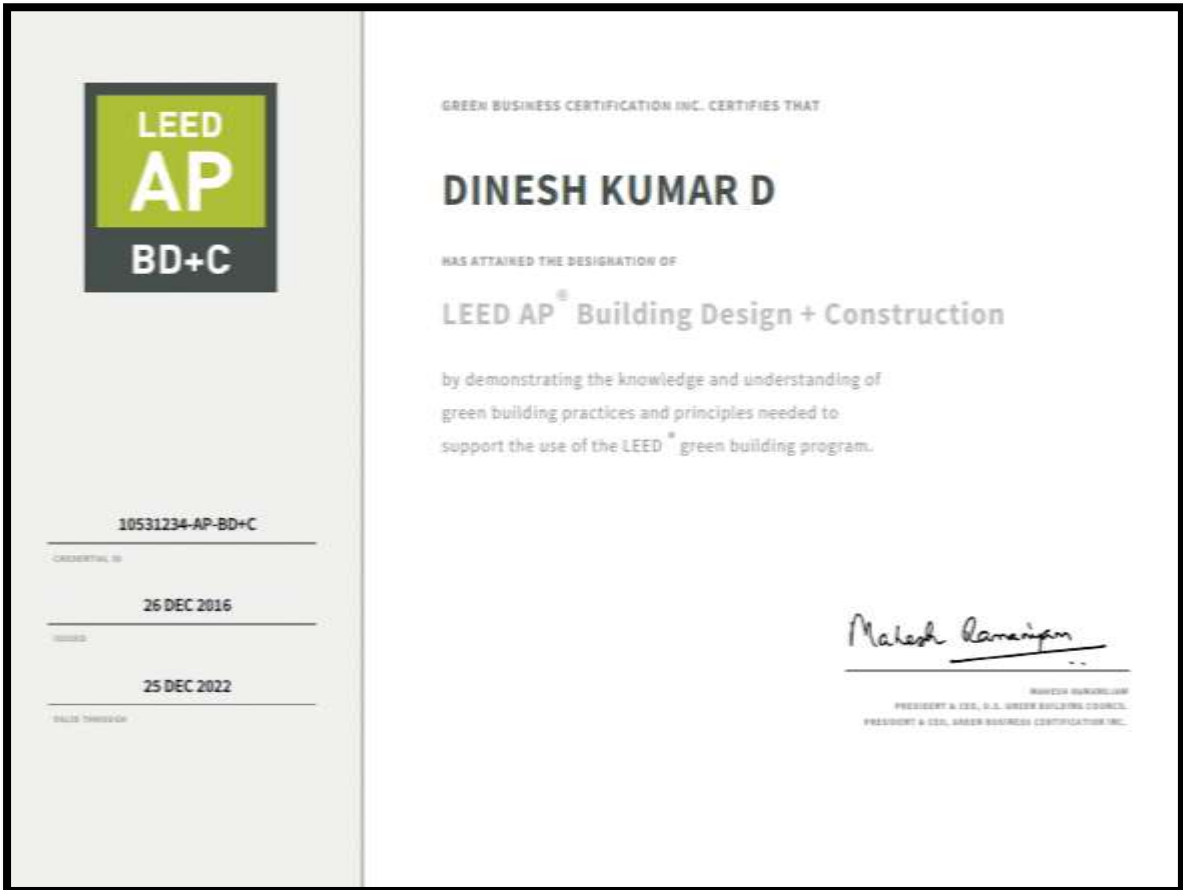
Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

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

 ऊर्जा दक्षता ब्यूरो BUREAU OF ENERGY EFFICIENCY विद्युत मंत्रालय, भारत सरकार MINISTRY OF POWER, GOVERNMENT OF INDIA	
प्रमाणित किया जाता है कि श्री/श्रीमती <u>दिनेश कुमार</u> ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए <u>7 दिसंबर '16</u> से <u>8 दिसंबर '16</u> तक एमएनआईटी / सीईपीटी / आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है। This is to certify that Shri/Smt. <u>Dinesh Kumar</u> has successfully completed the Master Trainer Certificate Programme conducted by MNIT / CEPT / IIT from <u>7 December '16</u> to <u>8 December '16</u> for the Energy Conservation Building Code.	
नई दिल्ली, <u>11.02.2017</u> New Delhi, _____	 महासचिव Director General



TECHNICAL REPORT OF ENVIRONMENT AUDIT



Submitted to

**ST. ANN'S COLLEGE FOR WOMEN,
GUNTUR-522 035, ANDHRA PRADESH, INDIA**

Date of Audit: 07.08.2023

Valid Till: 08.08.2025

Submitted by



NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)

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

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

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1. Introduction

Environment (Eco) audit is quantitative and qualitative data to track air, soil and water 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 (Gnanamangai *et al.*, 2022). 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 (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

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.

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 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.

Environment auditing is a kind of professional tool to identify organization's environmental performance aligning with its policies and compliances of the Government guidelines. 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 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 companies and Educational Institutions are advised to implement environment 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, accepted/standard test procedures, honest and transparent setting of standards.



In order to provide efficient eco-friendly atmosphere to the stakeholders, the organization should take responsibility in making good drinking water facility, use of the organic manure, cow dung, farmyard manure and vermicompost for manuring the plants, avoidance of non-compostable, single-use disposable plastics items, single-use plastic utensils, plastic straws and stirrers, commitment to plastic-free alternatives to bags, boxes, containers and etc. and reduction of use of papers alternated with e-services and e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system. These parameters should be considered while implementing the environment friendly campus in an organization. To set a pure atmosphere in an organization campus, waste disposal management should be proper which in turn to confine the environmental pollution. Waste management is an activity that starts from inception of waste to its final disposal. In other words, it includes a chain of action i.e., collection, transport, treatment and disposal of waste, together with monitoring and regulation. Dry waste includes paper, cardboard, glass, tin cans, etc., while wet waste refers to organic waste such as vegetable pods, left-over food, etc. Separation of waste material is necessary for the accountability of amount of waste being generated followed by proper recycling through the composting process and used as a fertilizing material.

5. Environmental Management Plan (EMP)

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

providing clean and environment friendly work culture. Main purpose of the EMP is to determine the environmental protection measures to be followed during in day-to-day's activities of the organization and confirm to minimize environmental effects are met. Environmental protection is an imperative component of overall preparation and execution of eco-friendly and green campus of an organization. It addresses the issues start from sanitation pertaining to human health/various stakeholders of an organization and protection



of plants, animals and microorganisms including wildlife habitats. Environmental Management Plan (EMP) is an integrated document with various approvals, authorizations and specific components and/or activities that to be carried out in the campus without harming the environment (Table 1). EMP is committed to regulate its assets with its core values to protect the health/safety of people/environment and to comply with Environment Health and Safety laws, regulations and Health and Safety standards. EMP should provide a reference document as per the legislative requirements for employees when planning and/or performing specific activities in the campus surroundings. In line with the Environment Policy, impact on the physical, chemical and biological environment should be determined along with statutory requirements and other environmental commitments.

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

S.No.	Monitoring areas	Parameters Monitored	Monitoring frequency	Reason for monitoring parameters
1.	Dredging	Erosion, landscape, sedimentation, vegetation, disposal of dredging	Continuous	Dredging results in disturbance of Benthic community and causes soil erosion and sedimentation
2.	Marine Ecology	Biodiversity survey and conservation	Continuous	Unmitigated operations may result in loss of biodiversity as per the Indian Biodiversity Act
3.	Vegetation (Flora and Fauna)	Survey of macro and micro plants, animals (mammals, birds, moths, houseflies, reptiles, amphibians, termites) and soil and air microbial biodiversity	Continuous	Conservation of macro and micro plant, animals (mammals, birds, moths, houseflies, reptiles, amphibians, termites) and soil and air microbial biodiversity conservation for future generations through modern technology
4.	Air Emission	O ₂ , CO, CO ₂ , SO ₂ , NO ₂ level in the open, car parking and indoor areas	Monthly monitoring	Unmitigated operations may result in deterioration of air quality

