REPORT OF ENERGY AUDIT

Submitted to

SVKM's Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai– 400 056, Maharashtra, India.

Date of Audit: 20.12.2021 (Monday)

Submitted by

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1. Introduction

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

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

Energy Conservation Building Code (ECBC) is established in the year 2017 which provides minimum requirements for the energy-efficient design and construction of buildings across India. It also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements (Gnanamangai *et al*., 2021). Bureau of Energy Efficiency (BEE) came into force in 2002 towards implementation of energy saving practices in an Organization. Energy-efficiency labels are information affixed to manufactured products and usually communicate the product energy performance (Ingle, 2014). BEE has developed a scheme for energy efficiency labelling of buildings coinciding with the star ratings of the building at accelerating energy efficiency activities. BEE Star Rating Scheme is based on actual performance of the building as well as equipment in terms of specific energy usage termed as 'Energy Performance Indicator' by means of star ratings labelled items used which will be useful for energy savings in a sustainable manner (Mishraand and Patel, 2016).

Energy audit programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on. In general, an energy audit process dealt with the driving conservation concepts into reality by giving technically possible solutions within a specified time

limit while also considering the economic and other organizational issues (Asnani and Bhawana, 2015). It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of production in terms of savings. It serves as a "benchmark" (reference point) for managing energy in the organization for planning more energy-efficient use across the board (Cabrera *et al*., 2010).

2. Need for an Energy Audit

In any Organization, the three top operating expenses are often found to be energy (both electrical and thermal), labour and materials. If one were to relate to the manageability of the cost or potential cost savings in each of the above components, energy would invariably emerge as a top ranker, and thus energy management function constitutes a strategic area for cost reduction. Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists. The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmes which are vital for production and utility activities. Such an audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified time frame. The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. Energy Audit provides a "bench-mark" (Reference point) for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization.

Eco-campus concept mainly focuses on the efficient use of energy and its conservation including savings opportunities in a sustainable manner. It also focuses on the reduction of contribution to carbon emissions, carbon footprint calculation, procurement of star rated equipment for a cost effective and secure supply of energy, encourage and enhance energy use conservation in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

Auditing for Energy Management may be studied in terms of energy savings and opportunities. In general, energy cannot be seen, but we know it is there in wire, pipes and other non-living materials because we can see its effects in the forms of heat, light and power. This indicator addresses energy consumption, energy sources, energy monitoring, lighting, vehicle movement, electrical and electronics appliances, and transportation. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. However, energy saving and opportunities may be taken into consideration while energy is extensively used. An old incandescent (tungsten) bulb uses approximately 60W to 100W while an energy efficient light emitting diode (LED) uses only less than 10W which indicated the positive indication on energy savings. Energy auditing deals with the conservation and

methods to reduce its consumption related to environmental degradation. In addition, suggestions and recommendations might be given after auditing which in turn useful for energy savings. It is therefore essential that any environmentally responsible institution examine its energy use practices at least once in two years using internal and external auditors.

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

3. Aims and Objectives of an Energy Audit

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an Organization. The aim of an energy audit is to identify the energy efficiency, conservation and savings opportunities at the premises of the audit sites in a systematic manner. The audit process is carried out as per the following.

- Review of energy saving opportunities and measures implemented in the audit sites.
- Identification of additional various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board.
- List ways that the use of energy in terms of electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others.
- Analysis of electricity bill amount for the last two to three years, amount paid for LPG cylinders for last one year and amount paid for water consumption for human beings and watering to the plants.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, air conditioners, cooling apparatus, heaters, computers, photo copiers, inverter, generators and laboratory equipment and instruments installed in the organization (for example- 60 watt bulb x 4hours x number of bulbs = kwh).

- Alternative energy sources / nonconventional energy sources are employed / installed in the organization (photovoltaic cells for solar energy, windmill, energy efficient stoves, Biogas, etc.).
- Creating awareness among the stakeholders on energy conservation and utilization.

4. Benefits of an Energy Audit

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

- **Energy audit Opportunities:** The audit will not only inform about the opportunities but also provide information with financial analysis. This will enable prioritization based on financial benefit and return on investment. It provides technical information regarding the proposed energy conservation measures.
- **Energy audit quality analysis:** A good quality audit will analyse the historical energy use and find potential issues using statistical methods. Provide information with emissions analysis to help understand the benefits of the decisions from an environmental standpoint. Understand where energy is used and which areas are worth focusing on the most. Provide benchmark information to help understand the energy use performance compared to others.

5. Procedures followed in an Energy Audit

In order to conduct an energy audit, several methods are adopted in the audit sites in which walk-through audit is conducted. The balance of total energy inputs with total energy outputs and identification of all energy streams in a facility are taken into account. The amount of energy used by each of its energy streams are calculated as per the methodology mentioned in the Manual of Gnanamangai *et al*. (2021). The top three operating expenses of the Organization are typically observed to be energy (both electrical and thermal), labour and materials. During the audit, physical verification of Lighting, Ceiling, Table and Exhaust Fans, A/C machines, Solar panels, Heaters, Generators, Uninterrupted power supply machines and ventilators load fixtures and verification of installed energy efficient system's capacities are carried out. Inspection of when the cost or prospective cost savings in each of the above components are considered, energy always wins, and the energy management task becomes a key cost reduction area. The energy audit assisted in better understanding how energy and fuel are used in the Organization as well as identifying waste factors and development potential towards energy savings opportunities. Finally after the audit process, the energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the auditee (Organization).

The audit involved visiting the campus and physical verification of the loads and sources installed. The entire campus is divided into different sections and those sections are audited in which electrical fittings and energy supply are monitored. The production process flow is studied and electricity consumption are measured. Location of the electrical machines, conditions of them and their accessories are inspected through physical verification is observed as per the regulation of Indian Green Building Council (IGBC, 2021) and World Green Building Council (WGBC, 2021). The energy bill from the supply utility company (Example: Tamil Nadu Electric Generation and Distribution Corporation Limited, Chennai) is audited and assessed for the load demand requirement and efficient consumption of energy. Stakeholders are interacted with the scope for improvement and energy management during the audit. Potential areas in which the scope of energy conservation and saving opportunities available in the current context have been identified and suggested for implementation to the Organization. The level of carbon dioxide might be measured in different places across the Organization campus using a portable CO_2 Analyzer to calculate the carbon footprint. It may be useful to check where carbon emission is prominent which could be taken into account to reduce.

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

6. Types of Energy Audit

The type of Energy Audit to be performed depends on:

- Function and type of industry
- Depth to which final audit is needed, and
- Potential and magnitude of cost reduction desired

Thus Energy Audit can be classified into the following two types.

I. Preliminary Energy Audit
II. Detailed Energy Audit
III. Potential and magnitude of Energy Audit
IV. Comprehensive Energy Audit

6.1. Preliminary Energy Audit Methodology

Preliminary energy audit is a relatively quick exercise to:

- Establish energy consumption in the organization
- Estimate the scope for saving
- Identify the most likely (and the easiest areas for attention
- Identify immediate (especially no-/low-cost) improvements/ savings
- Set a ‘reference point’
- Identify areas for more detailed study/measurement
- Preliminary energy audit uses existing, or easily obtained data.

6.2. Detailed Energy Audit Methodology

A comprehensive audit provides a detailed energy project implementation plan for a facility, since it evaluates all major energy using systems. This type of audit offers the most accurate estimate of energy savings and cost. It considers the interactive effects of all projects, accounts for the energy use of all major equipment, and includes detailed energy cost saving calculations and project cost. In a comprehensive audit, one of the key elements is the energy balance. This is based on an inventory of energy using systems, assumptions of current operating conditions and calculations of energy use. This estimated use is then compared to utility bill charges. Detailed energy auditing is carried out in three phases: Phase I, II and III.

Phase I - Pre Audit Phase
Phase II - Audit Phase
Phase III - Post Audit Phase

6.3. Potential and Magnitude of Energy Audit

A structured methodology to carry out an energy audit is necessary for efficient working. An initial study of the site should always be carried out, as the planning of the procedures necessary for an audit is most important.

Initial Site Visit and Preparation Required for Detailed Auditing

An initial site visit may take one day and gives the Energy Auditor/Engineer an opportunity to meet the personnel concerned, to familiarize him with the site and to assess the procedures necessary to carry out the energy audit.

During the initial site visit the Energy Auditor/Engineer should carry out the following actions: -

- Discuss with the site's senior management the aims of the energy audit.
- Discuss economic guidelines associated with the recommendations of the audit.
- Analyse the major energy consumption data with the relevant personnel.
- Obtain site drawings where available – building layout, steam distribution, compressed air distribution, electricity distribution etc.
- Tour the site accompanied by engineering/production

The main aims of this visit are:

- To finalise Energy Audit team
- To identify the main energy consuming areas to be surveyed during the audit.
- To identify any existing instrumentation/ additional metering required.
- To decide whether any meters will have to be installed prior to the audit eg. kWh, steam, oil or gas meters.
- To identify the instrumentation required for carrying out the audit.
- To plan with time frame
- To collect macro data on major energy consuming centers
- To create awareness through meetings/ programme.

6.4. Comprehensive Energy Audit

Depending on the nature and complexity of the site, a comprehensive audit can take from several weeks to several months to complete. Detailed studies to establish, and investigate, energy and material balances for specific plant departments or items of process equipment are carried out. Whenever possible, checks of plant operations are carried out over extended periods of time, at nights and at weekends as well as during normal daytime working hours, to ensure that nothing is overlooked.

The audit report will include a description of energy inputs and product outputs by major department or by major processing function, and will evaluate the efficiency of each step of the Organization. Means of improving these efficiencies will be listed, and at least a preliminary assessment of the cost of the improvements will be made to indicate the expected payback on any capital investment needed. The audit report should conclude with specific recommendations for detailed engineering studies and feasibility analyses, which must then be performed to justify the implementation of those conservation measures that require investments. The comprehensive energy audit may be useful to identify the consuming areas to be surveyed during the audit and to identify any existing instrumentation/ additional metering required. A care should be taken to identify the instrumentation required for carrying out the audit and to plan with time frame including the collection macro data on major energy consuming centers. It will be definitely useful for energy management towards energy savings opportunities.

The information to be collected during the detailed audit includes:

1. Energy consumption by type of energy, by department, by major items of process equipment, by end-use
2. Energy cost and tariff data
3. Generation and distribution of site services (eg. compressed air, steam).
4. Sources of energy supply (e.g. electricity from the grid or self-generation)
5. Potential for fuel substitution, process modifications, and the use of co-generation systems (combined heat and power generation).
6. Energy Management procedures and energy awareness training programs within the establishment.

   Existing baseline information and reports are useful to get consumption pattern. The audit team should collect the following baseline data:
   - Technology, processes used and equipment details
   - Capacity utilisation
   - Water consumption
   - Fuel Consumption
   - Electrical energy consumption
   - Steam consumption
   - Efficiencies / yield

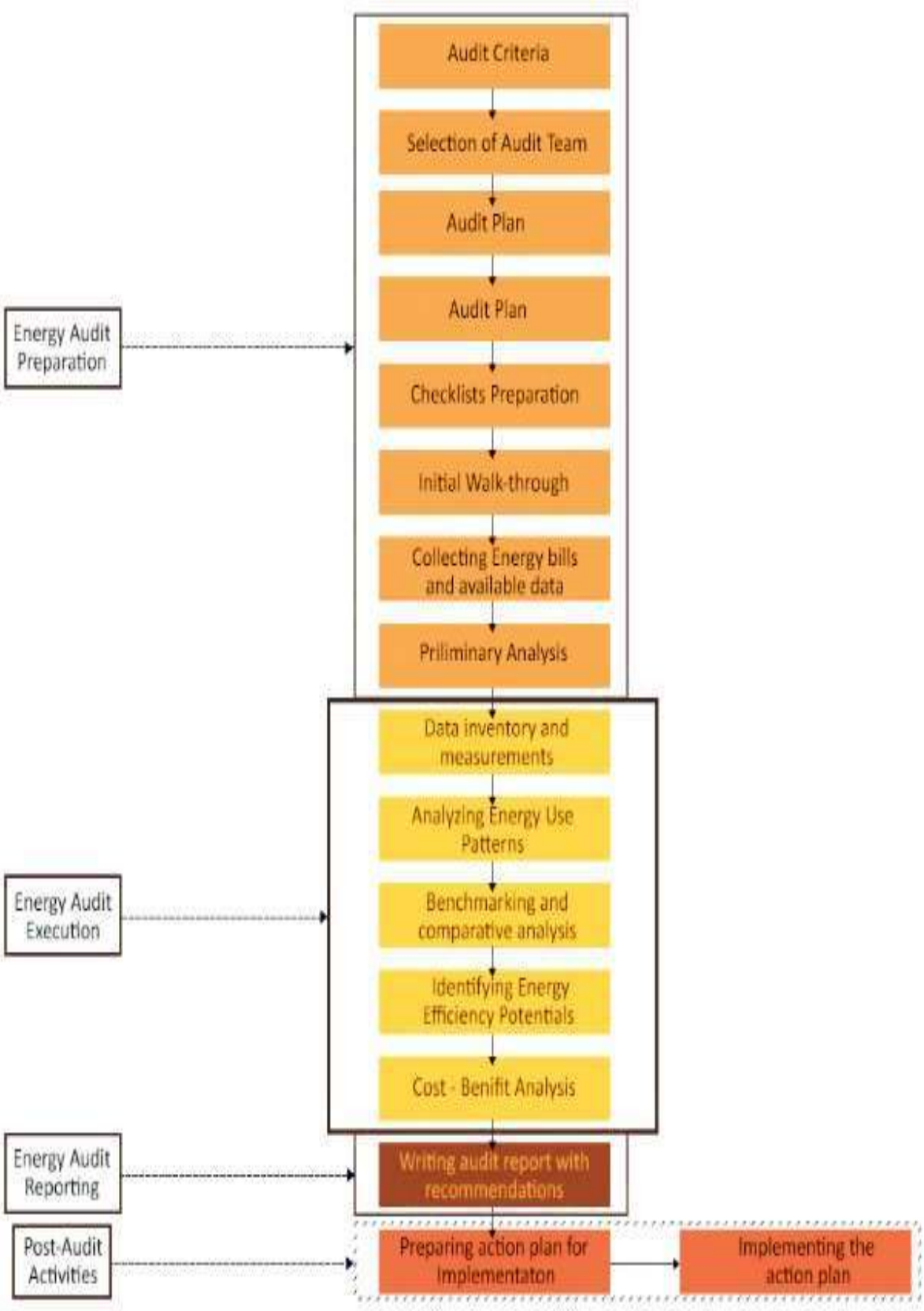
7. Carbon footprint by measuring Carbon dioxide level in the Campus

The level of Carbon dioxide is measured in different places across the Organization campus using a portable CO_2 Analyzer (Non dispersive infra-red meter). In addition, CO_2 meter is also displayed the readings of atmospheric temperature, relative humidity and dew point in the places, where the level CO_2 is measured. The meter started measurements of CO_2 level in the atmosphere after powered ON and updated the readings every second in the display screen. If the operating environment is changed (example from high to low temperature) which took 30 seconds for CO_2 sensor to respond and 30 minutes for flexibility in relative humidity. The meter features an audible alarm to give warnings when CO_2 concentration exceeds the set limit. It emits beeps (Abt.80Db) when CO_2 level goes over the set value and stops when any key (except SET) is pressed or the readings fall below the set values.

The Carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO_2 emission from electricity and the sum of transportation per year in terms of number of the shuttle buses service operated by the Organization and number of cars, motorcycles and trucks entering in the Organization campus. These factors are multiplied with total number of trips in each day and approximate travel distance of vehicles covered in each day with a coefficient (0.01) to calculate the emission of CO_2 in metric tons per year.

Humans contribute an increase of carbon dioxide emissions by burning fossil fuels, deforestation, and cement production. Methane (CH_4) is largely released by coal, oil, and natural gas industries. Human activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years. The largest source of greenhouse gas emissions from human activities is from burning fossil fuels for electricity, heat, and transportation.

The Methodology of the Audit is presented in the following chart:



Flow chart of Energy Audit Methodology

Calculating Carbon footprint

8. Energy Audit Process

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

Opening Meeting for the conduct of Energy audit

Walk through audit

8.1. Steps involved in an Energy Audit

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

8.2. Systems studied during the Energy Audit

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

8.3. Planning and organizing the Energy Audit

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

8.4. Walk-through Audit Process

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

8.5. Macro Data collection and observation

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

8.6. Measurements in the Energy Audit process

An energy audit required measurements, such as the energy identification and quantification, and these quantities necessitate the instruments used in a consistent way. Some of the basic electrical parameters are monitored during the energy audit such as Voltage (V), Current (I), Power factor, active power (Kw), apparent power (demand in Kva), reactive power (Kvar), energy consumption (Kwh), frequency (Hz), harmonics, illumination level, etc. Temperature and heat flow, radiation, air and gas flow, liquid flow, speed, air velocity, noise and vibration, dust concentration, TDS, Ph, moisture content, relative humidity, flue gas analysis – CO_2, O_2, CO, SO_x, NO_x, combustion efficiency are the mechanical, thermal and other parameters that are analysed during the audit depending upon the requirements.

