



**NIRMALA COLLEGE**  
**MUVATTUPUZHA**



# **GREEN AUDITING**

# **2018 - 19**

Audited by  
Heartian Green Audit Team Sacred Heart College Thevara, Cochin-13

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# **GREEN AUDIT 2018-19 NIRMALA COLLEGE**

## **EXECUTIVE SUMMARY**

Nirmala College, Muvattupuzha established by the Catholic diocese of Kothamangalam in 1953, is situated in a sprawling 50 acre green campus on the mid-land hilly terrain in Avoly Panchayat of Ernakulam district, about 2 kms away from Muvattupuzha town. The college in its fourth cycle of re-accreditation by NAAC has undergone a green audit for a second time (within a span of 3 years) in its progress towards the goal Swachch Nirmala. It has 2730 students, 143 faculty members and 52 non-teaching staff. The audit was undertaken by Heartian Green Audit Team of Sacred Heart College, which had an interdisciplinary composition of experts in various aspects of environment.

The audit period was between December 1, 2018 and Jan. 26<sup>th</sup> 2019. The audit team verified the documentation on green practices related to bio-diversity, energy management, water resource management, waste management, carbon footprint, agriculture, sustainability aspects, cleanliness etc. which had been prepared through participatory processes within the college.

The audit observed the following:

Sustainable improvement in the efforts by the college on the green front

Compliance efforts regarding suggestions of the previous audit

Involvement of all stakeholders, viz., college management, administration, faculty, student, alumni, etc.

1. Consistent improvement in physical facilities
2. Importance given to biodiversity and farming practices. More than 300 flowering plant species found on the campus is a good sign.

1. Elaborate audit process involving different stakeholders itself works out to be an educative programme for the campus community.
2. The activities effort towards *Swachh Bharath*, efforts at organic farming, conservation of water resources, clean campus, and conservation of biodiversity are to be appreciated.

The audit pose some suggestions and future action plans to be implemented in the campus including:

1. Articulation of comprehensive environment policy.
2. Effort to enhance solar energy trapping systems, with specific achievable target, and a time bound plan for converting non-LED bulbs to LED bulbs.
3. A comprehensive and specific environment education plan including the practices available in the campus to be given to all students in the campus.
4. Setting time bound targets for water treatment, especially from the labs.
5. Greater stress on documentation of bio-diversity and their periodical updation, with specific reference to avian and lepidopteran fauna with respect to their respective seasonality.
6. Annual internal audit to be conducted

We hope this audit will provide a solid platform to identify strengths and weakness of green management in Nirmala College Campus and the College team would take it further.



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**Green Audit – Nirmala College Muvattupuzha**  
**CERTIFICATE**

This is to certify that the Green Audit Report of Nirmala College is based on the original data collected during the period of study. Further, it is certified that the baseline data was prepared by the internal Green Audit team of Nirmala College, Muvattupuzha and submitted to us. The content of the baseline data of the study has been personally verified by the Green Audit Team for validity and reliability. The data used in the study are original in nature and have not been presented or published elsewhere. Photographs used in the report are either taken directly by the audit team or are given by the internal audit team.

**Heartian Green Audit Team**

1. Fr. Prasanth Palackappillil (Principal and Convener)

2. Dr. Giby Kuriakose (Coordinator)

3. Dr. Mathew George (Energy Management Expert)

4. Dr. Midhun Dominic (Water Management Expert)

28-03-2019

Thevara

# **Chapter – 1**

## **Introduction**

### **1.1. Green Audit**

The Green audit process was began in the 1970s with an intention of identifying the activities carried out in a given institution or company. This was initiated against the background of growing concern over changing climate and related aspects. Green audit is a tool to identify the range of environmental impacts and assess the compliance of the operations on the development and regular activities within an organisation. It may also assess the compatibility of the operations within an organisation or a company with existing applicable laws and regulations and the expectations of their various stakeholders. It further assesses the possible implications and effect of pollution due to the operations within the organisation. The audit also seeks to identify possible means and methods to save investments, enhance work quality, improve health and safety of their employees, reduce liabilities and reduce the rate of environmental pollution. A continuous process of such audit might result in maintaining the quality of these aspects within the premises of any organisation.