5.	Solid Waste	Solid waste quality and quantity, solid waste disposal, reuse, solid waste treatment	Monthly monitoring	Compliance of Environmental Laws and Legislative policy
6.	Wastewater	Primary, secondary and tertiary pollutants and their recycling, wastewater minimization, storage and handling, reuse, treatment before disposal	Monthly monitoring	Minimize the water pollution and to provide quality water as per the Central Pollution Board
7.	Soil	Soil contamination, soil edaphic parameters, soil, gravel and sand composition, water holding capacity, soil erosion	Half yearly	Soil surface and water pollution cause diseases as per the Compliance of Environmental Laws and Legislative policy
8.	Noise	Noise intensity, causes and impact, remedies, standard operating procedure	Monthly monitoring	Uncontrolled noise cause nuisance which affects the health
9.	Occupational Safety & Health	Safety, health and welfare of people at occupation, measures taken, Fire safety, First aid box, Safety protocol, Hospital facility	Continuous	Department of Occupational Safety & Health
10.	Land reclamation	Soil quality, soil micro and macro elements, soil composition	Half yearly	Legal obligation and structure protection, prevention of soil erosion and sedimentation to the port
11.	Restoration of the sites	Forest vegetation, plant vegetation, visual analysis, Photographic records	Continuous	Maintain the soil fertility and soil original reclamation

6. Environmental health and safety management system

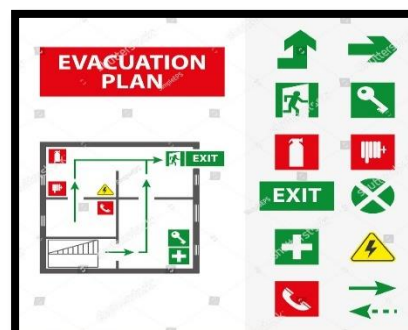
It is outlined the mitigate measures and the best management practices followed in the organization in terms of developing eco-friendly and green campus. It is suggested to perform complete assessment and control of entirely possible hazardous and risks arise in the organization without harming the environment (Rajalakshmi *et al.*, 2021). It

is to ensure that no significant adverse environmental health and safety impacts by carrying out various infrastructure facilities created to improve the human eco-system of the organization may be implemented. The facility should be designed to include fire protection equipment/system including flame, multiple gas, smoke and low- and high temperature detectors/ alarms, 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 measures which will be useful for protecting the environment without causing any adverse effect. 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 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 in order to impart knowledge on the latest developments in chemicals disposal methodologies and hazardous management policies. Safe method of handling 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 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, 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 characteristics.

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. 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 is 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. 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', '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 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 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 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.

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. Environment audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. It is necessary to 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. 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.

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. 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

15.1. 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

15.2. 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

15.3. 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

15.4. 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

15.5. 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

15.6. 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.

16. Procedures followed in Environment Audit

16.1. 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 Environmental audit was carried out as per the procedures mentioned of the Manual of Gnanamangai *et al.* (2021).

- 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.
- 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.

16.2. 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 to calculate the emission of CO₂ in metric tons per year.

16.3. Steps involved in the Process of Environmental Audit

1. Opening meeting among the audit team and auditees will be performed where the discussion on the audit procedure elaborated besides the scope of the audit
2. Onsite audit visit will be made along with audit team and auditees (IQAC Coordinator or responsible team member).
3. Inspect around the campus to monitor the available physical facility and took photographs for evidence.
4. Monitor the components as per the environmental checklist (sanitation and hygiene, water conservation, waste management, green campus and environment measures basis of respective policies)
5. Note down what are all the components available and what are all the facilities not available within the campus as per environment audit components ear-marked by NSF Checklist.
6. Mandatory – Record the Carbon dioxide, Oxygen, Noise levels at different places of the campus using CO₂, O₂ and noise meters respectively, as per the operational formats available with NSF
7. To monitor the pH of the water (Tap-, Bore well-, RO- and Recycled-water, if any and turbidity/EC of above said samples with portable pH and TDS meters, respectively, as per the handling procedures available with NSF
8. On client's request, monitoring the Global Positioning System (GPS) and Light Intensities at various places within the campus will be performed with GPS and Lux meter respectively following the standard operational procedures available with NSF
9. Identify the issues in the campus with respect to environment compliance and merits/weakness of the auditees Management controls beside the risks associated with environment audit.
10. Collect information about Ecology and Environment studies, awareness programmes conducted and publications with respect to Environment.
11. Exit meeting held after the walk-through audit where in the audit findings with the members of the organization will be conducted.
12. Comparison between the previous audit report with the current audit findings in which the number of suggestions and recommendations were adopted by management should be indicated (Applicable only number of audits conducted by NSF over a period and not applicable for the first-time audit).
13. Prepare and distribute the findings as a Technical Report along with the recommendations including the best practices adopted by auditee and distribute certificate pertaining to the audit.



**Meet with the Principal, IQAC Coordinator and Management Representatives of
St. Ann's college for women, Guntur,
Andhra Pradesh with the Audit Team of the Nature Science Foundation**

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. About the Organization

18.1. St. Anns College for Women

St. Ann's college for women was established in 1997 to uplift the rural women, impart intellect and spiritual integrity into the young lives and serve them for overall development. It is affiliated to Acharya Nagarjuna University and ever since its inception it has been emerging as a universal cosmopolitan and prestigious college in Guntur.

Initially the college had only B.Sc (M.B.C), B. Sc (M.P.Cs) and B.Com (General) courses. In 1998, B.C.A course & B.Sc (M.S.Cs) were introduced. Keeping in pace with the emerging needs of the society, additional course of B.Com (Res) was added in 1999. Seeing the aptitude for research in Biology, the courses were again streamlined in 2003 with the introduction of Biotechnology (B.B.C). To bridge the gap of previous value based education and the present day job oriented education, a Post Graduate course of M.C.A was installed into College Academics in 2003. During the Academic year 2007 – 2008, to be in par with the professionalism, M.B.A course was introduced and the college grew to the heights of excellence in educational ladder and thus reached the status of Post Graduate College.

Vision

To provide the value based education to the women, enrich them with innovative and unique skills and transforming them into socially useful citizens.

Mission

By inducing the novel techniques to achieve excellence in education, enhance ethical values for the holistic development of the students, the college aims to brighten the lives of the rural women by providing ideal and diversified learning environment.

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

S.No.	Details of Area	Total area
1.	Total Campus area	14486 sq mts
2.	Total Built up area	2299 sq.mts
3.	Open area	12186 sq.mts
4.	Forest vegetation	35%

5.	Planted vegetation	65%
6.	Total number of Girl students	1078
7.	Total number of Boy students	-
8.	Total number of Teaching Staff	40
9.	Total number of Non-teaching staff	27
10.	Total number of College buses	Nil

18.2. 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 (Table 3).

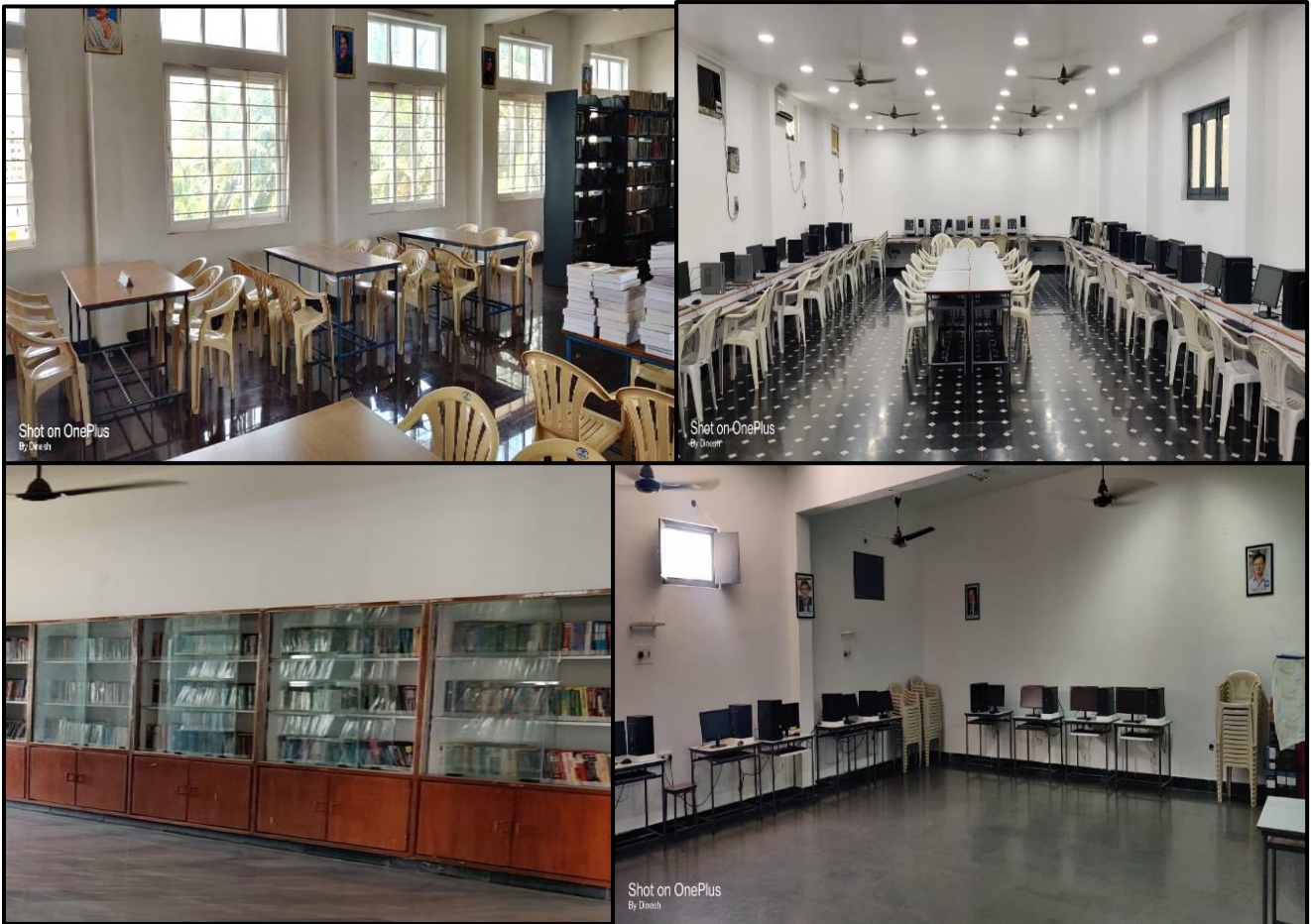
Table 3. Audit processes are being conducted through the certified Auditors as per the following by the NSF