9. About the Institution

Usha Pravin Gandhi College of Arts Science and Commerce is blossoming into an institution par excellence. With over a decade of fruitful and dedicated service, it has earned an enviable reputation. It is only possible because of untiring efforts of the faculty and staff of the institution, with good team work of faculty, the healthy cooperation of the students and the unstinting support of the Management. The college has been achieving distinction in academics and winning laurels in sports, cultural events and social work. With University rankers to boast of, UPGCASC is definitely a place for all aspiring students.

Along with sports, co-curricular and extra-curricular activities, the institute has a placement cell too, which interacts with the leading industries, arranges campus interviews and offers ample job opportunities and internships to students of all disciplines. In addition to curricular development, great emphasis is laid on character-building, discipline and life skills in students.

Ever since the inception of this college in 2003, The institution have been striving for academic excellence in areas of Mass Media, Information Technology (Graduation and Post-Graduation) and Management studies and at the same time

marching forward with a mission of professional, intellectual, personal and social development of students.

UPGCASC had hosted and organized an International Conference, with the theme “Spirituality of Workplace”. The conference resulted in a spiritual and secular environment in all areas and avenues in life is the only answer to man’s quest for peace and harmony.

SVKM’s Usha Pravin Gandhi College of Arts and Science established in the year 2003 affiliated to the University of Mumbai. The institution has been recognized by UGC, AICTE and ICMR and the courses offered are B.A., B.Com., B.Sc., BBA., M.A., M.Com., M.Sc., M.Com., MCA., MBA., M.Phil., M.S.(Res)., PhD., D.Sc., D.Lit. The total area of the institution is 15958.80 sq.mts. The total number of students studying in the institution are 1775 students with 25 teaching and 16 non-teaching staffs. The institution strives to empower students with knowledge and skills in their chosen fields, by providing opportunities to realize their potential by motivating them towards community linked initiatives, thereby shaping them into future leaders.

Usha Pravin Gandhi College is maintaining more than 20% of green cover area and open unutilized landfills zone after building construction as per the guidelines of World Green Building Council, Indian Green Building Council, Environmental Regulations and Compliances.

10. Audit Details

Date/Day of Audit	**: 20.12.2021 (Monday)**
Venue of Audit	**: Usha Pravin Gandhi College of Arts Science and Commerce**, Mumbai, Maharashtra, India.
Audited by	**: Nature Science Foundation,** Coimbatore, Tamil Nadu, India.
Audit type	**: Energy Audit**
Name of ISO EMS Auditor	**: Mrs. S. Rajalakshmi,** Chairman & ISO QMS, EMS Auditor, NSF.
Name of Lead Auditors	**: Dr. R. Mary Josephine,** Board of Directors, NSF. **Er. B. Vijayalakshmi,** Deputy Director & Certified Energy Auditor, NSF.
Name of Energy Auditors	**: Er. D. Dinesh Kumar**, BEE Certified Energy Auditor, NSF. **Dr. P. Ponmurugan,** Certified Lead Auditor.
Name of IGBC AP Auditor	**: Dr. B. Mythili Gnanamangai,** Vice-Chairman & ISO EMS Auditor, NSF IGBC AP, Indian Green Building Council.

11. Observations of the Energy Audit

11.1. Facilities visited during the Energy Audit

Date	Section where Energy Audit is conducted
20-12-2021	Administrative Block
	Power House
	Faculty Rooms
	Classrooms
	Seminar Halls
	Auditorium
	Laboratories
	Computer Centres
	Well, Sump and pumps.
	Sewage Treatment Plant
	Hostel
	Library

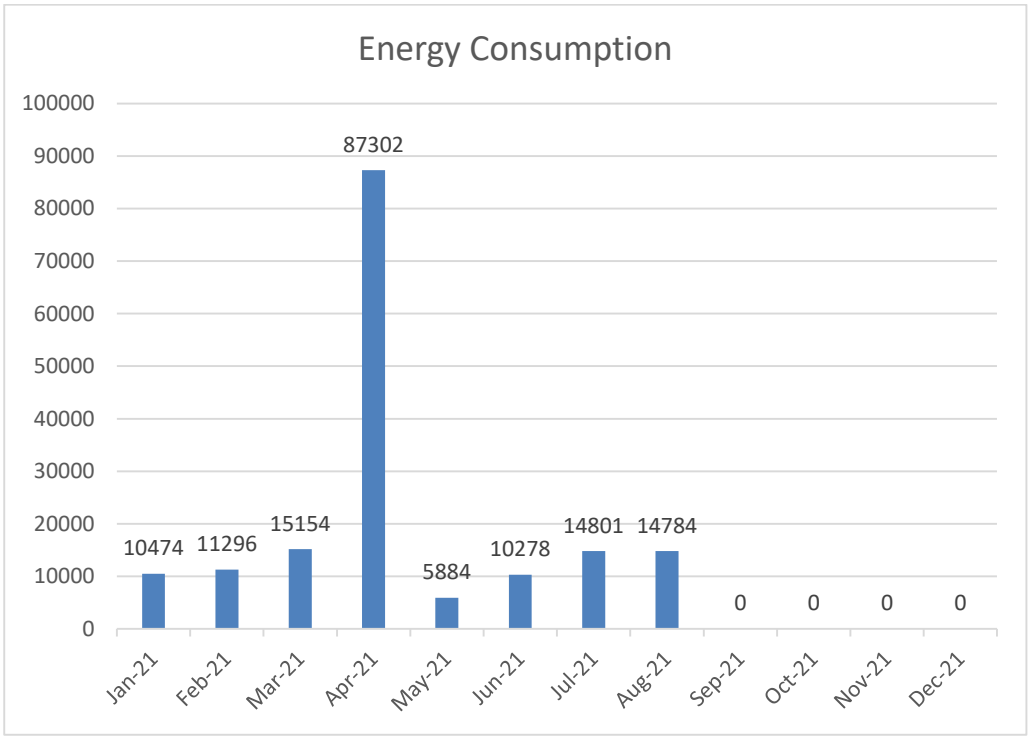
In the sections, the services offered are monitored, verified and analysed on the aspects of energy consumption. In all these areas lighting systems forms the major consumer of electrical energy. Three phase electricity service connections available in the campus are provided by Adani Electricity Mumbai Ltd (Ac/No : 150780599). The electricity consumption charges are audited and studied for the load demand requirement and efficient consumption of energy. Stake holders are interacted and the scope for improvement has been discussed. Potential areas in which scope of energy conservation and saving opportunities available have been identified and suggested for implementation.

11.2. Systems Studied during the Energy Audit

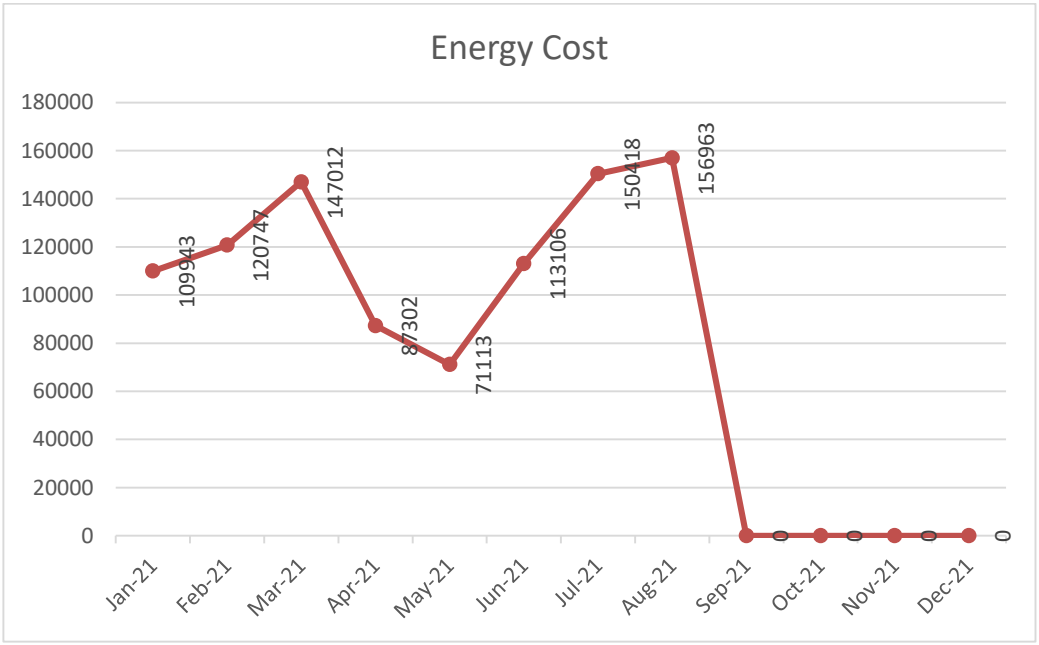
1. Lighting fixtures are verified physically.
2. Installation of energy efficient lighting systems are verified.
3. Installation of safety systems are verified
4. Installation of power backup systems (generators and UPS) are verified on the aspect of maintenance and consumption.
5. Electricity consumption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

11.3. Energy Consumption and Cost Profile

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



Energy Consumption Profile



Energy cost profile

Average energy consumption per stakeholder per month: 0.25 kWh.

11.4. Power supply Equipment and Major Loads

Table 1. Major Equipment related to Electrical energy utilization

S.No	Equipment/ Utility	Rating/ Capacity	Quantity
1.	Tube Light LED	16 W	35
2.	Tube Lights	18 W	461
3.	Solar Panel	12 kW	1
4.	Ceiling Fans	70 W	111
5.	Refrigerators	250 W	2
6.	Lift		2
7.	AC (Split, Window and Centralized AC)	1500 W	37
8.	Pedastal Fans	70 W	3
9.	Exhaust Fans	90 W	9
10.	Automatic Lights	9 W	1
11.	Podium Containing Mike, Speakers, Amplifiers, Radio, Camera, Sensors etc	220 W	4

11.5 Quantitative and Qualitative Measurement

S.No.	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have internal Energy audit procedures been developed and implemented in the Organization?	✓		
2.	Have programmes for the achievement of energy efficiency and conservation objectives been established and implemented as on today in the campus?	✓		
3.	Has a Management Representative, Electrical Engineer, Staff incharge been assigned for energy savings on power consumptions?	✓		
4.	Have programmes for the achievement of prescribed financial outlay for current bills for each building in the campus towards power consumptions?		✓	
5.	Has the organization ensured that personnel performing environmental specific tasks have the required knowledge on energy audit (e.g. education, training programme, seminar, workshop, camp, etc.)?	✓		
6.	Are objectives and targets documented towards energy audit periodically and any Register is made?	✓		
7.	Any analysis of energy flows for energy conservation in terms of the amount of energy input into the system without negatively affecting the output in buildings		✓	

8.	Implications of alternative energy efficiency measures sufficient to satisfy the financial criteria of sophisticated investors	✓		
9.	Identification of the most efficient and cost-effective Energy Conservation Opportunities (ECOs) or Measures (ECMs) taken by the Management		✓	
10.	Are the following energy efficiency and conservation aspects considered in sufficient detail?			
	a. Fluorescent (tube) lights, Incandescent lamp and sodium vapour lights are replaced with CFL / LED	✓		
	b. Number of Uninterruptible power supply (UPS) and Power generators for power back-up to alternative current supply facility in each building	✓		
	c. Number of solar panels, solar lights, solar water heaters, electric water heater installed	✓		
	d. Automatic sprinkler system used for irrigation purpose	✓		
	e. Ultra-violet lights and any other harmful lights used with safety precautions	✓		
	f. Attempt in reducing the energy expense and carbon footprint	✓		
	g. Disposal facility for hazardous arise from electrical gadgets, equipment and installation	✓		
	h. Renewable energy utilization (solar panel, wind mill)	✓		
	i. Natural / Mechanical air ventilation at Indoor / Outdoor auditorium, stadium, seminar halls, etc.	✓		
	j. Sign boards indicating Switch OFF / ON, Danger at Electrical equipment and Power transformers in the campus	✓		
11.	Signing of MoU with Govt. and NGOs to ensure about the energy conservation and efficiency in the campus	✓		
12.	Conduction of awareness programmes and outreach programmes on the energy conservation and efficiency		✓	
13.	The details of public transport, battery operated / electric vehicles, biofuel use, exhaust fans, boiling water system, chillers and geysers on energy savings mode		✓	
14.	Projects and Dissertation works on the energy conservation and efficiency carried out by students and staff members		✓	
15.	Steps taken to take care of daylighting, AC machines heat emission and ecofriendly Refrigerators, etc.	✓		

16.	Use of water metering, IoT based energy efficiency practices, remote waterlines, automation of electrical fittings and gadgets to save energy		✓	
17.	Are all monitoring electrical equipment appropriately maintained and calibrated?	✓		
18.	Are any energy conservation technologies and retrofit for energy conservation equipment being implemented?	✓		
19.	Skylight roof ratio, fenestration plan and Daylight illuminance in building construction towards energy efficiency*		✓	
20.	Any Automatic Lighting Shutoff with occupancy Sensors and Timers, Exterior / Interior lighting control facility*		✓	
21.	Have any rooms and guest suites a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles*		✓	
22.	Total electricity usage divided by total campus' population (kWh per person)	✓		
23.	The ratio of renewable energy production divided by total energy usage per year	✓		
24.	Total carbon footprint divided by total campus' population (metric tons per person)	✓		
25.	Elements of green building implementation as reflected in all construction and renovation policies	✓		
26.	Greenhouse gas emission reduction awareness programme to the stakeholders	✓		

11.6. Measurement of Carbon dioxide level in the Campus

Despite a massive increase in global warming, environmental changes and human population including many commercial activities now-a-days, the amount of carbon in Earth's atmosphere is playing an important role which act as a global indicator for checking the purity of the atmosphere. Using a portable CO_2 Analyzer, the level of carbon dioxide was measured in different places across the Usha Pravin Gandhi College campus. The observation showed that the concentration of CO_2 in the atmosphere is found to be low which did not exceeds the critical limit of CO_2. It is further revealed that all the selected locations are having pure air with good air exchange which are free from pollutants (Table 6).

Carbon footprint, amount of CO_2 emissions associated with all the activities of the College or other entities like building construction and anthropogenic activity by human beings includes direct emissions, such as those that result from fossil-fuel combustion in manufacturing, heating, and transportation, as well as emissions required to produce the electricity associated with goods and services consumed. In addition, the carbon footprint concept also often included the emissions of other greenhouse gases.

Table 6. Measurement of CO_2 Concentration in Usha Pravin Gandhi College of Arts Science and Commerce

S.No.	Different locations of the Organization's campus	Carbon dioxide level (ppm)	Remarks
1.	Classroom	452	CO_2 level is low
2.	Office	469	CO_2 level is low
3.	Staff Room	460	CO_2 level is low
4.	Auditorium	589	CO_2 level is low
5.	Library	568	CO_2 level is low
6.	Parking	398	CO_2 level is low
7.	Open Space	370	CO_2 level is low

Reference of Set values of CO_2 level

- 350-1000 ppm: Typical level found in occupied spaces with good air exchange along with pure air.
- 1000-2000 ppm: Moderate level associated with complaints of drowsiness and poor air quality.
- 2000-5000 ppm: Critical level associated with headaches, sleepiness, and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may present.

Calculation of Carbon Footprint at Usha Pravin Gandhi College with respect to electricity usage

The Carbon footprint calculation can be conducted based on the stage of calculation as stated in www.carbonfootprint.com, which is the sum of electricity usage per year.

The CO_2 emission from electricity
= (electricity usage per year in kWh/1000) x 0.84
= (169973 kWh/1000) x 0.84
= 142.777 metric tons

Notes:

Electricity usage per year = 169973 kWh
0.84 is the coefficient to convert kWh to metric tons.

CO_2 level measurement at various locations of UPG College

11.7. Ways to reduce Carbon Footprint

Understanding the carbon footprint can help limit the impact of your consumption on the environment. Small changes can make a big difference in the long run, for example when it comes to transportation, food, clothing, waste, etc. Here are some tips:

Food

- Consume local and seasonal products.
- Limit meat consumption, especially beef.
- Select fish from sustainable fishing.
- Bring reusable shopping bags and avoid products with excessive plastic packaging
- Make sure to buy only what you need, to avoid waste

Clothing

- Take good care of your clothes
- Try swapping, borrowing, renting or buying second-hand
- Buy responsibly-made clothes, e.g. made from recycled material or with an eco-label

Transport

- Cycle or use public transport
- Be smart about when and how you drive

Energy and waste

- Turn down the heating by 1°, it will already make a difference

- Take short showers
- Turn off the water while you brush your teeth or clean the dishes
- Unplug your electronic equipment and don't leave your phone on charge when the battery is already full
- Select energy efficient products with an "A" label (EU Energy label)
- Limit and recycle your waste.