Most companies, government and non-government bodies and other institutions conduct green audit aiming:

- to ensure that the performance of the institution with respect to environmental activities they are involved in, is in compliance with existing laws and regulations.
- To check the functionality and their operating success including water supply, energy related matters and other similar matters that are related to green operations in the campus
- To formulate or update the institution's environmental policy, if warranted.
- To measure the environmental impact of operational process related to green activities in the campus.
- To measure the performance of each green related operations and actions in the campus.

- To generate a database of green activities for continuous monitoring to assess the success of each of them.
- to identify future potential liabilities.
- to align the institution's developmental and day to day activities with the stated vision, mission, strategies, etc.
- to identify possible ways to reduce expenditure and running costs on equipments, appliances, etc. or try enhance revenue income.
- to improve process and materials efficiency, and in response to stakeholder requests for increased disclosure.

The process of green audit based on operational activities within an institution happens not necessarily based on laws and regulations. It might be largely based on awareness and concerns on environmental performances within and outside the institute's premises. This further strengthens the fact regarding social responsibilities of the organisation. Majority of the institutions that conducted green audits in the recent past has realised the importance of the same as they could easily manage their operational costs and provide good atmosphere to their stakeholders. The green audit also provides opportunities to identify full range of operations within an organisation, the impacts of maintaining and functioning of its operational goods and services, the actual source of raw materials for different activities within the organisation, the costs of operations of its offices, functional units, and other facilities. It also provide chances to understand the relationship with employees, material suppliers, stakeholders, etc. The recommendations, findings and suggestions that emerge during green audit would certainly help the management of the organisation to set up future action plan that best suits to them.

## **1.2. General steps involved in Green Audit**

1. Systematic and exhaustive data collection.
2. Evidence based documentation of activities.
3. Regular monitoring.
4. Provide standards and methods for improvement by establishing cost effective green action plan.

## Chapter – 2

### Nirmala College – A Historical Account

#### 2.1. Brief History

Nirmala College, Muvattupuzha is one among the leading higher education institutions in Kerala. It has completed 65 years of academic mission. The college was established in the year 1954 under the Syro-Malabar Catholic Church management of Kothamangalam Diocese. The college offers undergraduate and post-graduate degrees in the arts, science and commerce streams. Situated in a hilly region surrounded by agricultural farm lands it adopts a healthy culture of keeping traditional as well as modern green practices. The campus is surrounded by heterogeneous vegetation with a fair amount of shady trees naturally found in the locality. The Campus is situated two km away from the Muvattupuzha Township. The campus provides an apt academic ambience free from the hustle and bustle of the town.



- |                                                      |                        |                      |                                      |                                  |
|------------------------------------------------------|------------------------|----------------------|--------------------------------------|----------------------------------|
| 1. Nirmala College main block                        | 7. Botanical Garden    | 13. Herbal Garden    | 18. Assisi Bhavan – Study House      | 22. Nirmala Computer Academy     |
| 2. Silver Jubilee Memorial PG block                  | 8. Tennis Court        | 14. Handball Court   | 19. St. Joseph's Ladies' Hostel      | 23. Jeevayothi Pastoral Centre   |
| 3. Golden Jubilee Memorial Library & Research Centre | 9. Open air Auditorium | 15. Salim Ali Park   | 20. Little Flower Ladies' Hostel     | 24. Nirmala College Boys' Hostel |
| 4. Nirmala College of Pharmacy                       | 10. Basketball Court   | 16. Sports Hostel    | 21. Amala Bhavan – Study House       | 25. Nirmala Junior Public School |
| 5. Nirmala Matha Church                              | 11. Utility block      | 17. Football Stadium | 26. Nirmala Public & Sr. Sec. School |                                  |
| 6. MCA Block                                         | 12. Volleyball Court   |                      |                                      | 27. Nirmala Sadan                |

Figure – 1. Campus infrastructure illustrates the facilities and their respective places

## **2.2. Geography**

The College is situated in Avoly Panchayat of Muvattupuzha Taluk in Ernakulam district. Its locational coordinates are 9°58'38.14"N 76°35'46.81"E. The locality comes under the midland region of Kerala, which has the geographical features of undulated land areas tapering into paddy fields. The raised part of the region provides conducive conditions for the growth of tropical evergreen and deciduous varieties of fruit yielding and other trees.