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

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



**St. Ann's college for women, Guntur,
Andhra Pradesh - Infrastructure**



**St. Ann's college for women, Guntur,
Andhra Pradesh - Computer and Library Infrastructure**



**St. Ann's college for women, Guntur,
Andhra Pradesh – Front View**

19. Audit Details

Date / Day of Audit	: 07.08.2023
Venue of Audit	: St. Ann's college for women , Guntur, Andhra Pradesh 522019
Audited by	: Nature Science Foundation, Coimbatore, Tamil Nadu, India.
Audit type	: Environment Audit
Name of the Auditing Chairman	: Dr. S. Rajalakshmi, ISO QMS, EMS, OHSMS and EnMS Auditor Founder & Chairman of NSF
Name of the Auditing Team Leader	: Dr. D. Vinoth Kumar, ISO QMS, EMS and EnMS Auditor Joint Director of NSF.
Name of the Lead Auditor	: Er. D. Dinesh Kumar, Certified BEE, IGBC, ASSOCEM, GRIHA & LEED Auditor
Name of the Energy Auditor	: Dr. N. Balasubramanian, Bureau of Energy Efficiency
Name of Subject Expert	: Mr. B.S.C. Naveen Kumar, Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of the Eco Auditor	: Er. S. Srinivash, Tamil Nadu Fire and Rescue Services, Coimbatore.
Name of Eco & Green Officer	: Ms. M. Nithya, ISO QMS and EMS Auditor Programme Officer of NSF.



**Walk Through Audit of Nature Science Foundation Team in
St. Ann's college for women, Guntur, Andhra Pradesh.**

20. 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 (Vinothkumar *et al.*,2021).

Incinerator for napkin disposal use, Housekeeping, storage, areas, piping, plumping and etc. facility, Sign boards indicating plastic free campus, tobacco free campus, don't waste water, don't walk on the lawns, don't pluck 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.

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 4 and 5).

Table 4. Qualitative Measurements of Environmental Audit

S.No.	Part 11 clause as per National Building Code	Audit Checklist with weightage	Response	
			Yes	No
1.	3.7. Integrated Water Management	What are the efforts taken for water conservation (Recycling, automatic water tap sensors, sign boards, prevention of leakage)	Yes	
2.	3.11. Disaster Preparedness	Whether the building planning and design comprise of structural (staircase spacing, ramp), health (natural ventilation) and fire safety measures (fire extinguisher, fire safety sand buckets)?	Yes	
3.	6.2. Site Assessment prior to design	Whether the constructions are built without destroying any natural resources like dams, pond, rock, vegetation, if any	Yes	
4.	7.1.2.1. Previous paving design	Whether any initiatives taken for holding rainwater through previous paving (flat stones laid in pattern) design		No
5.	7.1.2.2. Heat island effect and parking design	Observation of open parking areas to reduce heat island effect (temperature) (eg: parking vehicles under trees shade)	Yes	
6.	7.2.1. Rainwater harvesting	Maintenance of rainwater harvesting unit and recharging ground water aquifers	Yes	
7.	7.3.2. Water conservation and irrigation	Observation on water conservation activities like irrigation, reuse of gray water (recycled waste water). Per capita water consumption per day of the campus will be calculated at the time of onsite audit.		No
8.	7.4.2. Long term private and public transportation plan	Use of low-carbon emitting, battery operated vehicles and use of public transport facilities.	Yes	
9.	7.4.3. Bicycle lanes and pedestrian access – safety and comfort	Designing pedestrian path, cyclists for friendly environment like planting of trees, overhangs, arcades and closely built buildings provide shading and adequate street lighting	Yes	
10.	10.2.1.1. Availability of water	Availability of fresh water and ground water facilities in the campus [Availability of data on Physico-chemical properties of drinking / RO / Borewell / Open well / Municipal or Corporation water (Data may be verified at onsite audit)].	Yes	
11.	10.2.3. Hot water systems planning	Providing hot water by using alternative sources of energy like solar energy?		No

	and design approach			
12.	10.3. Treated wastewater use for landscape and irrigation	Whether the wastewater and rain water are used for irrigation or domestic purpose?		No
13.	10.5. Process of water requirements and effluent treatment	Availability of sewage & effluent treatment plant facilities.		No
14.	10.6.1-10.7 Planning and design of solid waste management system	Collection, segregation and disposal of solid, hazardous waste	Yes	
15.		Collection, segregation and disposal of bio-medical and e-wastes by keeping different coloured dustbins	Yes	

* Applicable for Industrial sectors

** A minimum of 50% criteria should be attained

Table 5. 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	Under Implementation
2.	Number of Borewell water and Open well water facility	01
3.	Number of Percolation Pond and Check Dam facility	NA
4.	Number of Wastewater treatment facility	Under Implementation
5.	Number of Solid waste management facility	01
6.	Number of Renewable energy utilization (Solar panel and solar water heater)	85%
7.	Number of Rain harvesting system and water reservoirs	03
8.	The ratio of Environment sustainability courses (Environmental Science, Engineering, Technology, Management, Monitoring, Climate change, Global warming) to total courses / subjects	13%
9.	Functioning of Nature club, Eco club, Association, and NSS on environment conservation, environmental pollution, nature protection and natural resources maintenance.	90%

10.	Signing of MoU with Govt. and NGOs to ensure eco-friendly campus maintenance	01
11.	Implementation of Government schemes (Swachh Bharath Abhiyan under Clean India Mission) programmes conducted	90%
12.	Number of composting pits and vermicompost unit for recycling of kitchen wastes and plant leaf litters degradation	02
13.	Usage of Water (liter/day) in our institution	50 litres per capita per day
14.	Carbon footprint in the campus due to Electrical energy usage	56.01 metric tonnes
15.	Carbon footprint in the campus due to Vehicle's usage	59.806 metric tonnes

21. Observations of the Environment Audit.

21.1. 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 degrade, rot, like paper or organic waste like food and hence, it can hang around in the environment for hundreds of years. More than eight million tonnes of plastic escapes from the land cover and enters the world's oceans each year while only 9 per cent of the total plastic waste in the world is recycled. It is observed that 96% of plastic wastes are collected and segregated by the respective urban bodies in which the recyclable plastic waste is sold to the recyclers and non-recyclable plastic waste are sent for co-incineration in cement plants.