12. Best Practices followed in the Organization

- Transformer, Generators and UPS are protected properly with fencing and kept awareness boards on 'Dangers' and 'Warnings'.
- Most of places, sign board of 'Switch ON' and 'Switch OFF' are kept towards saving energy measures to the stakeholders.
- Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members.
- Installed roof top solar power plant.
- Solar water heaters are installed and they are functioning well.
- Installed automatic switches with sensors.
- HVLS Fans are fitted in the auditorium.
- Water level controllers are used.
- Power factor is maintained near to unity with APFC.
- STP is used for water recycling which is functioning well.
- VFDs based Lift and ACs.
- Replaced old generation computers and TVs with LED monitors.
- Availability of Drip and Sprinkler Irrigation system.
- Promoting ECON awareness and practice among the stakeholders are being conducted periodical through Association, Clubs, Forums and Chapters.
- Usage energy efficient light-emitting diode (LED) bulbs instead of incandescent and CFL bulbs and Installation of Solar Street lights.
- Maintainanace of appliances and replaced old appliances in all laboratories
- Value added / Non-formal / Certificate / Diploma course on 'Energy and Environment Management Audits' are being conducted for the benefit of students and research scholars to become a certified Lead Auditor.
- Establishment of a system of carpooling among the staff members and students to reduce the number of four wheelers coming to the College.
- Discouraging the students and research scholars using two wheelers for their commutation in the campus.
- Switching off the lights, fan, air conditioners, equipment and instruments when they are not in use.

Walk-through Audit Conducted at various locations in UPG College Campus and the Energy Equipments were inspected

Best Practices Followed at UPG College Campus

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

The energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for utility operation in the audit sites.

- Procurement of equipment with energy efficiency (4-5 star rated equipment) during replacement may be considered.
- Optimal water usage and temperature settings may be used which are coming under automatic process towards energy savings.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- Turn off electrical equipment when not in use
- Use computers and electronic equipment in power saving mode.
- Installation of Biogas plant for hostel kitchen as well canteen.
- Automatic switches with occupancy sensors in common areas
- Inclusion of on campus e-vehicle.
- Monthly use of electricity in the College is very high which may be reduce to a greater extent by means of undertaking a periodical energy audit.
- There are fans of older generation and non-energy efficient which can be phase out by replacing with new energy efficient fans.
- Regular monitoring of equipment in all laboratories and immediate rectification of any problems.

14. Recommendations on Carbon Footprint in the Organization

- Introduce College bus services to the students and staff members across the city.
- Encourage students and staff members to use cycles and battery operated vehicles.
- Establish a more efficient cooking system to save gas in hostel kitchen and canteen.
- More use of generators, inverters and UPS every day should be discouraged.
- Large number of ventilation and exhaust systems may be placed in auditorium, seminar and conference halls to reduce the carbon dioxide level among the participating students, scholars and staff members.

15. Conclusions

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial. Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. There are some best Practices followed on Energy Audit in the 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 places, sign board of ‘Switch ON’ and ‘Switch OFF’ are kept towards saving energy measures to the stakeholders. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members. Adaptation of drip and sprinkler irrigation 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 prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.

16. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Management and Principal of Usha Pravin Gandhi College of Arts, Science and Commerce, Mumbai, Maharashtra, for providing us necessary facilities and co-operation during the energy audit process. This helped us in making the audit a success. Further, we hope that the best practices on sustainability followed by the Organization and recommendations and suggestions given by the NSF will boost the new generations to take care of the Electrical energy conservation, Energy saving measures and sustainability incompliance with the applicable regulations, policies and standards in the College Campus.

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Certificates of
Nature Science Foundation, Coimbatore, Tamil Nadu.

1. ISO Certificate
2. 12A Certificate
3. 80G Certificate

QUALITY MANAGEMENT SYSTEM

Certificate of Registration

ROHS

This is to Certify That The Quality Management System of

NSF

NATURE SCIENCE FOUNDATION

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

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

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

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

IAF

eiaci

035-CB-QMS

DIRECTOR

ROHS Certification Pvt. Ltd.

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.

F.2984

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
Rajes. S. Ponnuswamy
17/07/19
17/07/2019

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

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

2. This approval shall be valid in perpetuity with effect from **A.Y. 2019-20** unless specifically withdrawn. **The details and validity of the certificate is available @ office.incometaxindia.gov.in**

3. The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually **to** the Assessing Officer having jurisdiction over the case.

4. No change in the Trust Deed/~~Memorandum of Association~~ shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai**.

5. Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. **URNo. AACTN7857J/05/18-19/T-1105/80G** and date of this order i.e. **10.04.2019.**

6. Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.

Sd/-
(G.M.DOSS, 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.

Certificates of Energy Auditors

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Founder & Chairman of NSF.

2. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.

3. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, and Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.

4. Energy and Environment Engineering (EEE Auditor) of Er. B. Vijayalakshmi, Deputy Director of NSF.

5. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dinesh kumar, Energy Auditor 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 TN00

Note: The course conforms to the principles and practice ... *systems for compliance with standards. This certificate* ... *this certificate is recognized by Exemplar Global* ... *ate, please write to Mail: info@isoindi*...

IGBC

Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

B Mythili Gnanamangai

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairman
Indian Green Building Council

Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

210122

17 April 2021

ASSOCHAM

GEM Certificate

ASSOCHAM hereby certifies that

Dr. B. Mythili Gnanamangai

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

16 July, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects. ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/649

Deepak Sood
Secretary General, ASSOCHAM

CII
Confederation of Indian Industry

GreenCo

CERTIFICATE

This is to Certify that

A K Srivastava

Is a "CII-Certified Facilitator on GreenCo Rating System",
upon successful completion of
"3rd Edition of Facilitator Development Workshop on GreenCo Rating System"
during 27 - 29 October 2021.

L S Ganapati
CHAIRMAN
CII GREENCO ASSESSOR PANEL

K S Venkatagiri
EXECUTIVE DIRECTOR
CII GODREJ GBC

Certificate No: CII/GCRF/002/2021; Issued date : 5 Nov 2021; Valid till: 5 Nov 2024

ASSOCHAM

GEM Certificate

ASSOCHAM hereby certifies that

Mr. Ashutosh Kumar Srivastava

has successfully passed the
Green and Eco-friendly Movement Certified Professional Test (GEM CP)
with
"Good Performance"
on
03 September, 2021

We are now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/666

Deepak Sood
Secretary General, ASSOCHAM

Sl.No.: 0010669

TAMIL NADU AGRICULTURAL UNIVERSITY
COIMBATORE

On the recommendation of the
Academic Council and the Board of Management
hereby admits

VIJAYALAKSHMI, B.
to the degree of
Bachelor of Technology
(Energy and Environmental Engineering)

he / she having qualified to receive the same
securing an Overall Grade Point Average
of **7.61** out of **10.00** in the year **2017**
together with all the honours and distinctions belonging
to this degree given under the seal of the University

COIMBATORE
Date : 26.02.2019

N. KUMAR
Vice Chancellor

ANNA UNIVERSITY

CHENNAI - 600 025

PROVISIONAL CERTIFICATE

Folio No.: AUO2359635

This is to certify that the following candidate has qualified for the award of Degree as detailed below:

Name	: VIJAYALAKSHMI B
Registration Number	: 412718416013
Degree	: M.E.
Branch/Specialization	: Environmental Engineering
Month and Year of Passing	: April 2020
Classification	: FIRST CLASS WITH DISTINCTION

Controller of Examinations Chennai 600 025 Anna University

Chennai - 600 025
Date 02/11/2020

Controller of Examinations i/c

V122065190828B

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 (/) 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

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			

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 19th June 2020

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

Chief Executive Officer
GRIHA Council

LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

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

10531234-AP-BD+C

26 DEC 2016

25 DEC 2022

ENERGY IS LIFE
CONSERVE IT

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BUREAU OF ENERGY EFFICIENCY

विद्युत मंत्रालय, भारत सरकार
MINISTRY OF POWER, GOVERNMENT OF INDIA

प्रमाणित किया जाता है कि

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

This is to certify that

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

नई दिल्ली
New Delhi

महानिदेशक
Director General

REPORT OF GREEN CAMPUS AUDIT

Submitted to

SVKM'S USHA PRAVIN GANDHI COLLEGE OF ARTS, SCIENCE & COMMERCE
Mumbai – 400 056, Maharashtra, India.

Date of Audit: 20.12.2021 (Monday)

Submitted by

NATURE SCIENCE FOUNDATION
(A Unique Research and Development Centre for Society Improvement)
An ISO 9001:2015 Certified Organization
LIG-II, 2669, Gandhi Managar, Peelamedu
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Contents

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 and planned to incur less energy, less water, less or pollution free, less or no CO_2 emission (Aparajita, 1995). Green Campus Audit is a tool of the environment management system which is used methodologically for protection and conservation of environment and sustenance of the ecosystem. Green campus constitutes the environmental friendly practices and education combined to promote sustainable and eco-friendly practices along with user-friendly technology in the campus. It creates environmental culture, develops sustainable solutions to environmental problems and provides solutions to various social and economic needs (APHA, 1981). It provides 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, also useful for biodiversity conservation, landscape management, proper water irrigation, natural topography and vegetation (Gowri and Harikrishnan, 2014). The maintenance of an eco-friendly campus ensures a neat and clean environment. For the benefit of stakeholders, solid state management, recycling of water, disposal of sewage and waste materials including electronic and biomedical wastes, plastic use, 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 (Gnanamangai *et al*., 2021). It analyses to help the educational institutions and industries to maintain eco-friendly environment and personal hygiene to various stakeholders and supports the nation as a whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life to all living beings (Arora, 2017).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation's growth and development which starts from maintenance of green campus without harming the environment. A clean and healthy environment in an Organization determine effective learning and provides a conducive learning environment to the students. Educational institutions are asked both Central and State Governments to give 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 environmental problems such as recycling of solid wastes and wastewaters, plastics usage, napkin disposal water consumption, water harvesting and storage mechanisms, etc. through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government plays by the Educational institutions plays a major role in terms of giving

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

Green campus auditing is a systematic process whereby an organization's environmental performance is checked against its environmental policies and compliances of the Government guidelines. This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including Management people. It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report.

3. Green Campus and Environment Policy

The green campus and environment policy aims to provide an education and awareness in a clean and green environment to the stakeholders with regards to environmental compliance. The scope of this policy applies to all employees and students of the Institution to provide an ecofriendly atmosphere. Policy making dealt with cleanliness on the campus is maintained through proper disposal of wastes and steps taken to recycle the biodegradable wastes. Utilization of eco-friendly supplies and an effective recycling programme to maintain the campus free from hazardous wastes. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes, seminars / conferences, reuse and recycle the waste materials. Attempts is made to limit energy usage and also replace 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, NCC and NSS units are also responsible for the implementation of the green campus and environment policy in the Organization.

4. Environment Friendly Campus

The organization is responsible to provide an eco-friendly atmosphere to the stakeholders along with making good drinking water facility to the students and staff members. The organic manure, cow dung, farmyard manure and vermicompost for the cultivation of plants should be adopted. All non-compostable, single-use disposable plastic items, single-use plastic utensils, plastic straws and stirrers should be avoided. Education on the commitment to plastic-free alternatives for all incoming and current students, staff and faculty should be undertaken. Reduction of use of papers alternated with e-services and e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be taken into consideration.

5. Aims and Objectives of Green Campus Audit

- To recognise the initiatives taken towards the green campus by means of gardening by the Organization.
- 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 grow a large number of oxygen producing and carbon-di-oxide absorbing plants in the campus to give a pure atmosphere to the stakeholders.
- To ensure proper utilization of resources available in the surrounding areas towards future welfare of the community.
- To set a procedure for disposal of all kinds of wastes and use green cover as a carbon sink for pollution free air.
- To assess the greenish nature of an Organization campus in terms of trees, herbs, shrubs, climbers, twins, lianas, lawns and reflected in reducing the environmental pollution soil erosion, biodiversity conservation, landscape management, natural topography and vegetation.

6. Scope and Goals of Green Auditing

The Management of the Organization (Auditee) should be shown their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage all types of green activities. They should promote all kinds of green activities such as conduct of environment awareness programmes, campus farming, planting trees, maintenance of greening, irrigation, use of biofertilizers and avoidance of chemical fertilizers and agrochemicals on the campus etc., before and after the green auditing. The management should formulate 'Green and Environment Policies' based on green auditing report. A clean and healthy environment should enhance an effective teaching and learning process and provides a conducive learning environment to the stakeholders. They should create the awareness on the importance of environment through environmental education among the student members. Green Audit is the most efficient and ecological way to manage environmental problems.

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 large number of trees which is the responsibility of each and every individual who are the part of economical, financial, social, 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 advantages to save the planet by means of 'Go green concept' and help the institution to set environmental examples for the community, and thereby to educate the young learners. Green audit is a professional and useful tool for an Organization to determine how and where they are maintaining the campus eco-friendly manner. It can also be used to implement the mitigation measures is a win-win situation for all the stakeholders and the planet. It gives an opportunity for the development of ownership, personal and social responsibility for the stakeholders.

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 after receiving the report of audit. The green campus audit contained methodology followed and both qualitative and quantitative measurements including physical observation of greeneries in terms of growing of terrestrial and aquatic plants, animals and microflora in the campus. The natural and planted vegetation and their maintenance are also considered in the organization campus through topography, landscape management design and soil erosion control in environment sustainable development. The following are the major benefits of the green auditing.

- Know the status of development of internal and external Green campus audit procedures and implementation scenario in the Organization.
- Establishment d Green campus objectives and targets as on today as per the 'Green and Environment Policy', 'Indian Biodiversity Act' and 'Wildlife Protection Act' of the Ministry of Environment, Forests and Climate Change, New Delhi and World & Indian Green Building Council concepts.
- Assigning the roles and responsibilities of Environmental Engineer and Agriculture Staff to give 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
- Improving the drinking water / RO water / Bore well water / Open well water / Pond water / Municipal or Corporation water quality through the analysis of Physico-chemical properties of water.
- Creation of wastewater treatment facility and solid waste management provision in the campus for recycling of wastewater and solid wastes to minimize the air, water and soil pollution.
- Suggested of availability of Biogas plant to the management to restrict the usage of fossil fuel in cooking purposes.
- Implementing status of the rain harvesting system, water reservoirs, percolation pond, etc. in the campus to increase the ground water level.
- Establishment of terrace garden, herbal garden, kitchen, zodiac, ornamental gardens, etc. for enhancing teaching and learning and commercial exploitation.
- Treated water consumption towards plant cultivation, canteen, hostel, machinery cleaning, transport, toilet use and etc. on water consumption and per capita water consumption per day calculation.
- Studying the campus flora by making a complete data on total number of both terrestrial and aquatic plants, herbs, shrubs, climbers, twins and grasses.
- Survey of campus fauna by conducting the number living and visiting animals, insects, flies, moths and worms in the campus.
- Documentation of the number of oxygen producing and carbon dioxide absorbing plants planted in the campus to give pure atmosphere to the stakeholders.
- Operation of water irrigation, drip and sprinkler irrigation methods to improve the green campus.

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

8. About the Organization

Usha Pravin Gandhi College of Arts Science and Commerce is blossoming into an institution par excellence. With over a decade of fruitful and dedicated service, it has earned an enviable reputation. It is only possible because of untiring efforts of the faculty and staff of the institution, with good team work of faculty, the healthy cooperation of the students and the unstinting support of the Management. The college has been achieving distinction in academics and winning laurels in sports, cultural events and social work. With University rankers to boast of, UPGCASC is definitely a place for all aspiring students.

Along with sports, co curricular and extra-curricular activities, the institute has a placement cell too, which interacts with the leading industries, arranges campus interviews and offers ample job opportunities and internships to students of all disciplines. In addition to curricular development, great emphasis is laid on character-building, discipline and life skills in students.

Ever since the inception of this college in 2003, we have been striving for academic excellence in areas of Mass Media, Information Technology (Graduation and Post-Graduation) and Management studies and at the same time marching forward with a mission of professional, intellectual, personal and social development of students.

UPGCASC had hosted and organized an International Conference, with the theme "Spirituality of Workplace". The conference resulted in an A spiritual and secular environment in all areas and avenues in life is the only answer to man's quest for peace and harmony.

Usha Pravin Gandhi College of Arts Science and Commerce Campus details

S.No.	Details of Area	Total area
1.	Total are of the plot on which the building stands	15958.80 Sq.mt
2.	Total area of the plot used for the Building	7685.92 Sq.mt
3.	Floorwise carpet area of the building	9229.98 Sq.mt
4.	Total floorwise built up area of the building	
4.1	Ground Floor	784.12 Sq.mt
4.2	First Floor	653.22 Sq.mt
4.3	Second Floor	732.70 Sq.mt
4.4	Second (half) Floor	493.34 Sq.mt
4.5	Third Floor	882.24 Sq.mt
4.6	Fourth Floor	690.05 Sq.mt
4.7	Nineth Floor	690.05 Sq.mt

SVKM'S Usha Pravin Gandhi College of Arts Science and Commerce - Front view

9. Audit Details

Date / Day of Audit	**: 20.12.2021 (Monday)**
Venue of Audit	**: SVKM's Usha Pravin Gandhi College of Arts Science and Commerce** Mumbai- 400 056, Maharashtra, India.
Audited by	**: Nature Science Foundation,** Coimbatore - 641 004, Tamil Nadu, India.
Audit type	**:** Green Campus Audit
Name of ISO EMS Auditor	**: Mrs. S. Rajalakshmi,** Chairman, ISO QMS & EMS Auditor, NSF.
Name of Lead Auditor	**: Dr. R. Mary Josephine,** Board of Directors & Botanist, NSF. **Dr. Sunayana J Kadle,** Certified Lead Environment Auditor, NSF.
Name of Subject Expert-I	**: Dr. D. Vinoth Kumar,** Joint Director & Biotechnologist, NSF.
Name of IGBC AP Auditor	**: Dr. B. Mythili Gnanamangai,** IGBC AP, Indian Green Building Council.
Name of ASSOCHAM Auditor	**: Er. Ashutosh Kumar Srivastava,** Associated Chambers of Commerce and Industry
Name of Eco & Green Officer	**: Ms. S. Sowndharya,** Eco & Green Council Programme Officer, NSF.