## **2.3. General Information**

The college offers 17 UG programmes and 14 PG programmes. Seven departments are recognised as research centres. The college has almost 2730 students on its rolls in various programmes with girls forming almost 60%. There are 65 teaching staff in the aided stream in various disciplines. Of which, 36 staff members hold PhD. Further, the college has 68 teachers on ad-hoc basis. More than 64% of the members of different faculties are women. About 52 administrative staff members and supporting staff are working in the college office and different departments. The college is tapping various funding sources from different National and State funding agencies such as University Grants Commission (UGC), Department of Science and Technology (DST), Department of Bio-technology (DBT) and Kerala State Council for Science, Technology and Environment (KSCSTE) for different academic activities including research.

Science departments are supported with DST-FIST. The College gained ‘Star College’ status (2017-2020) by the Department of Biotechnology, (India). Several major and minor research projects are being carried out by different staff members. Quality publications over a period in reputed national and international journals with high impact factor and h-index.

The college is adopting information technology as per the requirements. It also implement advance learning practices and system with utmost care. Digital Library with over 65000 titles of various disciplines, UGC sponsored INFLIBNET, etc. are

some examples for the same. The college publishes a bi-annual journal called “Science and Society” with ISSN number since 2003. Several endowment lectures inter-disciplinary national seminars and invited talks by experts are some dedications the college shown towards academic excellence.

Various clubs and fora such as National Service Scheme (NSS), National Cadet Corps (NCC), Debate Club, Quiz Club, Catholic Students Movement (CSM), Entrepreneurship Development Club (EDC), Human Rights Club (HRC), Anti-Narcotic Club (ANC), Road Safety Club, Nature Club, etc. are actively involved in the development of student capacity and personality.

The college apparently has a proven track record of its social commitment. The staff, students and managements are trying to reach out to the public and educating them on topics of common interest. Also, the college authorities, using public addressing system or programs such as ‘Nirmala Radio’ and ‘Zero Hour’ provides ample opportunity to the students to experience extra-curricular aspects.

Different department celebrations, inter-departmental and inter-collegiate competitions, and other celebrations helps the students to perform and sharpen their talents. All UGC, state government and university norms and directions are practiced without fail in the campus. This enables the students to develop their life with multifaceted and systematic activities. Parent Teacher Association (PTA) and Alumni Association play a good role in between the on campus students and society.

There are five air conditioned and well-furnished conference halls, four auditoriums of ample space, six seminar halls belonging to different departments, five computer labs, three smart class rooms, one language lab, about 250 computers with internet access, six photocopying machines, 22 DLP Projectors and so on. Two Ladies’ Hostels, Boys Hostel, Sports Hostel, Cafeteria, Post-office, Bank, Two ATM Counters, Kiosks, Staff Co-operative Society, Electronic workshop, Gymnasium,

Yoga Centre, Chapel, Counselling Centre, Book Stall and Stationery Shop are the strength and diversity of the infrastructure of the campus. This indicates that the campus is aligning its resources with advancement in the world of technology and development. This is very much in line with the vision of the college.

A dedicated and well equipped IQAC cell controls the activities that enables the campus to run along the forerunners of academic institutes in Kerala. The IQAC is well connected with the college management, administrative office, different departments, clubs and fora, etc. It also act as a mediator in organising several activities in the campus. Systematic documentation of activities and academics is a characteristic feature of the college. The IQAC cell enables the campus to get accreditations from different accrediting agencies.