People should be probed to use reusable substances and initiate models which allow up-cycling of waste for better use. This will help to reduce plastic waste from urban local bodies, as well as curb the value for waste among the citizens. Plastic waste management is very important, because plastic not only pollute the environment, it destroys food chains. People use plastic bags and plastic ware items every day to hold objects like meals, clothes, grocery and stationary items, which can be bought from shops. Generally, the plastic items are non-degradable in nature that led to soil pollution and affect the soil health significantly. Most of the plastic items are considered as solid waste and enhance the unwanted animal choking, water pollution, blockage of channels, rivers and streams, and landscape disfigurement.

According to the World Health Organization (WHO) report, plastic items take at least 400 years to decompose completely in the soil which illustrates the subsequent effects on the environment. Plastic pollutants form a basis for damage to the healthier environment besides the living organisms in the ecosystem. It impacts all organisms in the food chain from tiny species to big ones. And hence, reduction of plastic usage is the need of the hour to protect at least the present-day natural resources. There is a need to reduce the plastic use to effectively limit plastic waste in the campus. College has taken sufficient attempts not to use plastics in the campus and displayed a slogan ‘say no to plastics’ in College ’s like canteen, hostel dining halls, seminar halls, corridors, etc. to the students, parents and public. The College Management insisted the people use eco-friendly bags made from organic materials like plant fibres which are easily decomposable in nature. These efforts are very much essential to keep the environment neat and clean to conserve nature.

21.2. Solid Waste Management Practices at the Campus

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



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



Solid Waste Management Practices in St. Ann's college for women, Guntur, Andhra Pradesh.

21.2.1. 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 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) Disposal of E-Waste and 3) Rainwater Harvesting System. Regarding the food wastes, a portion of food wastes being pulverized and used in the bio-gas digester and the balance quantity is sent to piggeries. Organic wastes like dry leaves, vegetable cuttings, etc. are sent for bio-composting (Setyowati *et al.*, 2017)

21.2.2. 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 College viz. Students Hostels and Staff rooms, Students Service Centre, Sports Complex and Guest rooms. A Contractor is engaged for the collection and further process of waste generated within the campus where biodegradable wastes subjected to preparation of organic compost.

21.2.3. 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.

21.2.4. Disposal of E-Waste

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

21.2.5. Construction & Demolition of Waste Management

The Ministry of Environment, Forest and Climate Change, Government of India has notified the Construction and Demolition Waste Management Rules, 2016 exclusively to manage waste (building materials, debris and rubble) from construction activities like new construction, re-modelling, repair and demolition. According to the Rules, the local authorities need to ensure proper management of construction and demolition wastes. State Pollution Control Board is to grant authorization for the waste processing facility and to monitor the implementation of these Rules. One of the best waste management practices is rebuilding of construction waste into pillars, pathway road. The construction waste inside the campus is found to be very low.

22.2.6. Hazardous Waste Management

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

Chemical wastes are regulated by the Environmental Protection Agency (EPA) through the Resource Conservation and Recovery Act (RCRA). Chemical waste cannot be disposed of in regular trash or in the drainage system. Most chemical wastes must be disposed of safely without affecting the environment, soil health and water quality as per the directions of World Hazardous Waste Programme. Carcinogenic substances should not dispose of from the laboratories directly through drains or by evaporation into the atmosphere, nor should they be buried since they might be released later. Carcinogenic substances should be treated strictly as per the protocol and the degraded products should be non-toxic and non- carcinogenic in nature. Procedures involved in treatment and disposal do not result in exposure to the personnel in charge of the work and the procedures on treatment and disposal do not end with contamination of equipment or workplace. Biological and animal wastes, human or animal blood and body fluids can be disseminated through drains (sanitary sewer), under running water after it has been decontaminated by autoclave or using chemicals. In addition, animal wastes and microorganisms including some biological waste materials should be disinfected with liquid detergents and disinfectant solution and then poured down the drainage after dilution with water (pH 6.6-7.4). The campus has a certain protocol to dispose waste as well as expiry chemicals properly (Table 6). Hazardous chemical waste is not used in College and also its not applicable.

21.2.6. Waste Disposal and Tracking Form

Name of the Organization	: St. Ann's college for women
Address of the Organization	: Gorantla, Guntur-522 035, Andhra Pradesh, India
Date of Waste Disposal	: From April 2021 to August 2023
Reporting Team and details	: IQAC and NAAC Teams

Table 6. 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)	--	--	--
3.	Agriculture Waste	Compost pit	On-site	Inhouse
4.	Aluminium, Metal Cans, Tins	5 No's	On-site	Recycled inhouse for flower garden
5.	Asbestos	---	--	--
6.	Batteries (Dry)	2 Battery banks	On-site	Buy back to suppliers
7.	Batteries (Lead Acid)	--	--	--
8.	Biomedical Waste	--	--	--
9.	Car exhaust	--	--	--
10.	Charcoal	--	--	--
11.	Clinical Waste	--	--	--
12.	Cloth Materials Waste	--	--	--
13.	Construction Waste	10% of the Total Material	Off-site	College
14.	Condensate Waste	--	--	--
15.	Crude Oil	--	--	--
16.	Descaling Acids	--	--	--
17.	Drilling Fluids / Solids	--	--	--
18.	Drums and Containers (Empty)	--	--	--
19.	Effluents from major equipment	--	--	--
20.	Electrical Waste (Wires, Switches, Fans, A/C machines, Holders, Meters, Coils, etc.)	--	--	--
21.	Electronic Waste (Computer, Laptop, CD, Pen drive, Keyboards, Mouse, Printers, UPS)	2410kg	Off-site	Local Disposal shops
22.	Fertilizer Waste	--	--	--
23.	Filters	--	--	--

24.	Fluorescent Light Tubes	--	--	--
25.	Food Waste	Few kgs	Off-site	Local Disposal shops
26.	Furniture Items	100kg	Off-site	Local Disposal shops
27.	Garbage and Cardboards	Few kgs	Off-site	Local Disposal shops
28.	Glass Bottles	10 bottles		Recycled for Ornamental plants
29.	Glassware items Waste	10bottles		Recycled for Ornamental plants
30.	Glycols	--	--	--
31.	Hazardous Waste	--	--	--
32.	Household items	--	--	--
33.	Human Waste	--	--	--
34.	Inert Waste	--	--	--
35.	Laboratory Wastes	Few kgs	Off-site	Local Disposal shops
36.	Lights and Bulbs	Few kgs	Off-site	Local Disposal shops
37.	Kitchen Waste	--	--	--
38.	Metal Waste	Few kgs	Off-site	Local Disposal shops
39.	Napkins	20/day	On-site	Incinerator
40.	Oil Contaminated Soil	--	--	--
41.	Oily Sludge & Rags (Used)	--	--	--
42.	Packaging Waste	Few kgs	Off-site	Corporation
43.	Paint Waste	--	--	--
44.	Paper Waste	Few kgs	Off-site	Local Disposal shops
45.	Pathological Wastes	--	--	--
46.	Pigging Wastes	--	--	--
47.	Plant Wastewater	5000lit/day	On-site	Wetting of roads
48.	Plastic Waste	--	--	--
49.	Plasticware items waste			
50.	Produced Water Waste	--	--	--
51.	Radioactive Waste	--	--	--
52.	Rinsate Waste	--	--	--
53.	Rubber Waste	--	--	--

54.	Salts used in Laboratories (Used & Expiry Chemicals)	50 litres per month (Liquid waste)	On-site	Following the standard operating procedures
55.	Sanitary Wastewater	--	--	--
56.	Scale (Pipe and Equipment)	Once in a year	Onsite	Drainage
57.	Sewage Sludge	--	--	--
58.	Solvents	--	--	--
59.	Sludge and allied	--	--	--
60.	Trash (i) Glass (ii) Metal (iii) Plastic (iv) Oils (v) General Trash	--	--	--
61.	Synthetic Dyes, other items	--	--	--
62.	Textile Waste	--	--	--
63.	Used Engine Oil	Few	Off-site	In Gaurages
64.	Wastewaters (Liquid Waste: Detergents, Soap, Oil, etc)	--	--	--
65.	Wood Waste	Few	Off-site	Local Disposal shops

21.2.7. 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. 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.



Energy Conservation and Management Activities at St. Ann's college for women, Guntur, Andhra Pradesh.

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.

21.3. Biogas plant facility

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



**Biogas plant Activities at
St. Ann's college for women, Guntur, Andhra Pradesh.**

21.4. 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.



**A well-Maintained composting Unit in St. Ann's college for women, Guntur,
Andhra Pradesh.**

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. College is in initial stage of composting and Vermicomposting Activities.