10. Procedures followed in Green Campus Audit

Green campus audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducing the environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. It is a kind of a professional tool for assessing the green campus. Green audit projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. The 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, 2008).

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.

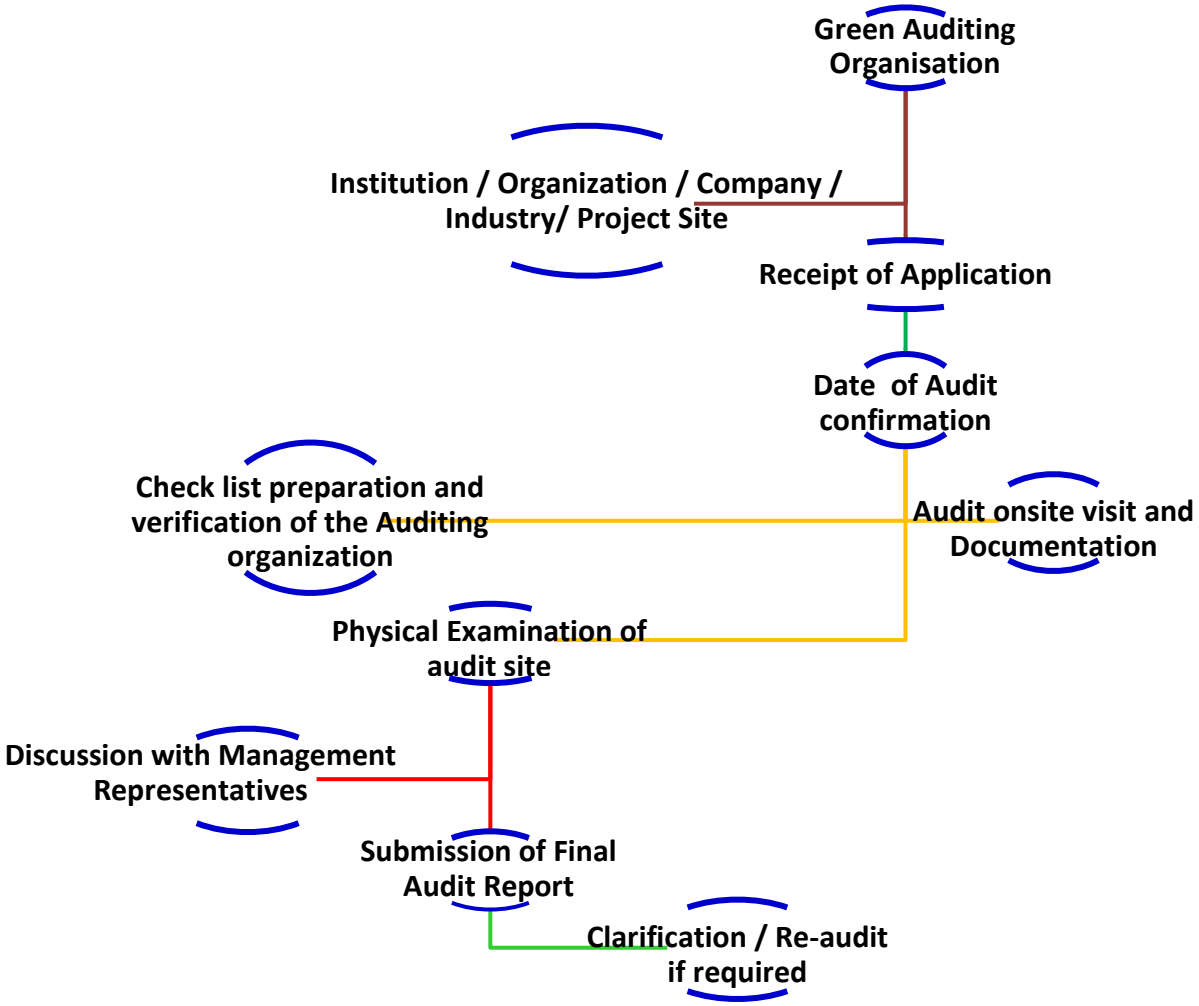
During the audit, the nature of plants and animals / birds species present in the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal garden / aquarium and aquatic (hydrophytes) plants in the campus were recorded. Labelling of common names and Botanical names of plants were observed. The operation of the water irrigation system, trip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted. The number of water wells, bore wells and water reservoir facilities in the campus were also noted as per the Audit Manual of Gnanamangai *et al*. (2021).

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 receipt of application forms from the auditee (organization) and ending upon the submission of final report to the concerned organization within 15 days. 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 to the stakeholders were assessed (IGBC, 2021; WGBC, 2021). In addition, the

role of students and staff members in supporting the vision and mission of the greenery activities of the Organization is also assessed.

The purpose of the green audit is to ensure that the practices followed in the campus are in accordance with the Green and Environment Policy developed by the Government and private agencies working with environment sustainable development adopted by the institution. The criteria, methods/procedures, checklists and recommendations used in the audit were based on the identified risks. The methodology includes: preparation and filling up of questionnaire along with checklists, physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations. The methodology adopted for this audit was a four step process comprising of data collection, data analysis, best practices followed in the campus and recommendations and suggestions given to the organization to improve the greeneries practices further.



Flow-chart of Green Campus Audit Procedures

10.1. Onsite Green Campus Audit activities

1. The opening meeting is the first step between the audit team and auditee. In this meeting, the purpose of the audit, the procedure is to be followed for the conduct of the audit, document verification and the time schedules were discussed in brief along the Management Representatives.
2. Site inspection is the second step for onsite activity. In this step, the Audit team members visited different sites in UPGCASC and sufficient photographs were taken then and there for preparing the audit report.
3. During the onsite phase of visit, it is vivid how the various facilities made by UPGCASC Management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.
4. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders. It is assessed the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in Green campus facilities were recorded.
5. Gathering audit evidence *ie*, collecting data and information from the auditee as per the audit protocol were carried out.
6. An exit meeting was conducted to explain the findings of the audit with the Management Representatives and staff members along with the audit team in brief.

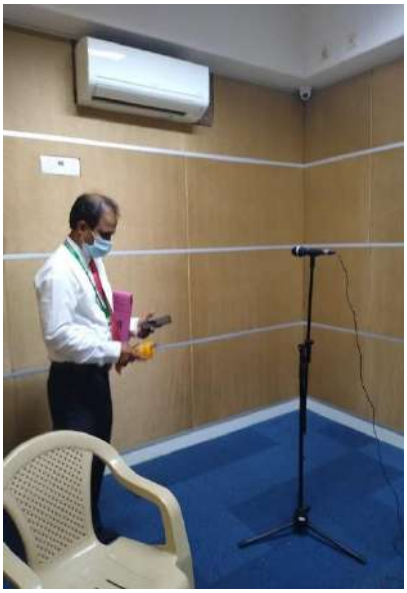
10.2. Pre-Audit stage activities

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

Meeting with the Hon'ble Pro Chancellor of UPGCASC with the Audit Advisory Committee and Audit Team of the Nature Science Foundation

Energy and Environment Audit Activity at UPGCASC by NSF Audit Team








10.3. Target Areas of Green Auditing

Green campus audit is nothing but a professional tool to assess the greenery activities in the educational institutions and give a value addition to the campus and considered as a resource management process. Eco-campus concept mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also economic efficiency. Green campus audit process may be undertaken at frequent intervals and their results can illustrate 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.

There are several target listed in the Green audit process in which a few are taken into consideration as per the Indian scenario is concerned. They are water use efficiency, energy use efficiency, solid, e-waste biomedical, food, sewage waste management and reuse methods, planting of oxygen producing and carbon dioxide absorbing pants, landscape management, topology, vegetation, soil erosion control, carbon footprint due to use of vehicles, electricity and fossil fuels. drinking water quality supply, Biogas plant, rain harvesting system, water reservoirs, percolation pond, establishment of various herbal, terrace and ornamental, gardens, campus and flora fauna, water irrigation, implementation of Government schemes, conduction of awareness programmes management, public transport, low-emitting vehicles and control of car smokes and exhaust, Organization’s budget for greenery activities, campus facilities for disabled, special needs and or maternity care, security, safety and health infrastructure facilities for stakeholder’s wellbeing.

10.4. Study area of Flora and Fauna diversity

UPGCASC Campus is situated on the Northernwest of India. It is located about 3.3 km from Arabian seashore and 7.3 km from Chhatrapati Shivaji Maharaj International Airport, Mumbai. It is situated in picturesque surroundings adjacent to the Mumbai metropolitan city. The campus now quite clean, green and has much less pollution to the rest of the city. It is frequently visited by several nature enthusiasts to study the floral and faunal aspects. Biodiversity provides a useful measure of the quality of the environment and the ecological studies are important aspects of environment, in view of the consideration of environmental quality and protection of natural flora and fauna.

10.4.1. Topography

The College campus enjoys a uniform climate throughout the year. In summers the maximum temperature reaches 35 °C (95 °F) and the minimum temperature is 25 °C (77 °F). The weather is hot in 'winter'. Monsoons prevail from mid-June to September, when it rains quite heavily.

10.4.3. Climatic conditions

The Climate is a tropical, wet and dry climate. It can be best described as moderately hot with high level of humidity. Its coastal nature and tropical location ensure temperatures do not fluctuate much throughout the year.The mean average is 27.2 °C and average precipitation is 242.2 cm (95.35 inches). The mean maximum

average temperatures is about 32 °C (90 °F) in summer and 30 °C (86 °F) in winter, while the average minimums are 25 °C (77 °F) in summer and 18 °C (64 °F) in winter. Generaly three distinct seasons: 1. Winter (October to February) winter temperature 15 to 20°C Peak Winter Months – Dec to Mid Feb with temperature range 12–19 °C; 2. Summer (March to May) Avg temperature 30 to 27 °C; Peak Summer Months (Mid March to 1 June week), temperature shoots up to 30–40 °C with humidity being approx 70–80%. 3. Monsoon: (June to September). Peak monsoon months: July & August sometimes with winds and thunderstorms.

11. Identification of Plant Species at UPGCASC Campus

11.1. Identification of Flowering Plant Species

Various vascular plant species were collected across UPGCASC campus and subjected to identify them based on botanical name, family, habitat, uses and anthropogenic disturbances to the natural vegetation in campus. The plants were freshly collected and their digital photographs were also taken. The collected plant specimens have been identified using taxonomic literatures (Gamble and Fischer, 1915-1936; Matthew, 1983; Nair and Henry, 1983; Henry *et al*., 1989; Chandrabose and Nair, 1988). Further, their identification was confirmed by matching with authentic specimens in the Madras Herbarium (MH), Botanical Survey of India, Southern Circle, Coimbatore, India.

11.1.1. Key to Plant Families Identification

1a. Seeds enclosed in fruit wall, Perianth Present……..2
b. Seeds not enclosed in frcuit 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 distict 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 disck…….....… Cleomaceae
b. Stamens inserted of the gynophore …….……Capparaceae
11a. Trees, Petals more or like the sepals; carpels free …….. Mangnoliaceae
b. Herbs, petals coloured unlike the sepals; carpels united……12
12a. Plants with yellow sap, Flowers pedicelled ……Papaveraceae
B. Plants with watery sap, Flowers sessile…….Portulacaceae

13a. Flowers unisexual,gynoecium apocarpus……..... Menispermaceae
b. Flowers bisexual, gynoecium Syncarpous……...……14
14a. Petals 4, Stamens 6 ……..……Brassicaceae
b. Petals 5, Stamens ∞…….....15
15a. Ovary1, loculated …….…….....16
b. Ovary 2-more loculated…… 17
16a. Flowers actinomorphic, placentas free- central …….....Caryophyllaceae
b. Flowers zygomorphic, placentas parietal ……..……..……..Viloaceae
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 sycarpous; placentas 3-5, parietal……...32
b. Ovary 1 or more free, placentas basal……33
32a. Climbing herbs tendril……Passifloraceae
b. Erect shrubs or trees with tendril……..Turneraceae
33a. Ovules arising from the inner angles or from base of the carpels or loculi……34
b. Ovules pendulous form the apex of the carpels or locules…….Combretaceae
34a. Carpels solitary; fruits legume……..35
b. Carpels more than 1; fruits otherwise……37
35a. Flowers zygomorphic; petals imbricate……36
b. Flowers actinomorphic; petals valvate…….Mimosaceae
36a. Upper petals outermost stamens monodelphous or diadelphous……Fabaceae

b. Upper petals innermost stamens always free ……Caesalpiniaceae
37a. Flowers unisexual……...Cucurbitaceae
b. Flowers bisexual……...38
38a. Ovary 1-celled……..Cactaceae
b. Ovary more than 1 celled……..39
39a. Carpels free if ultimately united the styles distinct……40
b. Carpels and styles united throughout……..……Myrtaceae
40a. Flowers in dichasial – polychasial cyme……Molluginaceae
b. Flowers in clustered, cymes or solitary……..Aizoaceae
41a. Ovary inferior, stamens as many as the corolla lobes……42
b. Ovary superior, stamens numerous……...43
42a. Anther free; ovary 2-loculed; stipulate……Rubiaceae
b. Anther syngenesious; ovary 1-loculed, exstipulate……Asteraceae
43a. Ovary 1-loculed; placentation free central……...Plumbaginaceae
b. Ovary 2-many loculed; placentation axile or parietal……44
44a. Ovary 3 or more carplelled……..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 inseperratable; 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. Arbrorescent woody; leaf blade many nerved articulate with sheath...Bambusaceae
b. Herbs with herbaceous culms; leaf blade sessile not articulate with sheath…….68
68a. Perianth 0 or reduced to scale……...Araceae
b. Perianth present…….....69
70a. Plant armed……71
b. Plant unarmed……...72
71a. Plants Xerophytic; leaves fibrous……Agavaceae
b. Plants not xerophytic; leaves nor fibrous……..Lilliaceae
72 a. Perianth segments connate……..Amaryllidaceae
b. Perianth segments free……..73
73a. Outer perianth calycine; inner coroline……Commelinaceae
b. Outer and inner perianth……..74

11.2. Identification of Non-Flowering Plant Species

11.2.1. Lichen Identification

The lichen specimens were collected from UPGCASC campus and then identified based on the lichen identification key of Awasthi (2007). The representative lichen were identified based on the morphological features of thalli such as rhizine, cilia and pseudocephellae and reproductive structures (fruiting bodies) such as apothecia, perithecia, soredia, soralia, conidia and isidia embedding on the thalli surface using a stereo microscope (CZM4, Labomed, India). The anatomy of thallus used in the present study characterized the features of micro morphological analysis 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. Over 700 secondary metabolites are known to produce from lichen species which were identified based on Thin Layer Chromatography (TLC) techniques. 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 described by Orange *et al*. (2001).

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

11.2.2. Key to identify the Lichen Genera

Key to Genera

1 a. Photobiont cyanobacteri urn .....*Leptogium cyanascens.*
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,……*Chrysothrix chlorina*
1 b. Thallus crustose..……*Graphis* sp

Group II

1 a. Lower side of thallus pseudocyphellae, photobiont Nostoc .....*Pseudocyphellaria*
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……...*Heterodermia leucomelos*
3 b. Thallus lower side no canaliculated only in medulla……*Heterodermia diademata*
4 a. Cilia bulbate at the base, thallus grey to grey brown .....*Bulbothrix*
4 b. Cilia present or absent, not bulbate.....5
5 a. Rhizines dichotomously branched present throughout the margins....*Hypotrachyna*
5 b. Rhizines restricted to center of lower surface, margin bare, smooth shining……6
6 a. Lobes narrow, long, dichotomously branched, canaliculate.....*Everniastrum*
6 b. Lobes otherwise.....7
7 a. Lobe margins ciliate……..……8
7 b. Lobe margins eciliate…….……..…9
8 a. Salazinic acid present K+ Red cortex……10
8 b. Salazinic acid absent ……..…..11
9 a. Thallus with isidia……...……..*Parmotrema tinctorum*
9 b Thallus with soredia……...……..12
10 a. thallus emaculate……..……*P.stuppeum*
10 b. thallus maculate……*P.reticulatum*
11 a. Protolichesternic acid in medulla ……*P.grayanam*
11 b. Alectoronic acid in medulla……*P. nilgherrense*
12 a. Thallus large lobed, loosely attached, mainly corticolous .....*P. austrosinense*
12 b. Thallus smaller, closely to strongly attached, saxicolous……..*P.defectum*

Group III

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

11.2.3. Identificayion 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. They 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 have many types of life cycles, and they range in size from microscopic *Micromonas* to species to giant kelps that reach 60 metres (200 feet) in length. Their photosynthetic pigments are more varied than those of plants, and their cells have features not found among plants and animals. In addition to their ecological roles as oxygen producers and as the 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 but lack the specialized multicellular reproductive structures of plants, which always contain fertile gamete-producing 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.