21.5. Recycling of Wastewaters

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. Rain water harvesting is implemented in our campus to collect and to recycle water to promote self-sufficiency and sustainability which is used or toilets. Rain Water tank is available in the campus at the ground level as well below ground level i.e. filtered and stored in sump.

21.6. Establishment of Eco-friendly Campus

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.



St. Ann's college for women, Guntur, Andhra Pradesh – Botanica Greenery view



Plants are maintained in Botanica at St. Ann's college for women, Guntur, Andhra Pradesh.

21.7. Napkin disposal facility

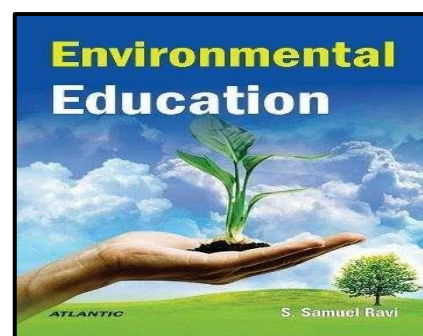
Menstrual Hygiene Management (MHM) is an indispensable part of the Swachh Bharath Mission Guidelines (SBM-G) for adolescent girls and ladies. As in step with MHM hints, 'Safe disposal' method making sure that the process of destruction of used and dirty materials is performed without human touch and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



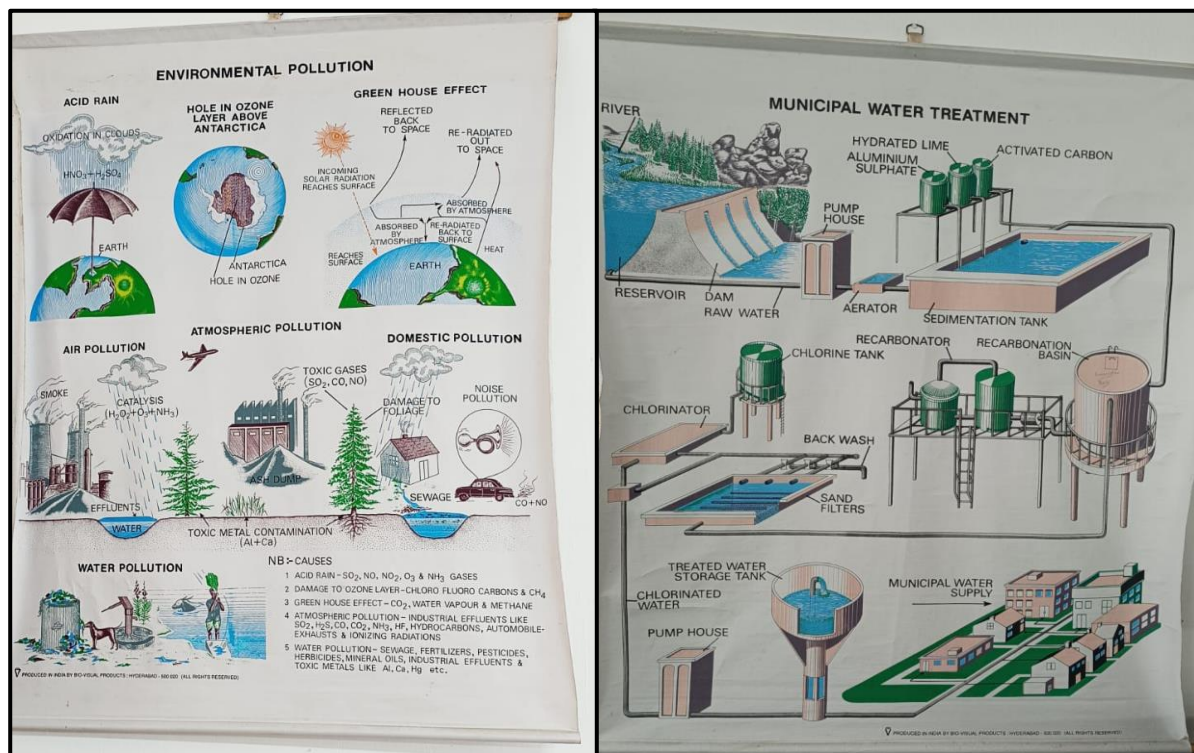
**Napkin Collecting and disposal Facilities
in St. Ann's college for women, Guntur, Andhra Pradesh.**

21.8. Environmental Education

An environmental study is the learning principle of the ecosystem and how it will expand sustainable techniques to defend the surroundings. It enables people to develop an understanding of the environment in which we live and helps to overcome tough environmental troubles affecting nature. In addition, the physical aspects of the environment should be studied, it also emphasizes the need to conserve biodiversity and undertake an extra sustainable way of life and make use of sources in a responsible manner. To create attention amongst



today's generation on pressing environmental troubles, the University Grants Commission (UGC) in India has made it mandatory for the Universities and Autonomous Colleges to introduce a course in 'Environmental studies' and teach to the students about the ecosystem, pollution and problems associated with the environment. Environmental education refers to structured efforts to deliver how natural environments function, how human beings can manage to protect the ecosystems in sustained manner (Breiting and Mogensen, 1999).



Environmental Education in St. Ann's college for women, Guntur, Andhra Pradesh.

21.9. 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



Two Wheelers are parked at proper places in St. Ann's college for women, Guntur, Andhra Pradesh.

21.10. Ventilation and Exhaust systems in Buildings

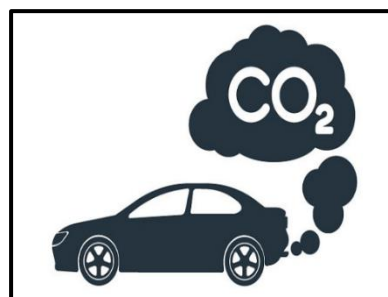
Ventilation is necessary in the buildings and continuous air flow removes 'stale' air and replace it with 'fresh' air which facilitates to moderate internal temperatures, reduce the accumulation of moisture, odours and other gases. In addition, ventilation create air movement which improves the comfort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



Ventilation and Exhaust systems in St. Ann's college for women, Guntur, Andhra Pradesh.

21.11. 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 assess the impact within defined boundary which can be helpful to derive better ways to minimize its impact. It is necessary to assess the Carbon footprints of an organization to understand how far they are contributing towards sustainable development. It is therefore essential that any environmentally responsible organizations should examine their carbon emissions and be subjected to calculate carbon footprint (Woo and Choi, 2013). The observation on carbon footprint due to electricity usage per year at the college showed 56.01 metric tons. It is calculated based on CO₂ emission from electricity per year in kWh/1000 units.

The carbon footprint due to transportation (Shuttle services) per year at campus showed 0 metric tons. It is calculated based on the number of the shuttle bus in the college multiplied with total trips for shuttle bus service each day and approximate travel distance of a vehicle each day inside campus (in kilometres), wherein, 365 is the number of working days per year is taken into account. Similar to that of the carbon footprint due to transportation in shuttle services, Carbon footprint due to car usage per year is calculated based on the number of cars entering into the campus multiplied with the approximate travel distance of a vehicle each day inside campus (in kilometres), wherein, 365 is the number of working days per year is taken into account. The recorded value of carbon footprint due to car usage per year is 0.146 metric tons. The Carbon footprint due to Motorcycle's usage per year is 3.65 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 59.806 metric tons which is the sum of the carbon emission from electricity plus transportation (bus, car, motorcycle) per year.

Calculation of Carbon Footprint Per Year in campus

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

$$\begin{aligned} & \text{The CO}_2 \text{ emission from electricity} \\ & = (\text{electricity usage per year in kWh/1000}) \times 0.84 \\ & = (66679 \text{ kWh/1000}) \times 0.84 \\ & = 56.01 \text{ metric tons} \end{aligned}$$

Notes:

Electricity usage per year = 56.01 metric tons

0.84 is the coefficient to convert kWh to metric tons

b. Transportation per year (Shuttle)

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

Notes:

365 is the number of working days per year

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

c. Transportation per year (Car)

$$\begin{aligned} & = (\text{Number of cars entering the campus} \times 2 \times \text{approximate travel distance of a vehicle} \\ & \text{each day inside campus only (in kilometres)} \times 365/100) \times 0.02 \\ & = ((1 \times 2 \times 1 \times 365)/100) \times 0.02 \\ & = 0.146 \text{ metric tons} \end{aligned}$$

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)

$$\begin{aligned} & = (\text{Number of motorcycles entering the campus} \times 2 \times \text{approximate travel distance of a} \\ & \text{vehicle each day inside campus only (in kilometres)} \times 365/100) \times 0.01 \\ & = ((50 \times 2 \times 1 \times 365)/100) \times 0.01 \\ & = 3.65 \text{ metric tons} \end{aligned}$$

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

$$\begin{aligned} & = \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\ & = (56.01 + (0 + 0.146 + 3.65)) \\ & = 59.806 \text{ metric tons} \end{aligned}$$

21.12. Auditing for Water Management in the campus

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.