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; ----------*Agmenellum*
3B. Cells somewhat evenly arranged toward periphery of spherical colony; barely visible gelatinous strands radiate from center of colony to cells ----- *Gomphosphaeria*
3C. Colony asymmetrical; cells very dense and unevenly distributed ---------*Anacystis*
4A. Filaments straight or slightly flexed ---------- 6
4B. Filaments curved, twisted, or spiralled ----------5
5A. Heterocysts and akinetes present ----------*Anabaena*
5B. Heterocysts absent ----------*Raphidiopsis*
6A. Heterocysts present ----------9
6B. Heterocysts absent ----------7
7A. Filaments without a sheath; cells discoid ----------
Oscillatoria

7B. Filaments with distinct sheath ----------8
8A. Trichomes tangled; sheaths confluent ----------*Phormidiwn*
8B. Trichomes separate; sheaths not confluent ----------*Lyngbya*
9A. Heterocysts terminal ----------*Cylindrospermum*
9B. Heterocysts intercalary ----------*Ahphanizomenon*
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 ----------*Stephanodiscus*
13B. Valves with two concentric regions, the inner being smooth ----------*Cydotella*
14A. Frustules with marginal keel containing a raphe ----------*Surirella*
14B. Frustules with a pseudoraphe or with a raphe not in a marginal keel ---*Cocconeis*
15A. Frustules cylindrical arranged end to end into filament ----------*Melosira*
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 ----------*Tabellaria*
17B. Frustules not in zigzag chains ----------*Pseudoraphe*
18A. Frustules united laterally ----------*Fragilaria*
18B. Frustules not united laterally ----------19
19A. Frustules united apically forming spokelike colony ----------*Asterionella*
19B. Frustules not forming spokelike colony ----------20
20A. Frustules needle shaped without costae ----------*Synedra*
20B. Frustules with prominant costae ----------*Diatom*
21A. Frustules sigmoid or "S" shaped ----------*Gyrosigma*
2IB. 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 ----------*Epithemia*
23B. Valves without transverse costae ----------24
24A. Raphe a smooth curve with well defined central and polar nodules -----*Cymbella*
24B. Raphe not a smooth curve, gibbose with marginal central nodule -------*Amphora*
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 ------*Rhoicosphenia*
26B. Frustules shaped otherwise ----------*Achnanthes*
27A. Raphe extended length of valve; polar nodules; central nodules lacking -*Eunotia*
27B. Raphe restricted to polar regions ----------28
28A. Raphe located in a canal ----------*Nitzschia*
28B. Raphe not located in a canal ----------29
29A. Frustules with symmetrical valves ----------30
29B. Frustules with valves symmetrical but asymmetrical ----------*Gomphonema*
30A. Valves with transverse costae ----------*Pinnularia*

30B. Valves with transverse punctae ----------*Navicula*
31A. Cells solitary ----------45
31B. Cells colonial or grouped ----------32
32A. Cells enclosed in conical to cylindrical lorica; joined lorica have treelike appearance ----------*Dinobryon*
32B. Cells and lorica without treelike appearance ----------33
33A. Colony discoid, one cell in thickness; cells in concentric rings --------*Pediastrum*
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 ----------*Actinastrum*
35B. Colony with cells not radiating from common center ----------36
36A. Colony with four to eight cells positioned in linear series ----------*Scenedesmus*
36B. Colony with cells not in linear series ----------37
37A. Colony with arcuate to lunate cells with apices acutely----------*Selenastrum*
37B. Colony with spherical to broadly ellipsoidal cells ----------38
38A. Cells without spines or setae ----------*Crucigenia*
38B. Cells with spines or setae ----------39
39A. Cells quadrate, closely apposed; free face of each cell with spines ----*Tetrastrum*
39B. Cells quadrate and united; free face cell with long delicate setae ---*Micractinium*
40A. Colony with biflagellated cells ----------
Pandorina
40B. Colony with nonflagellated cells ----------41
41A. Cells lunate to sickle shaped ----------*Kirchneriella*
41B. Cells spherical or nearly so ----------42
42A. Cells borne terminally on dichotomously branched threads -----*Dictyosphaerium*
42B. Cells not on dichotomously branched threads ----------43
43A. Colony a hollow sphere ----------*Coelastrum*
43B. Colony not a hollow sphere ----------44
44A. Colony surrounded by gelatinized and expanded parent cell wall --------*Oocystis*
44B. Colony with cells equidistant and toward periphery –----------*Sphaerocystis*
45A. Cells with median constriction dividing cell into two distinct halves -*Cosmarium*
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 ----------*Peridinium*
48B. Cells walls with faintly distinct plates and sutures ----------*Glenodinium*
49A. Cells uniflagellate ----------52
49B. Cells biflagellate ----------50
50A. Cells with two flagella of equal length ----------*Chlamydomonas*
50B. Cells with two flagella of unequal length ----------51
51A. Cells with single chromatophore ----------*Chroomonas*
51B. Cells with 2 large chromatophores ----------*Cryptomonas*
52A. Cells surrounded by distinct lorica ----------*Trachelomonas*
52B. Cells without lorica; fusiform to acicular shaped; posterior end ----------*Euglena*

53A. Cells acicular to fusiform with ends tapering into long spines --------*Schroederia*
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 --------*Chodatella*
55B Cells with multiple peripheral long delicate setae ----------*Golenkinia*
56A Cells long, slender, and tapered at both ends ----------*Ankistrodesmus*
56B Cells flattened or isodiametric, triangular, quadrangular ----------*Tetraedron*

11.2.3. Identification of Major Groups of Mushrooms

1. Mushroom growing on other mushrooms or the decayed remains -------- *Mycotrophs*
2. Growing shelflike on wood (or, if not, then gills *concentric* rather than radial); mushroom *very* tough and leathery, corky, or woody (try tearing it in half); gills tough and hard, sometimes maze-like; cap frequently (but not always) with concentric zones of colour ----------*Polypores*
3. Gills running down the stem, not platelike and thus not easily separable from the cap and stem (try removing an entire "gill" with your fingers or a sharp object); mushroom usually *not* growing on wood ----------*Chanterelles and Trumpets*
4. Gills not as above; mushroom growing on wood or elsewhere ----*Gilled Mushrooms*
5. Stem absent--or, if present, lateral, Flesh in stem tough---------- *Polypores*
6. Cap round in outline; pore surface not running down the stem, or only slightly running down the stem; spore print not white ----------*Boletes*
7. 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*
8. 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*
9. 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*
10. Cap shape convex to centrally depressed or vase-shaped; undersurface, smooth, wrinkled, or gill-like; fruiting embedded ----------*Chanterelles*
11. 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*
12. 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*
13. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, grayish, brownish, or black; stem surface ribbed or "pocketed" in some species ----------*Saddles*
14. Found in summer and fall (or spring in warm coastal areas); cap lobed, saddle-shaped, or irregular and whitish, grayish, brownish, or black --------*Oddballs & Misfits*

12. 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 producing and Carbon-di-oxide absorbing plants planted in the Campus are taken into consideration to give pure atmosphere to the stakeholders. Establishment of different types of gardens in the campus, rainwater harvesting system, operation of water irrigation, drip and sprinkler irrigation methods may be adopted to improve the green campus. Similarly, biodiversity conservation strategies are very essential to conserve a variety of plant and animal species in the campus ecosystem. Biofertilizers, organic and green manures, cow dung manures and farmyard manures may be used for the cultivation of plants which may be protected the environmental health that will not cause any air, water and soil pollution. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC 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. Qualitative Measurements

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

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

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

13.2. Quantitative Measurements

S.No.	Details of Plant and animal species	Numbers / Percentage
1.	Total number of Flowering plant species inside the Campus	75 species belonging to 32 Genera under 20 families
2.	Total number of Non-Flowering plant species inside the Campus	10 species belonging to Lichens, Pteridophytes and Bryophytes
3.	Total number of living Birds inside the Campus	8 species belonging, Crow, Pigeon, Woodpecker, Sparrows, Myna, Parrot and Pelican Butterfly
4.	Total number of visiting Birds inside the Campus	3 species belonging Owl, Vulture and Eagle
5.	Total number of Grasshoper and Termites	Grasshoper: 8 species Termites: 3 species
6.	Total number of Butterflies and Mosquitos	Butterflies : 6 species Mosquitos: 02 species
12.	Percentage of Forest Vegetation	-
13.	Percentage of Planted Vegetation	0.011%
14.	Percentage of Water consumption to total human population	-
15.	Percentage of Water consumption to total flora and fauna	-
16.	Per capita water consumption per day	-

13.3. Flora and Fauna diversity in SVKM'S UPGCASC Campus

13.3.1. Flora diversity in SVKM'S UPGCASC 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-di-oxide. 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 SVKM'S UPGCASC campus has more than 30-35% of native plant species and the other 10-15% plant species are ornamental in nature coming under the planted vegetation. The native plant traits promote the indigenous fauna at the site area.

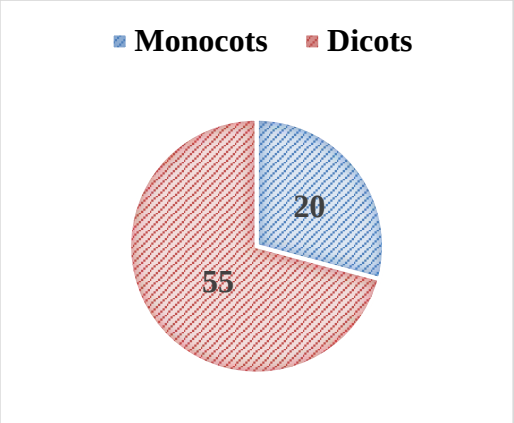
The most plants recorded are *Azadirachta indica* A. Juss., *Acacia ferruginea* Dc., *Acacia planifrons* Wight & Arn., *Dichrostachys cinerea* (L.), *Ficus benghalensis* L., *Ficus religiosa* L., *Polyalthia longifolia* (Sonn.) Thwaites, *Borassus flabellifer* L., which are dominant trees species characteristic to the vegetation of the campus. Some of the shrub species like *Hibiscus lunarifolius* Wild., *Sida rhombifolia* L., *Crotalaria pallida* Dryand., *Crotalaria retusa* L., *Tephrosia hookeriana* Wight & Arn., *Solanum surattens* Burm., are also rather common in the campus. Some of the common climbers found among the shrubs are *Cissampelos pareira* L. var. *hirsuta*, *Cocculus hirsutus* L., *Cyclea peltata* (Lam.), *Tinospora cordifolia* (wild.), *Toddalia asiatica* L., *Cardiospermum halicacabum* L., *Clitoria ternatea* L., *Macrotyloma uniflorum* (Lam.), *Passiflora edulis* Sims, *Passiflora foetida* L., *Citrullus landaus* (Thumb.), *Jasminum auriculatum* Vahl, *Jasminum cuspidatum* Rottl., *Jasminum trichotomum* Heyne, *Hemidesmus indicus* L., *Pergularia daemia* (Forssk.) and *Tylophora indica* (Burm.f).

Invasive species

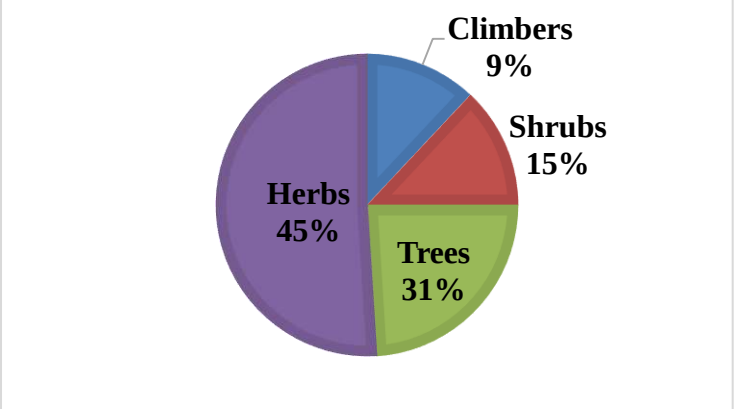
The campus has 6 invasive species such as *Ageratum conyzoides* L., *Alternanthera pungens* H.B.K., *Alternanthera sessils* (L.) R.Br. ex Dc., *Argemone mexicana* L., *Bidens pilosa* L., *Borassus flabellifer* L., *Calotropis gigantea* (L.). This is clearly indicated disturbances to the natural setting in the vegetated areas.

The alien / exotic species *viz.,Annona squamosa* L., *Asparagus racemosus* Wild., *Borassus flabellifer* L., *Cassia siamea* Lam., *Casuarina equsetifolia* J. R & G.Forst., *Delonix regia* (Hook.) Raf., *Eucalyptus tereticornis* SM., *Holoptelea integrifolia* (Roxb.) Planchon, *Pithecellobium dulce* (Roxb.) Benth., *Parkia biglandulosa* Wight & Arn., *Polyalthia longiflora* (Sonn.), and *Roystonea regia*, Kunth.

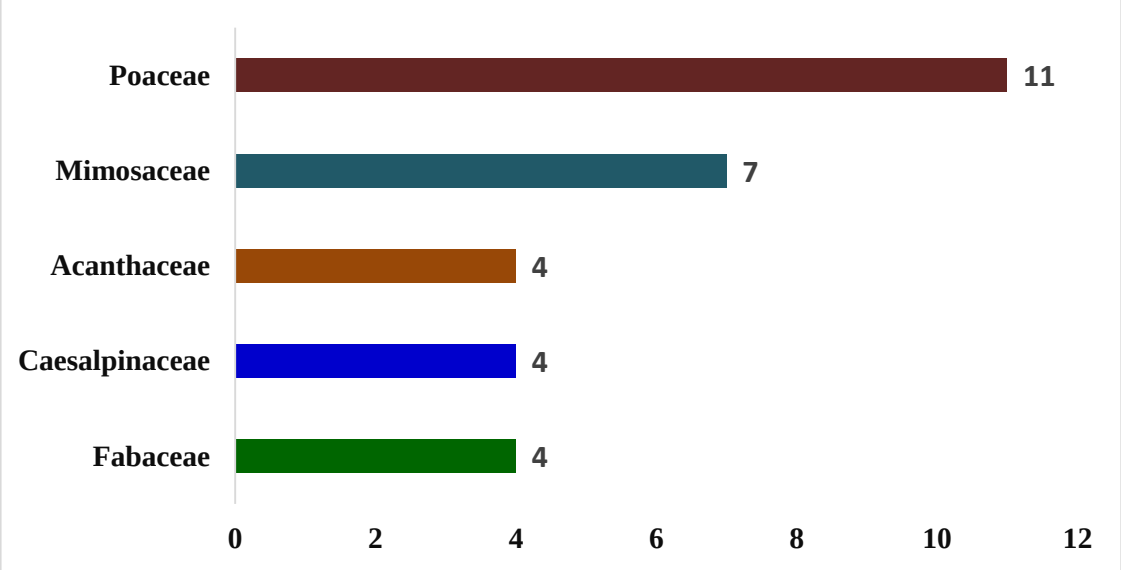
Some of the species are utilized as fruit yielding like *Annona squamosa* L., (Seetha), *Mangifera indica* L. (Maa) Thwaites., *Moringa pterygosperma* Gaertn. (Murungai), *Psidium guajava* L., (Koyya) and *Syzygium cumini* (L.) Skeels. (Naval). Species such as *Cordia sebestena* L., *Millingtonia hortensis* L.F., *Plumeria alba* L., *Plumeria rubra* L., *Tabebuia rosea* (Bertol.) DC. and *Tecoma stans* (L.) Kunth. are also utilized for their attractive flowers.



Systematic groups of the plants in SVKM'S UPGCASC campus



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



Plant families with higher number of species in the campus area

The biodiversity of SVKM'S UPGCASC Campus comprises a total of 75 species belonging to 32 genera under 20 families excluding the lichens, pteridophytes and bryophytes which was not possible during the present study. Of these, Dicots are dominating with 55 families whereas, monocots with 20 families. Over all the herbs were the most dominant flora 45% followed by Trees 31%, Shrubs 15% and Climbers 9%. Among dicots, Polypetalae formed a larger percentage with 9 families, 25 genera and 34 species, Gamopetalae with 5 families, 18 genera and 24 species and Monochlamydeae with 3 families, 11 genera and 14 species. In monocots 11 families are spreading over 29 genera belonging to 11 species. Poaceae is the first dominant family with 72 species followed by Fabaceae with 27 species and Mimosaceae with 14 species. During the study in the campus, a total of 23 alien and 41 invasive floral species were recorded. This clearly indicated disturbances to the natural setting in the vegetated sector.

List of Flowering plants in the SVKM'S UPGCASC campus, India

S.No	Common Name	Botanical Name	Family	Habit
1.	Rosary Pea / Crab's Eye	*Abrus precatorius* Wall.	Fabaceae	Climber
2.	Northern Black Wattle	*Acacia auriculiformis* L.	Mimosaceae	Tree
3.	White Bark Acacia	*Acacia ferruginea* DC.	Mimosaceae	Tree
4.	Soap Bush / Candelabra	*Acacia holosericea* L.	Mimosaceae	Shrub
5.	Candelabra Wattle	*Acacia lenticularis* Buch.	Mimosaceae	Tree
6.	Lebbek / Flea Tree	*Albizia lebbeck* L.	Mimosaceae	Tree
7.	Black Siris	*Albizia odoratissima* L.f.	Mimosaceae	Tree
8.	Neem Tree	*Azadirachta indica* A.	Meliaceae	Tree
9.	Common Bamboo	*Bambusa arundinacea* (Retz.) Roxb.	Bambusaceae	Tree
10.	Box-leaved Barleria	*Barleria buxifolia* L.	Acanthaceae	Herb
11.	Spiny Barleria	*Barleria cuspidata* F.B.	Acanthaceae	Herb
12.	Candelabra Wattle	*Brachiaria semiundulata* L	Poaceae	Herb
13.	Golden Shower Tree	*Cassia fistula* L.	Caesalpinaceae	Tree
14.	Red Cassia	*Cassia roxburghii* DC.	Caesalpinaceae	Tree
15.	Siamese Cassia Tree	*Cassia siamea* Lam.	Caesalpinaceae	Tree
16.	Yellow Cassia	*Cassia spectabilis* DC.	Caesalpinaceae	Tree
17.	Whistling Pine / Casuarina	*Casuarina equisetifolia* J.R	Casurinaceae	Tree
18.	Field / Golden Dodder	*Cuscuta campestris* Yun.	Cuscutceae	Climber
19.	Giant Dodder	*Cuscuta reflexa* Roxb.	Convolvulaceae	Climber
20.	Creeping Cradle Plant	*Cyanotis axillaris* (L.) D.	Commelinaceae	Herb
21.	Crested Dew Grass	*Cyanotis cristata* (L.) D.	Commelinaceae	Herb
22.	The Queen Sago	*Cycas circinalis* L.	Cycadaceae	Tree
23.	Indian Moon-Seed	*Cyclea peltata* (Lam.)	Menispermaceae	Climber
24.	Kachi Grass / Turpentine Grass	*Cymbopogon caesius* Nees	Poaceae	Herb
25.	Wild Crabgrass / Southern Crabgrass	*Digitaria ciliaris* (Retz.) Koel.	Poaceae	Herb
26.	Lollipop Climber / Striped Cucumber	*Diplocyclos palmatus* L.	Cucurbitaceae	Climber
27.	Spreading Ruellia	*Dipteracanthus patulus* (Jacq.) Nees	Acanthaceae	Herb
28.	Hop Brush	*Dodonaea viscosa* L.	Sapindaceae	Shrub
29.	Jungle Rice / Deccan Grass	*Echinochloa colonum* (L.) Link	Poaceae	Herb
30.	Indian Laurel Tree	*Ficus microcarpa* L.f.	Moraceae	Tree
31.	Sacred Fig	*Ficus religiosa* L.	Moraceae	Tree
32.	Fern Tree	*Filicium decipiens* Wight	Sapindaceae	Tree
33.	Flat spike Sedge / One Spike Fimbry	*Fimbristylis ovata* Burm. f.	Cyperaceae	Herb
34.	White Teak	*Gmelina arborea* Roxb.	Verbenaceae	Shrub
35.	Flame Lily	*Gloriosa superba* L.	Liliaceae	Climber
36.	Cockscomb Gomphren	*Gomphrena celosioides* L.	Amaranthaceae	Herb
37.	Globe Amaranth	*Gomphrena globosa* L.	Amaranthaceae	Herb
38.	Tree of Life	*Guaiacum officinale* L.	Zygophyllaceae	Tree

39.	Rough Diamond Flower	*Hedyotis aspera* Heyne	Rubiaceae	Herb
40.	Choy Root	*Hedyotis puberula* G. Don	Rubiaceae	Herb
41.	Indian Sarsaparilla	*Hemidesmus indicus* L.	Asclepidaceae	Climber
42.	Black Speargrass	*Heteropogon contortus* L.	Poaceae	Herb
43.	Lunaria Leaf Hibiscus	*Hibiscus lunariifolius* Wild.	Malvaceae	Herb
44.	Candelabra Wattle	*Hibiscus ovalifolius* L.	Malvaceae	Herb
45.	Jungle Cork Tree / Indian Elm	*Holoptelea integrifolia* (Roxb.) Pl.	Ulmaceae	Tree
46.	Blue Spade Flower	*Hybanthus ennaspermus* L.	Violaceae	Herb
47.	Candelabra Wattle	*Hybanthus puberulus* Mill.	Violaceae	Herb
48.	Rusty Indigo	*Indigofera colutea* Burm	Fabaceae	Herb
49.	Jasminum Molle	*Justicia prostrata* (Clarke)	Acanthaceae	Herb
50.	Drumstick Tree	*Moringa pterosperma* L.	Moringaceae	Tree
51.	Madras Pea Pumpkin	*Mukia maderaspatana* L.	Cucurbitaceae	Climber
52.	Cork Bush	*Mundulea sericea* Willd.	Fabaceae	Tree
53.	Nerium / Oleander	*Nerium indicum* Mill.	Apocynaceae	Shrub
54.	Night Jasmine	*Nyctanthes arbor-tristis* L.	Nyctanthaceae	Tree
55.	Hoary Basil / Lime	*Ocimum americanum* L.	Lamiaceae	Herb
56.	Sweet Basil	*Ocimum basilicum* L.	Lamiaceae	Herb
57.	Yellow Sorrel	*Oxalis corniculata* L.	Oxalidaceae	Herb
58.	Candelabra Wattle	*Panicum curviflorum* L.	Poaceae	Herb
59.	Guinea Grass	*Panicum maximum* Jacq.	Poaceae	Herb
60.	Millet Rampant / Witch	*Panicum psilopodium* Trin.	Poaceae	Herb
61.	Badminton Ball Tree / African Bean	*Parkia biglandulosa* Wight & Arn.	Mimosaceae	Tree
62.	Carrot Grass	*Parthinium hysterophorus*	Asteraceae	Herb
63.	Yellow Watercrown	*Paspalidium flavidum* Retz.	Poaceae	Herb
64.	Purple Passionfruit	*Passiflora edulis* Sims	Passifloraceae	Climber
65.	Foxtail	*Setaria intermediata* Roem. & Schult.	Poaceae	Herb
66.	Indian Snakeweed	*Stachytarpheta jamaicensis*	Verbinaceae	Herb
67.	Pemba Grass	*Stenotaphrum dimidiatum*	Poaceae	Herb
68.	Witch Weed	*Striga densiflora* (Benth.)	Scorphulariaceae	Herb
69.	Shrubby Pencil Flower	*Stylosanthes fruticosa* L.	Fabaceae	Herb
70.	Java Plum	*Syzygium cumini* (L.)	Myrtaceae	Tree
71.	Silver Trumpet Tree / Tree of Gold	*Tabebuia aurea* Benth. & Hook.	Bignoniaceae	Tree
72.	Cuban Pink Trumpet	*Tabebuia pallida* (Lindl.)	Bignoniaceae	Tree
73.	Indian Borage	*Trichodesma indicum* L.	Boraginaceae	Herb
74.	Sleepy Morning	*Waltheria indica* L.	Sterculiaceae	Herb
75.	Dyer’s Oleande	*Wrightia tinctoria* L	Apocynaceae	Tree

Tradescantia

Pleioblastus viridistriatus

Sansevieria

Oxalis grandis

Epipremnum aureum

Plectranthus

Moringa oleifera

Polyalthia longifolia

Musa paradisiaca

Ficus religiosa

Ocimum Sanctum

Murraya koenigii

Solanum melongena

Leguminous sp

Cymbopogon citratus

Ananas comosus

Ficus recemosa

Chamaecostus cuspidatus

13.3.1.1. Lichen diversity at SVKM'S UPGCASC campus

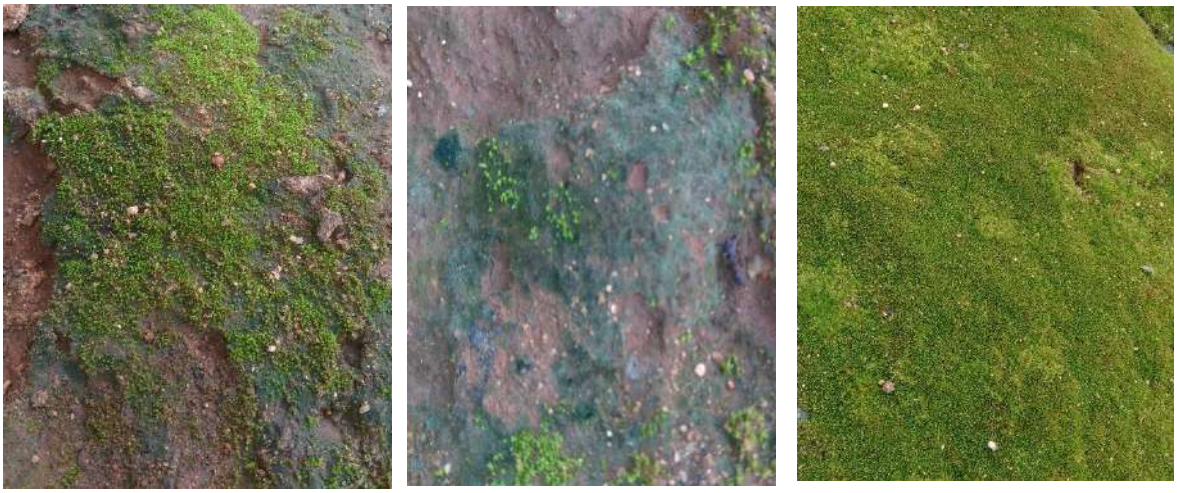
Lichens are one of the most fascinating symbiotic organisms found worldwide. The lichens species are ubiquitous and common inhabitants of the bark of the tree, rock surface, soil etc. They are a lower group of plants coming under non-flowering plants that live in a variety of substrates under a wide 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 symbiotic association between a fungal and an algal partner results in a species called lichens in plant kingdom. In this relationship both the organisms are mutually benefited. The algal partner may be cyanobacteria or the blue green algae and this is responsible for the process of photosynthesis. The algae thus provide food or nutrition for the fungi too. The fungal partner in turn provides space and protection for the algae. The lichen is an autotrophic organism in the sense that they can produce their own food by the process of photosynthesis. Even though the lichen is made up of two different organisms, the characteristics of the lichen are entirely different from the original characteristics of the algal and the fungal partner. Lichens are classified as micro lichens and macro lichens in which the microlichens cover the substrate on which they grow in the form of a crust whereas macro lichens grow in the form of a bush or a leaf like structure. The major forms of lichens are a) Foliose lichens exhibit a flat leaf like thallus, b) Fruticose lichens exhibit erect, pendulous and bushy thallus, c) Squamulose lichens exhibit thallus with minute, scale like squamules and d) Crustose lichens exhibit flat crust shaped thallus.

Lichen diversity at SVKM'S UPGCASC campus showed a total of 10 different lichens species belonging to 7 genera and 2 families. The observation on lichen diversity revealed that three types of lichens genus belonging to *Buellia* spp., *Lecanora* spp. and *Parmotrema* spp.

Lichen diversity of SVKM'S UPGCASC campus
[lichens genus belonging to *Buellia* spp., *Lecanora* spp. and *Parmotrema* spp.]

13.3.1.2. Algal diversity at SVKM'S UPGCASC campus

Chlamydomonas ovoidae, Scytonema varium, Oscillatoria curviceps, Spirogyra porticalis, Microcystis elongate and *Cladophora albida* belonging to the class of Cyanophyceae, Chlorophyceae and Bacillariophyceae. The families Chlorellaceae, Closteriaceae, Desmidiaceae, Radiococcaceae, Ulotrichaceae, Uronemataceae and Oedogoniaceae were represented by single genus and species. Chlorophyceae plays an important role in both terrestrial and aquatic ecosystem as most of the members are found to be ecologically important. The highest diversity of Chlorophyceae indicated relatively good health of atmosphere.



13.3.2. Fauna Diversity in SVKM'S UPGCASC campus

13.3.2.1. Birds Diversity in SVKM'S UPGCASC campus

The observations on fauna diversity incated that the UPGCASC campus has a large number of living as well as visiting animals, birds, reptiles and insects including termids. A total number of 84 birds belonging to the 21 species were recorded from different habitats during winter and summer, of them one of which were endemic to the western Ghats like purple rumped sunbird. Totally 18 species of birds representing 8 families and 4 orders were observed during this study, passeiformes constituted the predominated group representing 8. Total number of 19 bird species,out of them 3 species were migrant, 9 species were local migrant during winter and summer season because of unfavour environment and low availability of food resources. Migratory bird species like Red winged creased cuckoo, Indian cuckoo, forest wag tail, Yellow browed bulbul, Paddy field warbler, small green billed malkhoa, Alexadrine parakeet, Rose ringed parakeet and red whiskered bulbul.

Birds Diversity in SVKM'S UPGCASC campus

S.No	Common Name	Scientific Name
1.	Lesser Whistling-Duck -- FO	*Dendrocygna javanica*
2.	Indian Spot-billed Duck -- FO	*Anas poecilorhyncha*
3.	Rock Pigeon (Feral Pigeon)	*Columba livia*
4.	Spotted Dove	*Spilopelia chinensis*
5.	Laughing Dove	*Spilopelia senegalensis*
6.	Greater Coucal	*Centropus sinensis*
7.	Asian Koel	*Eudynamys scolopaceus*
8.	Alpine Swift	*Tachymarptis melba*
9.	Little Swift	*Apus affinis*
10.	Asian Palm-Swift	*Cypsiurus balasiensis*
11.	White-breasted Waterhen	*Amaurornis phoenicurus*
12.	Black-winged Stilt	*Himantopus himantopus*
13.	Red-wattled Lapwing	*Vanellus indicus*
14.	Marsh Sandpiper	*Tringa stagnatilis*
15.	Wood Sandpiper	*Tringa glareola*
16.	Black-headed Gull	*Chroicocephalus ridibundus*
17.	Brown-headed Gull	*Chroicocephalus brunnicephalus*
18.	Whiskered Tern	*Chlidonias hybrida*
19.	Painted Stork -- FO	*Mycteria leucocephala*
20.	Little Cormorant	*Microcarbo niger*
21.	indian Cormorant	*Phalacrocorax fuscicollis*
22.	Gray Heron	*Ardea cinerea*
23.	Intermediate Egret	*Ardea intermedia*
24.	Little Egret	*Egretta garzetta*
25.	Cattle Egret	*Bubulcus ibis*
26.	Cattle Egret (Eastern)	
27.	Indian Pond-Heron	*Ardeola grayii*
28.	Black-crowned Night-Heron	*Nycticorax nycticorax*
29.	Glossy Ibis -- FO	*Plegadis falcinellus*
30.	Eurasian Spoonbill -- FO	*Platalea leucorodia*
31.	Indian Gray Hornbill -- FO	*Ocyceros birostris*
32.	White-throated Kingfisher	*Halcyon smyrnensis*
33.	Green Bee-eater	*Merops orientalis*
34.	Blue-tailed Bee-eater	*Merops philippinus*
35.	Indian Roller	*Coracias benghalensis*
36.	Coppersmith Barbet	*Megalaima haemacephala*

37.	Amur Falcon -- FO towards South	*Falco amurensis*
38.	Alexandrine Parakeet	*Psittacula eupatria*
39.	Rose-ringed Parakeet	*Psittacula krameri*
40.	Indian Golden Oriole	*Oriolus kundoo*
41.	Black-naped Oriole	*Oriolus chinensis*
42.	Spot-breasted Fantail	*Rhipidura albogularis*
43.	Black Drongo	*Dicrurus macrocercus*
44.	Ashy Drongo	*Dicrurus leucophaeus*
45.	Black-naped Monarch	*Hypothymis azurea*
46.	Indian Paradise-Flycatcher	*Terpsiphone paradisi*
47.	House Crow	*Corvus splendens*
48.	Large-billed Crow	*Corvus macrorhynchos*
49.	large-billed Crow (Indian Jungle)	
50.	Common Tailorbird	*Orthotomus sutorius*
51.	Ashy Prinia -- Heard only	*Prinia socialis*
52.	Sykes's Warbler -- Unsure about ID	*Iduna rama*
53.	Blyth's Reed Warbler	*Acrocephalus dumetorum*
54.	Clamorous Reed Warbler	*Acrocephalus stentoreus*
55.	Dusky Crag-Martin	*Ptyonoprogne concolor*
56.	Barn Swallow	*Hirundo rustica*
57.	Wire-tailed Swallow	*Hirundo smithii*
58.	Red-rumped Swallow	*Cecropis daurica*
59.	Streak-throated Swallow	*Petrochelidon fluvicola*
60.	Red-vented Bulbul	*Pycnonotus cafer*
61.	Red-whiskered Bulbul	*Pycnonotus jocosus*
62.	Sulphur-bellied Warbler	*Phylloscopus griseolus*
63.	Greenish Warbler	*Phylloscopus trochiloides*
64.	Western Crowned Warbler	*Phylloscopus occipitalis*
65.	Lesser Whitethroat	*Sylvia curruca*
66.	Rosy Starling -- FO	*Pastor roseus*
67.	Asian Pied Starling	*Gracupica contra*
68.	Brahminy Starling	*Sturnia pagodarum*
69.	Common Myna	*Acridotheres tristis*
70.	Asian Brown Flycatcher	*Muscicapa latirostris*
71.	Brown-breasted Flycatcher	*Muscicapa muttui*
72.	Indian Robin	*Saxicoloides fulicatus*
73.	Oriental Magpie-Robin	*Copsychus saularis*
74.	Tickell's Blue Flycatcher	*Cyornis tickelliae*