21.12.1. Water Management Activities

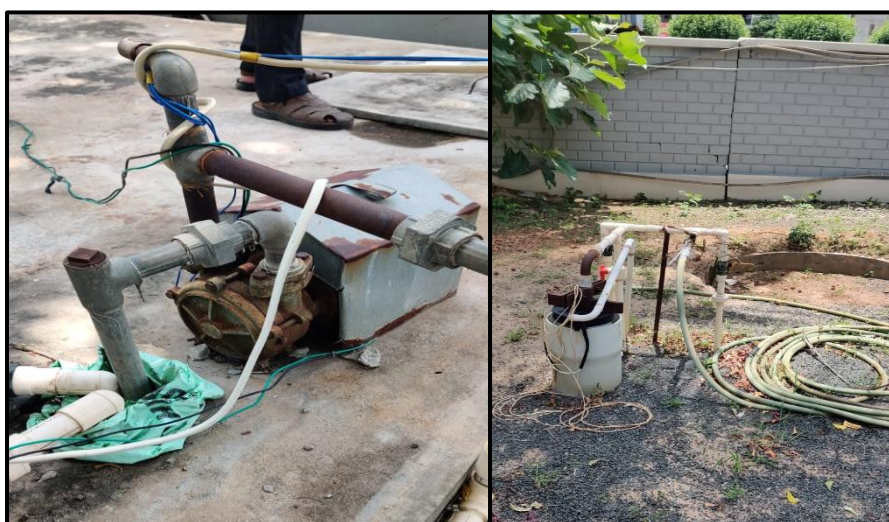
In order to conserve water resources, it is essential that any environmentally responsible institution should examine its water use practices. Water auditing is conducted for the appraisal of facilities of raw water intake and determining the facilities for water treatment and reuse. Auditor concerned investigates the relevant method that can be adopted and implemented to balance the demand and supply of water (Rajalakshmi *et al* 2023). The college is taking enough attempt to manage wastewater that are coming out from various Department laboratories, hostels and canteens. In general, water management activities are very important in terms of conserving water and its resources for future generations which in turn useful to reduce the land contamination.



R. O. Drinking Water Unit in St. Ann's college for women, Guntur, Andhra Pradesh.

21.12.2. 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.



Borewell units in St. Ann’s college for women, Guntur, Andhra Pradesh.

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

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

Rainwater Harvesting

Rainwater harvesting programme concerned with a) installation of rain gauge rain recording system a) 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.



Rainwater Harvesting Activities in St. Ann's college for women, Guntur, Andhra Pradesh.

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

21.12.4. Water Quantity Estimation

After air, water is the second most critical element for life to exist. As a result, the scientific literature has numerous descriptions of water quality. "It is the physical, chemical, and biological characteristics of water," is the most frequently used definition of water quality. Water quality is a measurement of the state of water in relation to the needs of one or more biotic species and/or to any human need or purpose.

Physico-chemical parameters of water quality

- One of the most crucial aspects of water quality is pH. It is described as the hydrogen ion concentration's negative logarithm. It is an arbitrary number that expresses how acidic or basic a solution is. Actually, water's pH is a gauge of how acidic or basic it is. Both basic and acidic water have more hydrogen (H⁺) and hydroxyl (OH) ions than usual.
- Total Dissolved Solids is referred to as TDS. It calculates the overall concentration of soluble salts and minerals in water. One mg/L of dissolved minerals, for instance, means that your water pitcher contains one mg/L of TDS.
- The salinity of a body of water, commonly known as saline water (also see soil salinity), is the degree to which salt is present. It is often measured in grammes per litre (g/L) or kilogrammes (g/kg; the latter is dimensionless and equivalent to).
- Water that is cloudy is referred to as turbid. It gauges how well light can travel through water. It is brought on by particulate matter suspended in water, including clay, silt, organic matter, plankton, and other particles.
- One of the most crucial indicators of the water quality in streams, rivers, and lakes is dissolved oxygen (DO), which is regarded as one of the factors. It is an important indicator of water pollution. The water quality improves as the dissolved oxygen concentration does.

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. The campus's various types of water were tested for pH, TDS, salinity, turbidity, and dissolved oxygen, and the results were compiled in a table 7.

Assessment of Physico-chemical property of Water of Campus

Physio-chemical property of waters such as pH, Total Dissolved Solids, Salinity, Turbidity, Dissolved Oxygen are playing important parameters to determine the quality of water. pH and EC are unusually high levels may suggest chemical contamination. Turbidity could be an indication of surface runoff and may interfere with water treatment. Bacteria and viruses can attach to suspended particles and cause health risks. High turbidity decreases water acceptability. Salinity is a naturally occurring form of the salt elements, which is sometimes found in groundwater at levels that exceed safe levels. According to the Bureau of Indian Standards (BIS), the upper limit of TDS levels in water is 500 ppm. Long term exposure to high levels of salinity and turbidity could lead to bone issues in adults and also the fertilisation of nearby farm fields or sanitation facilities located too close to the well. In most cases, these compounds aren't a serious health risk. They are harmful to infants, however, causing blue baby syndrome, which can be lethal effects.

Standards for Comparison

TDS Level (Milligram/Litre)	Remarks
Less than 50	Unacceptable as it lacks essential minerals
50-150	Acceptable for drinking. The TDS level is ideal for areas where the water polluted by sewage or industrial waste
150-250	Good. The water is ideal for people with cardiovascular disease
250-350	Good. The water is ideal for people with cardiovascular disease
350-500	Fairly acceptable
500-900	Less acceptable
900-1200	Least acceptable. Avoid drinking water that has a TDS level of 900
1200-2000	Water is not acceptable for drinking.
Above 2000	Unacceptable

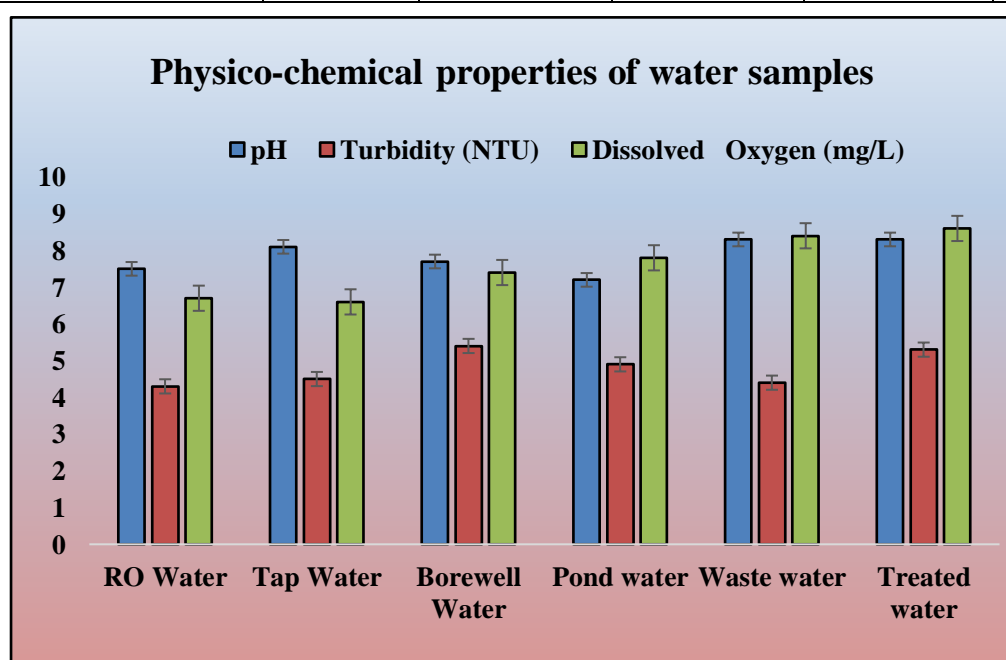
Source: <https://www.kent.co.in/blog/what-are-total-dissolved-solids-tds-how-to-reduce-them/>.