75.	Verditer Flycatcher	*Eumyias thalassinus*
76.	Red-breasted Flycatcher	*Ficedula parva*
77.	Asian Brown Flycatcher	*Dicaeum erythrorhynchos*
78.	Purple-rumped Sunbird	*Leptocoma zeylonica*
79.	Purple Sunbird	*Cinnyris asiaticus*
80.	Baya Weaver	*Ploceus philippinus*
81.	Scaly-breasted Munia	*Lonchura punctulata*
82.	House Sparrow	*Passer domesticus*
83.	Gray Wagtail	*Motacilla cinerea*
84.	White Wagtai	*Motacilla alba*

13.3.2.3. Butterflies diversity in SVKM'S UPGCASC campus

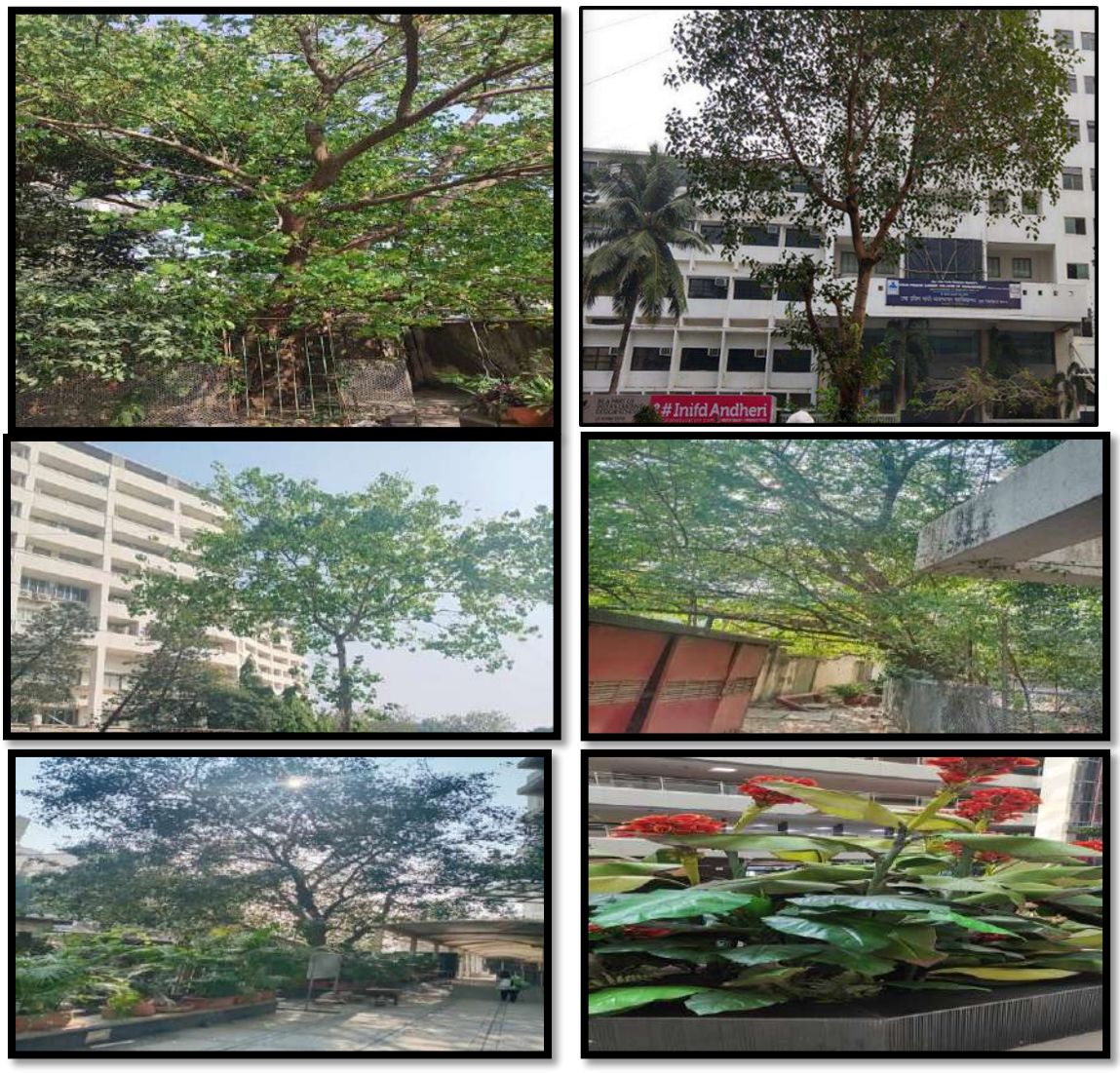
SVKM'S UPGCASC campus has three family level diversities such as Papilionidae, Nymphalidae, and Lycaenidae in which Common butterflies species such as Mormon, Rose, Birdwing, Emigrant, Grass yellow, Gull Wanderer, Emigrant, Small Orange Tip, Plain Orange Tip, White Orange Tip, Yellow Orange Tip, Pioneer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

List of Butterflies recorded in SVKM'S UPGCASC campus

S.No.	Common Name	Scientific Name	Family
1.	Common Bluebottle	*Graphium sarpedon*	Papilionidae
2.	Common Mime	*Chilasa clytia*	Papilionidae
3.	Red Helen	*Papilio helenus*	Papilionidae
4.	Paris Peacock	*Papilio paris*	Papilionidae
5.	Common Banded Peacock	*Papilio crino*	Papilionidae
6.	Blue Mormon	*Papilio polymnestor*	Papilionidae
7.	Chocolate Pansy	*Precis iphita*	Nymphalidae
8.	Dark Blue Tiger	*Tirumala septentrionis*	Nymphalidae
9.	Double-branded Crow	*Euploea sylvester*	Nymphalidae
10.	Common Silverline	*Spindasis vulcanus*	Lycaenidae
11.	Common Shot Silverline	*Spindasis ictis*	Lycaenidae
12.	Forget-Me-Not	*Catochrysops strabo*	Lycaenidae
13.	Lesser Grass Blue	*Zizina otis*	Lycaenidae
14.	Tiny Grass Blue	*Zizula hylax*	Lycaenidae
15.	Dark Grass Blue	*Zizeeria karsandra*	Lycaenidae

13.4. An account of more Oxygen producing and Carbon-di-oxide absorbing plants in the Campus

There are some plants which are being considered highly efficient in oxygen production and carbon-di-oxide absorption 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. The snake plant (*Sansevieria zeylanica*) otherwise known as the mother-in-law's tongue and Gerbera Daisy (*Gerbera jamesonii*) plant are unique for its night time oxygen production, and ability to purify air through the removal of various toxic gases in the atmosphere. Although there are options available for increasing oxygen by reducing CO_2 through means such as oxygenators and air purifiers, there are a variety of natural alternatives for increasing air quality that are beneficial for both body and mind. SVKM'S UPGCASC campus has a maximum number of more oxygen producing and CO_2 absorbing plants such as *Areca Palm, Money plant, Neem tree, Tamarind tree, Ficus, Bamboo, Arjun tree, Magizhamboo, Marudhu, Maramalli, Nettilingam, Manja arali, Puvarasu* and *Pongam* trees.



Oxygen producing and Carbon dioxide absorbing plants [Sacred fig tree (*Ficus religiosa*) Indian Sandalwood tree (*Santalum album*)]

13.5. Lawns, Trees, Herbs, Shrubs, Climbers and Lianas in UPGCASC 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 CO_2 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.

SVKM'S UPGCASC campus has a large number of trees, herbal plants, shrubs, 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. A total of 27 type of shrub species are available in the campus. The commonly available native as well as wild shrub species in the SVKM'S UPGCASC campus are Kakithapoo (*Bougainvillea spectabilis*), Madhanakamaboo (*Cycas revolute*), Pigeon-berry (*Duranta plumieri*), Nilamulli (*Eranthemum roseum*), Sembaruthi (*Hibiscus rosa-sinensis*), Vetchi (*Ixora coccinea*), Malli (*Jasminum sambac*) and Arali (*Nerium odorum).*

The existence of climber, creepers, twiners and lianas species available which accounted more than 24 species in the **S**VKM'S UPGCASC campus are Kayathalai (*Allamanda cathartica*), Kovai (*Coccinia indica),* Kattu-kodsi (*Cocculus hirsutus*), Amirtaval (*Tinospora cordifolia*) and Sinthal (*Monstera deliciosa*). The major grasses are Periapullu (*Aristida pinnata*), Chevvarakupul (*Chloris barbata*), Arugam Pillu (*Cynodon dactylon*), Korai Pollu (*Cyperus rotundus*) and Crowfoot grass (*Dactyloctenium aegyptium*). Creepers are plants with weak stem that grow along the ground, around another plant, or up a wall by means of extending stems or branches. Climbers are plants whose stems are weak, so they climb up trees and walls for support to grow. They are the type of herbs and shrubs which are green in colour and grow vigorously without any pest and disease attach which are observed in SVKM'S UPGCASC campus.

13.6. Establishment of different Gardens in SVKM'S UPGCASC Campus

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

the ornamental plants with beautiful flowers can be maintained in the frontage gardens of campus for attraction and good ambience. This will give an overall aesthetic look and also provide fresh air for healthy respiration to the stakeholders.

Graderning features at SVKM'S UPGCASC Campus

Establishment of Roof Gardens in UPGCASC Campus

13.7. Landscape design and Soil Erosion control

Landscape management is the care of land to make sure that landscapes can fulfil the needs and aspirations in an effective and sustainable manner for current and future stakeholders. It is an action that forms a perspective of sustainable development, to ensure the preservation of a panorama, in order to help and harmonize changes which are added 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 SVKM'S UPGCASC campus has very good landscape design. UPGCASC is located in the Western Ghats located in Mumbai, Maharastra. The SVKM'S UPGCASC Campus is almost very close to the Seashore which reflected the floral and fauna diversity along with soil and environmental conditions. The SVKM'S UPGCASC is established without damage of the original landscape and a nimum number of trees are growing naturally which control the soil erosion signicantly.

13.8. 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 / ornamental gardens can be connected with sprinkler irrigation. SVKM'S UPGCASC 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 beings carried out.

13.9. Pedestrian Path facility at SVKM'S UPGCASC 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 is created in the campus as per the norms of green and energy conservation code. 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. SVKM'S UPGCASC campus is having very good facility in creating pedestrian path for stakeholders.

13.10. 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 SVKM'S UPGCASC to cultivate plants.

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

Professional implementation of all the Eco plans in the campus should be done through the Eco clubs, Nature clubs, Science clubs, Youth Red cross units, Fine Arts clubs, Women cell, Associations, Forums, SSL, NCC (National Cadet Corps) and NSS (National Service Scheme). All the students, members of staff and employers should be mandatory members of the club and should do tree planting and maintenance of greenery in the campus periodically. Conducting frequent seminars, conferences, workshops, awareness rallies, etc. on topics relevant to the environment is necessary to educate and create awareness among the students and staff members. In addition, student's associations, cells, clubs and forums should be the first hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus. The SVKM'S UPGCASC has well developed NSS, Swacht Bharath Abhiyan under Clean India Mission. Th NSS is actively involved in tree planting programmes and cleaning the surrounding areas of rural, seashore and urban people across Mumbai City. The College is conducting a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people.

Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner. Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain. Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses. SVKM'S UPGCASC 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.

SVKM'S UPGCASC 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 Juhu village. These activities are very important in view of the immediate vicinity to take up developmental activities and conducted Participatory rural appraisal programmes. It is involving the socioeconomic status of the inhabitants, natural resources, traditional knowledge systems, cropping patterns, etc. of the rural people living in Juhu village. SVKM'S UPGCASC is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of the target group through the NSS units. 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, team spirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

13.12. 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. SVKM'S UPGCASC faculty members and students from various subject domains are doing extensive project work related to nature conservation, environmental pollution, soil and water analysis. Department of Management studies is being offering various courses in Regulation 2021 related to Environmental Mangement, and Ecology.

Revised Syllabus of Courses of Bachelor of Management Studies (BMS) Programme at Semester II with Effect from the Academic Year 2016-2017

Skill Enhancement Courses (SEC)

5. Foundation Course – II

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Globalisation and Indian Society	07
2	Human Rights	10
3	Ecology	10
4	Understanding Stress and Conflict	10
5	Managing Stress and Conflict in Contemporary Society	08
	Total	**45**

Sr. No.	Modules / Units
1	Globalisation and Indian Society
	Understanding the concepts of liberalization, privatization and globalization;Growth of information technology and communication and its impact manifested in everyday life; Impact of globalization on industry: changes in employment and increasing migration; Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides.
2	Human Rights
	Concept of Human Rights; origin and evolution of the concept; The Universal Declaration of Human Rights,Human Rights constituents with special reference to Fundamental Rights stated in the Constitution
3	Ecology
	Importance of Environment Studies in the current developmental context; Understanding concepts of Environment, Ecology and their interconnectedness; Environment as natural capital and connection to quality of human life; Environmental Degradation- causes and impact on human life;Sustainable development- concept and components; poverty and environment
4	Understanding Stress and Conflict
	Causes of stress and conflict in individuals and society; Agents of socialization and the role played by them in developing the individual; Significance of values, ethics and prejudices in developing the individual; Stereotyping and prejudice as significant factors in causing conflicts in society. Aggression and violence as the public expression of conflict
5	Managing Stress and Conflict in Contemporary Society
	Types of conflicts and use of coping mechanisms for managing individual stress; Maslow's theory of self-actualisation;Different methods of responding to conflicts in society; Conflict-resolution and efforts towards building peace and harmony in society

UBMSFSII.7 : ENVIRONMENTAL MANAGEMENT

[50 lectures : 3 Credit]

The objectives of the course are:

1) The basic objective of this course is to provide fundamental knowledge about environmental studies.
2) To develop knowledge base for demographic and environmental factors affecting business.
3) To make the students aware of environmental problems related to Business and commerce.
4) To inculcate Environmental ethics and values amongst the students.

NCRT - C

Unit	Name of the Topic	No. of Lect.
Unit I	**Environmental Concepts:** Environment: Definition and composition, Lithosphere, Atmosphere, Hydrosphere, Biosphere Biogeochemical cycles - Concept and water cycle. Ecosystem & Ecology; Food chain, food web & Energy flow pyramid. Resources: Meaning, classification(Renewable & non-renewable), types & Exploitation of Natural resources in sustainable manner.	12
Unit II	**Environment degradation:** Degradation-Meaning and causes, degradation of land, forest and agricultural land and its remedies. Pollution – meaning, types, causes and remedies (land, air, water and others) Global warming: meaning, causes and effects. Disaster Management: meaning, disaster management cycle. Waste Management: Definition and types -solid waste management, anthropogenic waste, e-waste & biomedical waste (consumerism as a cause of waste)	13
Unit III	**SUSTAINABILITY AND ROLE OF BUSINESS** **Sustainability:** Definition, importance and Environment Conservation. Environmental clearance for establishing and operating Industries in India. EIA, Environmental auditing, ISO 14001 Salient features of Water Act, Air Act and Wildlife Protection Act. Carbon bank & Kyoto protocol.	13
Unit IV	**INNOVATIONS IN BUSINESS- AN ENVIRONMENTAL PERSPECTIVE** Non-Conventional energy sources- Wind, Bio-fuel, Solar, Tidal and Nuclear Energy. Innovative Business Models: Eco-tourism, Green marketing, Organic farming, Eco-friendly packaging, Waste management projects for profits, other business projects for greener future.	12

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

1. It is observed that SVKM'S UPGCASC is being maintained a healthy environment along with the cleanliness and ecofriendly atmosphere as per the guidelines of World Green Building Council and Indian Green Building Council and Green, Envrionment and Energy Conservation Code to provide and ecofriendly atmosphere to the stakeholders.

2. SVKM'S UPGCASC campus is located in the Arabian seashore of the Western Ghats belonging to Maharashtra which provide pure atmosphere to the stakeholders under natural environment, topology, landscape and soil erosion. The campus is established without disturbing the landscape management.

3. The College has created 'Roof Gardern' for establishing a massive medicinal, herbal and ornamental planting programmes in which a large number of herbs and climber plant species were planted in earthern pots in the roof and land in the ground floor areas including man made constructed regions.

4. In view of floral biodiversity in SVKM'S UPGCASC campus, a sum 75 plant species belonging to 32 Genera under 20 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 3 species belonging to Lichens and Algae 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 College campus, a total of 84 species of birds, very few species of Butterflies and 2 species Mosquitos were recorded.

6. The campus has a maximum number of more oxygen producing and carbon-di-oxide absorbing plants such as Sacred fig tree (*Ficus religiosa*) Indian Sandalwood tree (*Santalum album*), Money plant, Neem tree and ect. including some of the shrub and herbal plants.

7. Department of Management studies, Information Technology and Multimedia and Mass Communication, SVKM'S UPGCASC is being offering various courses in Regulation 2021 related to biodiversity conservation, environmental safety and safeguard, environmental pollution, natural disaster management and waste management and environmental impact assessment and green auditing to the students and research scholars.

15. Recommendations for Greening

- The name board may be kept in each plant species in which the common name along with binomial name may be mentioned. The year of planting and economic importance with medicinal values if any may be mentioned in some plants so that the oldest as well as useful herbal plants may be identified in the campus.

- Honey Bee hives may be kept in the campus which is free from student's mobilization. Honeybees are natural pollinators helps 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, water holding capacity, 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. It may be analysed which may be useful for the plant growth as well as to the stakeholders.

- Vermicompost production may be increased substantially using tree leaf litter, kitchen wastes collected from hostels and cafeteria / canteen and biodegradable waste materials available in the campus. The vermicompost manure can be used for plant cultivation and the excess amount of vermicompost may be sold in the local market as consultation work.

- 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.

- Automatic water irrigation systems like drip and sprinkler irrigation methods adopted may be extended in the entire green area of the campus which in turn are useful to reduce the operation costs under energy conservation policy.

- 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.

- The 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 are virtualization technology.

- Eco club Student Chapters, Nature Club, Students Forums & Cells, etc. may be started to among the all Arts, Science and commerce students from which a large number of awareness programmes on nature conservation and environmental protection may be conducted to rural, tribal and urban people across Mumbai city.

17. Conclusion

In the two decades of service to higher education, SVKM’S UPGCASC, Mumbai, Maharashtra has made significant progression in teaching learning, research and consultancy, innovation and transfer of technology, community service and value education. SVKM’S UPGCASC is a well-established Self-Financing Institute in India which imparts quality education to rural, tribal and urban people across the world. 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 urben community people without disturbing the natural environment, topology, landscape management and vegetation. SVKM'S UPGCASC has their own Green Campus and Environment policy with respect to nature conservation and environmental protection.

SVKM'S UPGCASC is being maintained a healthy environment along with the cleanliness and ecofriendly atmosphere as per the guidelines of Green, Envrionment and Energy Conservation Code to provide and ecofriendly atmosphere to the stakeholders. The campus is established without disturbing the landscape management. The College has created 'Roof Gardern' for establishing a massive medicinal, herbal and ornamental planting programmes. In view of floral biodiversity in the college campus has 75 plant species belonging to 32 Genera under 20 families covering trees, herbs, shrubs, climbers, lianas, twiners and lawns and 3 species belonging to Lichens and Algae were recorded. Similarly, in view of faunal biodiversity, the College campus, has 84 species of birds, very few species of Butterflies and Mosquitos. The campus has a maximum number of more oxygen producing and carbon-di-oxide absorbing plants. Department of Management studies of SVKM'S UPGCASC, Information Technology and Multimedia and Mass Communication is being offering various courses related to nature conservation and environmental protection.

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Certificates of
Nature Science Foundation, Coimbatore, Tamil Nadu.

1. ISO Certificate
2. 12A Certificate
3. 80G Certificate

QUALITY MANAGEMENT SYSTEM

Certificate of Registration

ROHS

This is to Certify That The Quality Management System of

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

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

DIRECTOR
ROHS Certification Pvt. Ltd.

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

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.

F.2984

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 S. Ponnuraj 17/07/19
Rajd. 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:-	

	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)

Digitally Signed by SIBICHEN K MATHEW
Date: 2021.11.03 19:52:36 IST

Certificates of Green Campus Auditors.

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Founder & Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarthi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredidated Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Associated Chambers of Commerce and Industry of India (ASSOCHAM), of Er. Ashutosh Kumar Srivastava, Board of Directors (North Zone) of NSF.
6. Botanist and Suject Expert of Plant Taxonomy of Dr. D. Vinoth kumar, Joint Director of NSF.
7. Energy and Enivornment Engineering (EEE Auditor) of Er. B. Vijayalakshmi, Deputy Director of NSF.
8. Bureau of Energy Efficiency (BEE) of Dr. N. Balasubramanian, Energy Auditor of NSF.


vidya dadati vinayam
Exemplar Global
NEUTRAL VERITAS TRANSPARENT
Certificate of Training
TNV hereby certifies that
S. Rajalakshmi
has successfully completed the 5 days
Auditor / Lead Auditor Training Course which meets the training requirements of the
Exemplar Global and has been declared as competent in the following competency units
- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams
ISO 14001:2015
Issue Date: 17th Jun. 2021
Training Date : 20th to 24th May. 2021
Certificate Number : 2106170721010105
Authorised Signatory
(Pragyesh Singh)
This course is certified by Exemplar Global vide registration number TN006669
Note: The course conforms to the principles and practice of audits of Management Systems
for compliance with standards. This certificate remains the property of TNV and this
certificate is recognized by Exemplar Global. For verification of this certificate,
please write to Mail: info@isoindia.org

TÜV NORD

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

CQI | IRCA

CERTIFIED COURSE

IGBC

CII
Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

B Mythili Gnanamangai

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairmar
Indian Green Building Council

Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

210122

17 April 2021

GEM Certificate

ASSOCHAM
Celebrating 101 Years

ASSOCHAM hereby certifies that

Dr. B. Mythili Gnanamangai

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

16 July, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/649

Deepak Sood
Secretary General, ASSOCHAM

GEM Certificate

ASSOCHAM hereby certifies that

Mr. Ashutosh Kumar Srivastava

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Good Performance"

on

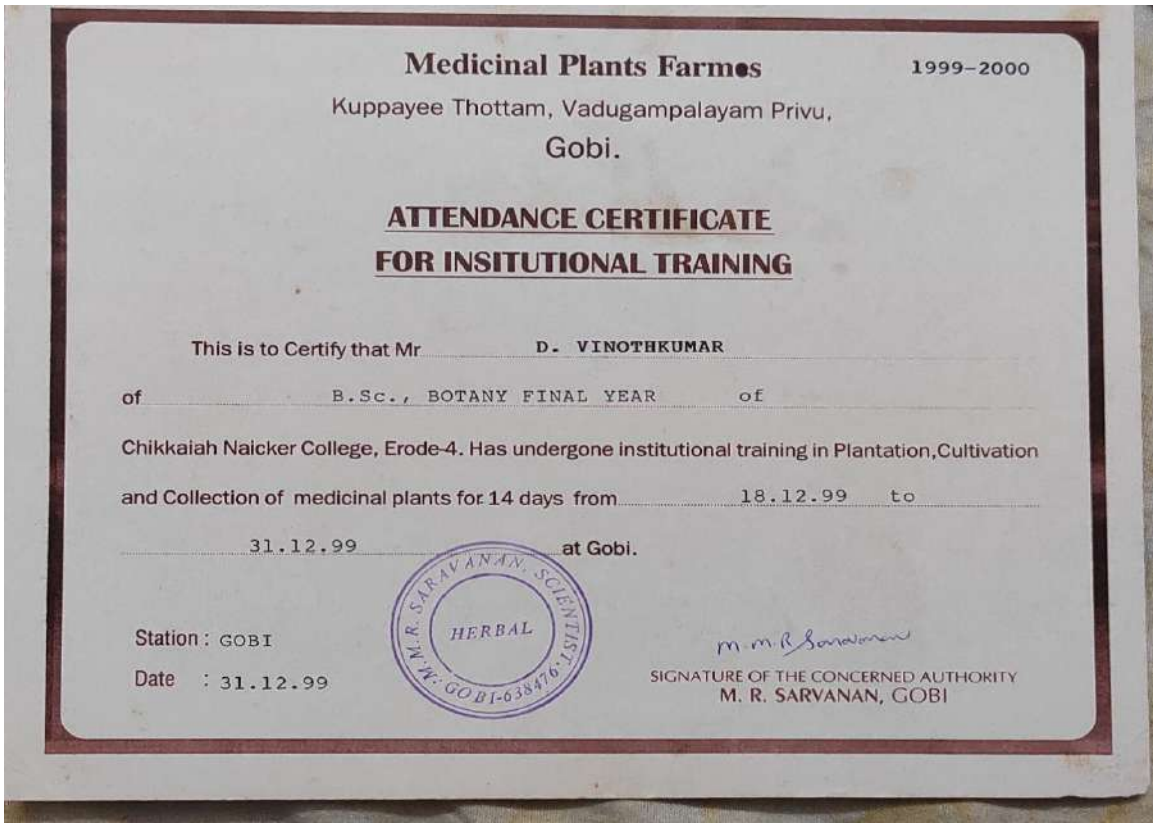
03 September, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/666

Deepak Sood
Secretary General, ASSOCHAM



Medicinal Plants Farmes 1999-2000

Kuppayee Thottam, Vadugampalayam Privu,

Gobi.

ATTENDANCE CERTIFICATE

FOR INSITUTIONAL TRAINING

This is to Certify that Mr D. VINOTHKUMAR

of B.Sc., BOTANY FINAL YEAR of

Chikkaiah Naicker College, Erode-4. Has undergone institutional training in Plantation,Cultivation and Collection of medicinal plants for 14 days from 18.12.99 to 31.12.99 at Gobi.

Station : GOBI

Date : 31.12.99

M.R. SARAVANAN, SCIENTIST HERBAL GOBI-638476

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

The Institution of Engineers (India)

Hosur Local Centre

Under the Aegis of

Chemical Engineering Division Board

In Association with

Department of Biotechnology & Department of Chemical Engineering

Adhiyamaan College of Engineering (Autonomous),

All India Seminar on

"BIODEGRADABLE MATERIAL AND BIOTECHNOLOGY FOR ENVIRONMENTAL PROTECTION FOR CHEMICAL INDUSTRY"

CERTIFICATE OF PARTICIPATION

This is to certify that ~~Mr.~~ / ~~Ms.~~ Dr. D. Vinothkumar of Adhiyamaan College of Engineering has participated in the All India Seminar held at Adhiyamaan College of Engineering, Hosur on 9th & 10th January, 2017.

Dr. V. Manivasagan, MIE
convener

Dr. J. Arivudainambi, FIE
Honorary Secretary
IEI - HLC

Dr. N. S. Bhadarinarayana, FIE
Chairman
IEI - HLC

TAMILNADU FIRE & RESCUE SERVICES

THIRUVALLUR DISTRICT

THIRUVALLUR

CERTIFICATE

This is to certify that Mrs. / Mr. S. SRINIVASH s/o B. SWAMIYAPPAN 4/855, ST. Xavier's Street, Pannur, Thiruvallur District has under gone the "Basic Fire Fighting & Rescue Operation" Training course conducted from 12-08-2016 to 26-08-2016 by Tamil Nadu Fire & Rescue Services Department at Thiruvallur District, Thiruvallur as per G.O.M.S. No.713, dated 17.08.2005 Home (Police XVII) Department, Government of Tamil Nadu.

Station: Thiruvallur.

Date: 20.9.16

District Officer, 20.9.16
Fire & Rescue Services,
Thiruvallur District,
Thiruvallur

Sl.No.: 0010669

TAMIL NADU AGRICULTURAL UNIVERSITY
COIMBATORE

On the recommendation of the
Academic Council and the Board of Management
hereby admits

VIJAYALAKSHMI. B.
to the degree of
Bachelor of Technology
(Energy and Environmental Engineering)

he / she having qualified to receive the same
securing an Overall Grade Point Average
of **7.61** out of **10.00** in the year **2017**
together with all the honours and distinctions belonging
to this degree given under the seal of the University

COIMBATORE
Date : 26.02.2019

N. KUMAR
Vice Chancellor

ANNA UNIVERSITY

CHENNAI - 600 025

PROVISIONAL CERTIFICATE

Folio No.: AUO2359635

This is to certify that the following candidate has qualified for the award of Degree as detailed below:

Name	: VIJAYALAKSHMI B
Registration Number	: 412718416013
Degree	: M.E.
Branch/Specialization	: Environmental Engineering
Month and Year of Passing	: April 2020
Classification	: FIRST CLASS WITH DISTINCTION

Controller of Examinations Chennai 600 025 Anna University

Chennai - 600 025.
Date : 02/11/2020

Controller of Examinations i/c

V122065190828B

BUREAU OF ENERGY EFFICIENCY

Examination Registration No. : EA-7391 Serial Number 7192

Certificate Registration No. : 7192

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. N.Balasubramaniam Son/Daughter of Mr./Mrs. M.Nanjukuttigounder who has passed the National Examination for certification of energy manager held in the month of December 2009 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 7192 being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. N.Balasubramaniam is deemed to have qualified for appointment or designation as energy manager under clause (*l*) 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

Dates of attending the refresher course	Secretary's signature	Dates of attending the refresher course	Secretary's signature

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 (*l*) 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

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			

Regn. No. EA-7391

Certificate No. 5093

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. N.Balasubramaniam

son / daughter of Mr. M.Nanjukuttigounder

has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

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

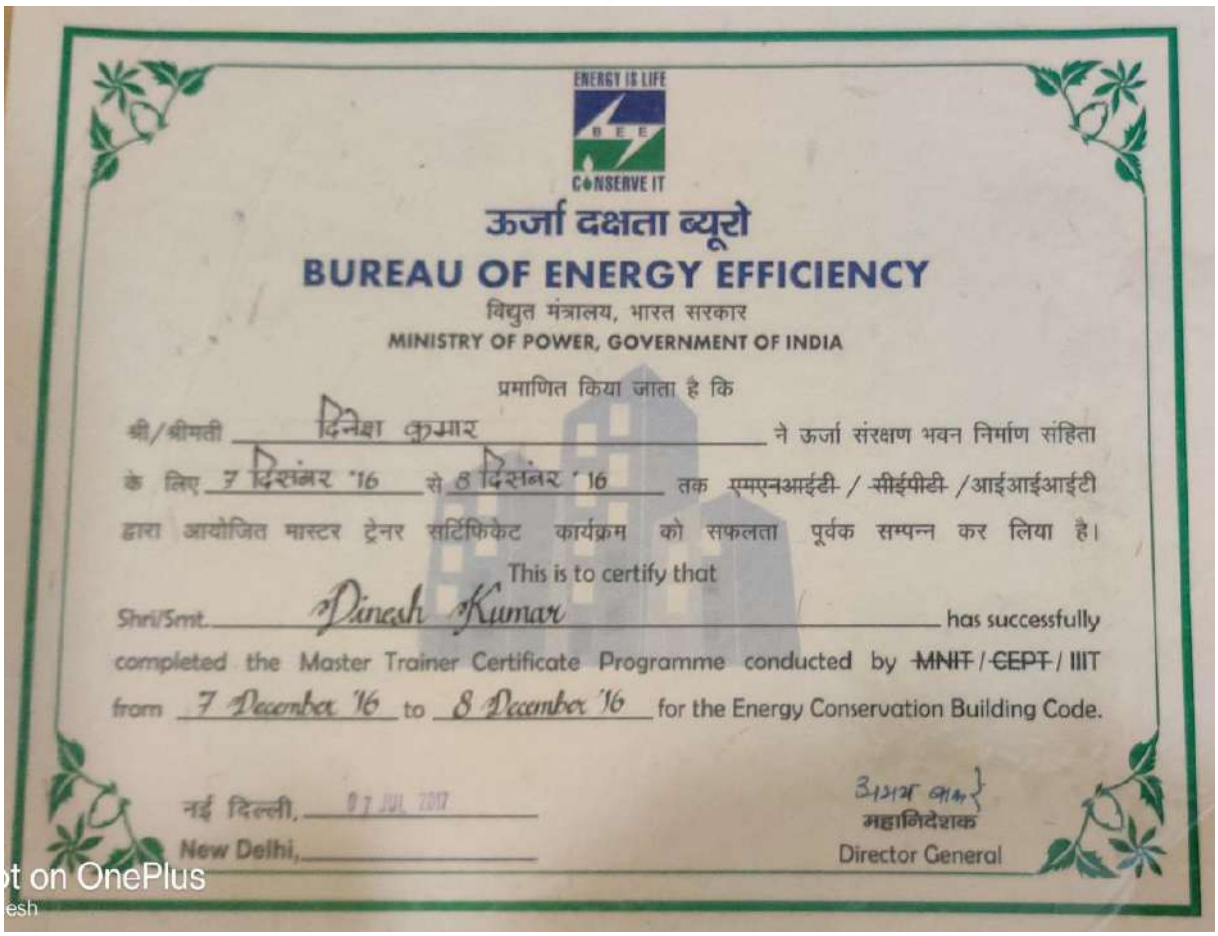
He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

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

Place : Chennai, India

Date : 11th February 2010

Controller of Examination



LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

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

10531234-AP-BD+C
CREDENTIAL ID

26 DEC 2016
ISSUED

25 DEC 2022
VALID THROUGH

Mahesh Ramanujam

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

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 19th June 2020

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

Chief Executive Officer
GRIHA Council