The water samples such as RO water, Tap water, Borewell water, Pond water, Wastewater and treated water samples were collected from the Organization and subjected to analyze the physicochemical parameters. The results showed that all the parameters were found to be appreciable and no harmful effect was recorded (Table 7). These parameters were observed to be within the limit of Indian standards of drinking

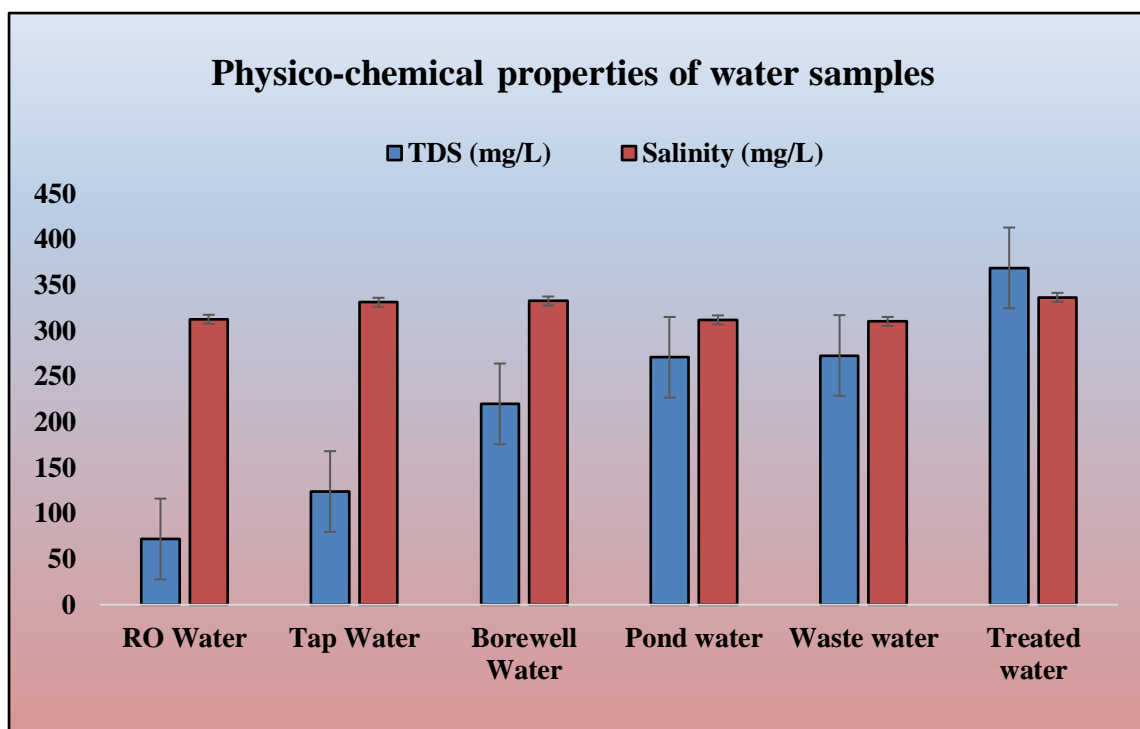
water quality. Hence the direct consumption of these waters are recommended for drinking, irrigation and domestic usage purposes. If any water samples exceed the limit of ISI standards, it could be reduced significantly by adopting reverse osmosis technology. The observed pH values were found to be 6.5 - 8.5 ranges. Similarly, the observed TSS and salinity were 0 - 900 mg/L and 300 - 380 mg/L; respectively. Turbidity and dissolved oxygen were 4.5 – 5.5 NTU and 6.5 - 8.0 mg/L; respectively as per the ISI standards.

Table 7. Physico-chemical Properties of various Water sources

S. No	Type of Waters	pH	TDS (mg/L)	Salinity (mg/L)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
1.	RO Water	7.5±0.1	72±1.0	312.7±3.1	4.3±0.2	6.7±0.2
2.	Tap Water	8.1±0.1	124±1.0	331.3±5.7	4.5±0.3	6.6±0.3
3.	Borewell Water	7.7±0.1	220±1.0	332.7±8.3	5.4±0.1	7.4±0.2
4.	Pond water	7.2±0.1	271±1.0	312±8.5	4.9±0.3	7.8±0.2
5.	Waste water	8.3±0.1	273±6.0	310.3±9.4	4.4±0.2	8.4±0.2
6.	Treated water	8.3±0.2	369±6.0	336.7±8.1	5.3±0.1	8.6±0.1
Mean		7.80	249.19	323.24	4.84	7.67
SE ±		0.09	3.93	6.72	0.16	0.13
CD at P = 0.05:		0.16	7.00	11.98	0.28	0.23



Physico-chemical parameters of water samples



Physico-chemical parameters of water and samples

21.12.5. 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 8)

Table 8. Water consumption for various purposes

S. No	Types of Consumption	Normal Range (lit/capita/day)	Average
1.	Per capita Domestic Consumption at Hostel and Canteen	75 - 125	95
2.	Industrial and Commercial Demand at Laboratories	30 - 70	55
3.	Public Uses including Fire Demand, Transport washes	10 - 60	25
4.	Losses and Waste as routine consumption	10 - 50	30
5.	Daily use (Day-to-day use)	75 - 175	125

Water is an immense requirement of any living organism. As a natural resource, we are exploiting water for various purposes in day-to-day activities. As an educational institution, water management for various activities may differ. Per capita Domestic Consumption Hostel combined with Canteen ranges between 65 – 125 litres. Industrial or laboratory demand for water is estimated ranges between 30 – 60 litres. Losses as leakages and routine consumption accounts approximately 10 – 30 litres (per capita) and other uses daily usage uses accounts another 85 - 185 litres. Public uses, watering the garden, fire demand and transport washing utilities a major portion of water.

21.12.6. 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 9)

Table 9. Water requirements calculation

S. No	Educational Institutions water requirements	Domestic use (lphd)	Flushing (lphd)	Total use (lphd)
1.	Without Boarding Facility	30	15	45
2.	With Boarding Facility	90	55	145

21.12.7. 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 10):

Table 10. 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

21.12.8. Factors affecting per capita demand of water consumption

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

22.12.9. 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

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

21.13. Climatic condition

In Guntur the climate is tropical. During the winter season, precipitation levels are significantly lower compared to those experienced in summer. The Köppen-Geiger climate classification is Aw. In Guntur, the mean yearly temperature amounts to 28.1 °C | 82.6 °F. In a year, the rainfall is 966 mm | 38.0 inch.

Because Guntur is located near the equator, the summers are not easy to define. According to our analysis, the optimal period for embarking on a journey is during January, February, March, October, November, December..

Table 11. Soil edaphic and Environmental conditions of campus

S. No	Details of Parameters	Data collected
Soil Edaphic parameters		
1.	Soil pH	6.5 – 7.5
2.	Soil type	Black cotton soils, Red loamy soils, and sandy loam
3.	Total Organic carbon	Medium (0.5-0.7)
4.	Electrical conductivity	Normal (0-2)

5.	Water holding capacity	1.35"/ft
6.	Total Nitrogen	Low (140-280 kg/ha)
7.	Available Phosphorous	High (25-45 kg/ha)
8.	Exchangeable Potassium	High (290-570 kg/ha)
9.	Available Mg and Mn contents	Mg- 5 g/kg, Mn (2.0 kg/ha)
10.	Available Zn and Fe contents	Zn- 13.8 kg/ha, Fe- (0.4-5.7 kg/ha)
Environmental parameters		
1.	Minimum Temperature	27 ⁰ C (72 ⁰ F)
2.	Maximum Temperature	34 ⁰ C (95 ⁰ F)
3.	Minimum Relative humidity	62%
4.	Maximum Relative humidity	92%
5.	Annual Average Rainfall	889.1 mm
6.	Annual Average Sunshine	12.2 hr
7.	Wind speed	18.8 kph (11.7 mph)

21.14. 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



Safety measures in St. Ann's college for women, Guntur, Andhra Pradesh.

The organization should have a police force, escort services, call boxes, first aid box, fire extinguishers, fire alarms, security systems and staffs towards the safety measures.

College has very good safety measures as per the green building conservation code such as fire extinguisher and fire bell and alarms in all the place. In addition, in all the place, 'Exit', 'Entry' and other sign boards kept across the place to give cent percent safety to the stakeholder



Sign Boards in St. Ann's college for women, Guntur, Andhra Pradesh.

21.15. 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 College 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. 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 Chennai. The Campus is conducting a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people. Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner.

Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain. Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses.

College has taken sufficient attempts to disseminate the green campus motto and green pledge as well as awareness programmes such as 'Don't cut trees', 'Don't use plastic bags', 'Don't waste waters', 'Plastic Free Zones' and 'Preserve the Natural Resources' etc. among the students and staff members in the campus. College is implemented the Government schemes (Swachh Bharath Abhiyan under Clean India Mission) to provide pure and safe water to and teach the importance of cleanliness of toilets and restrooms to rural people living in nearby hills. These activities are very important in view of the immediate vicinity to undertake all developmental activities and conduct Participatory rural appraisal programmes which is associated with socioeconomic status of the inhabitants living nearby hills, natural resources, traditional knowledge systems, cropping patterns, etc. The College is also converging interest on the progressive development of women, youth, children and in particular, "dalits" and to identify the extension and training needs of the target group through the Department of NSS.

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

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

1. '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. Ann's college for women.
5. The management has created a very good campus ecosystem for making a coexisting and sustainable environment which includes natural and planted vegetation supporting a rich biodiversity of flora and fauna.
6. A well-established Rainwater harvesting system s to recharge ground water status by collecting rainwaters from the campus coinciding with the contour of the terrain and natural drains.
7. Swachh Bharath Abhiyan and National service schemes are implemented effectively towards sanitation, solid waste management and refining drinking water quality to promote cleanliness to rural and tribal people across the Guntur district.
8. In addition to Natural Ventilation and Exhaust fans are made available in all buildings to replace 'stale' air with 'fresh' air which helps to create favourable microclimate during the occupied periods.
9. The carbon footprint with respect to the concentration of CO₂ in the atmosphere is found to be low which did not exceed the critical limit of CO₂ coinciding with pure air circulation without any contaminants in the campus.

10. To ensure Miyawaki Forest system, one student one plant concern to enrich the campus Green which provide an eco-friendly campus to the stakeholders.

23. Recommendations for sustainable environment

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

24. Conclusion

St. Ann's college for women, Guntur, Andhra Pradesh is a well-established College in India in terms of academic activities, efforts are continuously made in providing an eco-friendly atmosphere to the students, research scholars, parents and staff members. The environmental protection initiatives are substantial by means of creating solid waste management, wastewater treatment, sanitation, rainwater harvesting system and natural vegetation in the Campus without harming the environment. Campus has 'solid waste management and wastewater treatment facility to recycle the solid wastes and wastewaters; respectively. The Campus has some Technology Missions related to Green Campus and Environment sustainability as well. A campus ecosystem is supported a rich biodiversity of flora and fauna which is making a sustainable

environment and eco-friendly campus. Swachh Bharath Abhiyan is implemented effectively by the campus to promote sanitation and cleanliness to the rural/tribal people across the Guntur District, Andhra Pradesh. Environmental audit is carried out to provide an indication to company management about how the environmental Organization system and equipment's are performing. As a result, the best practicable means can be applied to preserve air, water, soil, plant and animal life from the adverse effect. To conclude an environment audit report, the College is an eco-friendly campus and providing pure atmosphere to the stakeholders and supports the nation as a whole in future generations. Further, we hope this will boost the new generation to take care of the environment and propagate these views for many generations to come by the Organization.

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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.

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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Please Update Your Profile

Welcome, Nature Science Foundation

Your Unique Id: TN/2018/0187711



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

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

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

Dated:03/09/2018

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

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

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

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

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

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

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

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

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

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

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

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



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

Copy to:

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

//CERTIFIED TRUE COPY//

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



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

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 E. 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)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

FORM NO. 10AC

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

Order for registration

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

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



Certificates of Environment Auditors

1. ISO Environment Management System (14001:2015) of Dr. S. Rajalakshmi, Chairman of NSF.
2. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dinesh kumar, Energy and Environment Auditor of NSF.
3. Tamil Nadu Fire and Rescue Service Certificate of Er. S. Srinivash, Energy Auditors of NSF.



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

Certificate of Achievement

Geethakarathi Alagarsamy

has successfully completed the above mentioned course and examination.

23rd - 27th March 2019

COIMBATORE, INDIA

Certificate No. 35242817 02

Delegate No. 171136

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

for TÜV NORD CERT GmbH

Essen, 2019-04-26

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

TÜV NORD CERT GmbH

Langemarckstraße 20

45141 Essen

www.tuev-nord-cert.com





BUREAU OF ENERGY EFFICIENCY



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

Certificate Registration No. : **9176**

Certificate For Certified Energy Manager

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

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

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

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

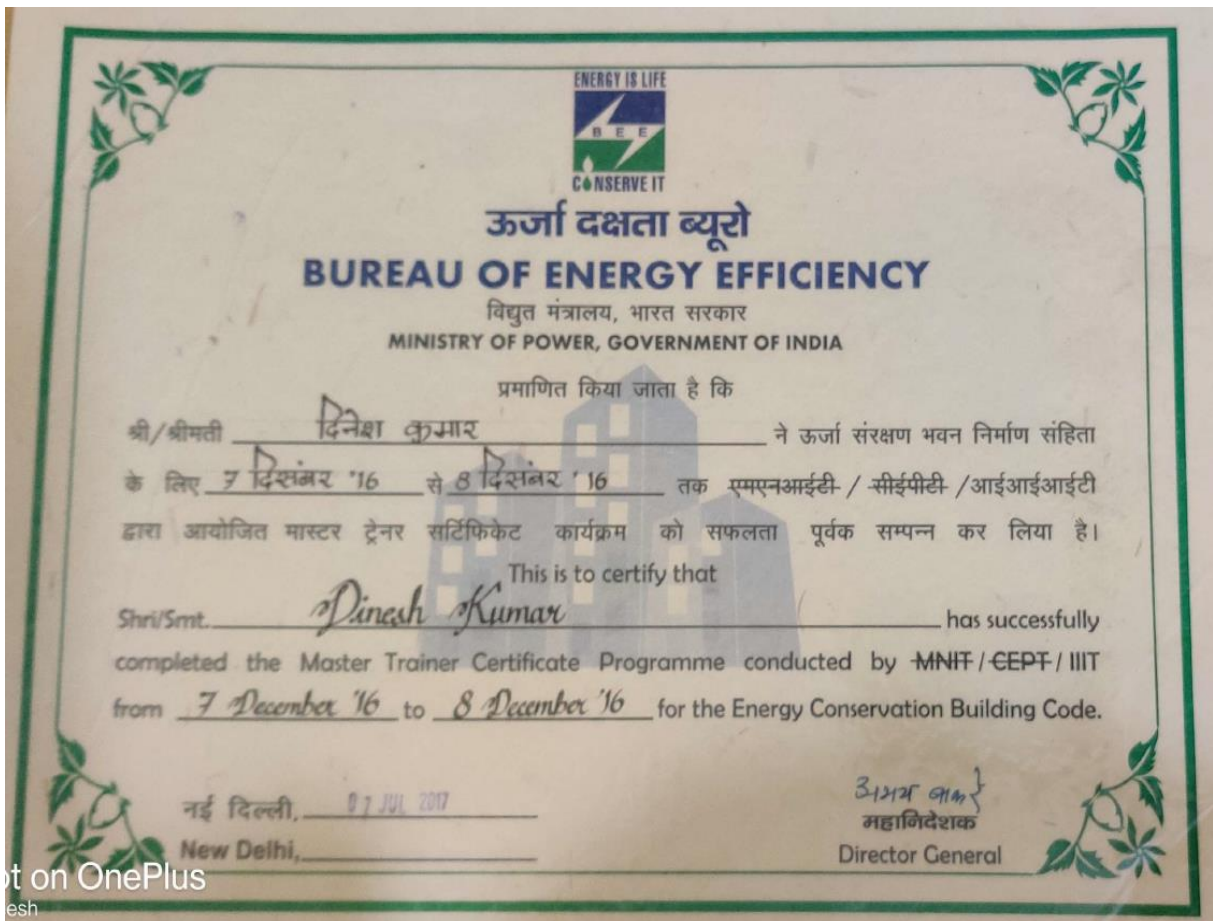
Given under the seal of the Bureau of Energy Efficiency, this **7th** day of **February, 2013**

Secretary
Bureau of Energy Efficiency
New Delhi

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

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





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

 GRIHA	
GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT GRIHA CERTIFIED PROFESSIONAL CERTIFICATE	
This is to certify that <u>Dinesh Kumar Dhanasekaran</u>	
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