#### **2.4. Previous Green Audit**

The previous green audit of Nirmala College Muvattupuzha was done during April-May 2017 by CMJ Eco Associates, Kochi. The report of the green audit was a comprehensive evaluation after thorough evaluation of all aspects related to concerned green activities of the campus. It identified the green activities in the campus involving, management, teachers and students. It also identified lacunas in green practices of the campus and recommended a few practices to be implemented for it to become a green campus. The following were the common recommendations posted in the previous audit.

- Adopt an environmental policy for the college.
- Establish a purchase policy towards environmental friendly materials.
- Introduce UGC Environmental Science course to all students.
- Conduct more seminars and group discussions on environmental education
- Students and staff can be permitted to solve local environmental problems.
- Renovation of cooking system in the canteen to save gas.
- Establish water, waste and energy management systems.(see Green Auditing of Nirmala College, 2017).

The college has apparently tried their level best to implement these recommendations within the stipulated time period. It also adopted other policies and practices that help them to achieve a green campus. The previous audit also suggested criteria wise recommendations such as water management and energy management. Most of the recommendations were dealt with by the campus authority.

## **2.5. Role of Management in Green Management**

The part played by the college management in bringing the campus to a green one is adorable.

The following were the initiatives by the college authorities in green management:

1. The management developed separate teams for implementing green policy in the campus.
2. Regular evaluation system has been established with monitoring cells for green activities in the campus.
3. The management has allotted budget for implementing green policies in the campus.
4. The green monitoring cell evaluates developmental and functional activities and makes recommendations for improvement of the green aspects.
5. These recommendations are implemented without delay and fail.
6. Clubs that are related to green activities are encouraged to conduct programs in and around the campus.
7. The management is keen on the social commitments and tries to reachout to the general public through teachers and students.
8. The management is keen in conducting awareness programs based on its green policies.
9. The support and part played by management is vital in the green campus related activities.

## **2.6. Swachh Nirmala**

Swachh Nirmala, “*Green Nirmala, Clean Nirmala*” is a novel initiative of the entire campus community to institutionalise cleanliness as an integral part of its functioning. The steps taken by the management to achieve this has fulfilled when Nirmala College listed in the MHRD, India Swachhatha Campus ranking twice. Mainly the college aim to achieve the following objectives by implementing Swachh Campus:

- To support the *Swachhta* movement in the country.
- To contribute positively to the environmental consistency.
- To campaign for good health, well-being, clean water, sanitation and clean energy.
- To monitor the environmental performance of the college.
- To formulate and implement a green protocol for students, faculty and campus level.

## **Chapter – 3**

### **Audit Preparations**

#### **3.1. Management**

The Nirmala College management was very keen in taking up the recommendation of conducting a green audit after two years after the previous audit. In the light of this, the college management approached Sacred Heart College, which has a consultancy wing offering services like green audit of institutions. The **Heartian Green Audit Team** agreed to conduct the green audit of Nirmala College. After this, there was a preliminary visit to the campus to set up different criteria and questions that are necessary for an updated green audit.

The following were different criteria set forth for the present green audit.

- a) Green Practices
- b) Water Management
- c) Energy Management
- d) Carbon Footprint

A detailed questionnaire for each aforementioned criteria was prepared based on the campus visit and thorough evaluation of the previous audit. The audit team in discussion with the college green cell has identified a team including teachers, non-teaching staff and students. The team has collected information that is addressed in the questionnaire.

#### **3.2. Teaching Staff and Students**

The following table illustrate the details of internal audit team involved at various levels of this audit process;

<b>Sl No</b>	<b>Name</b>	<b>Designation</b>	<b>Part Played</b>	<b>Audit Involved</b>
1	Dr Gigi K Joseph	Assistant professor, Zoology	Coordinator	Water
2	Albert Kattakayam	1St Msc Zoology	Data Collection	Water
3	Jithu Jacob Lal	1St Msc Zoology	Data Collection	Water
4	Ameena K A	1St Msc Zoology	Data Collection	Water
5	Suhaila P Bavu	1St Msc Zoology	Data Collection	Water
6	Noorasma	1St Msc Zoology	Data Compilation	Water
7	Anand K S	1St Msc Zoology	Data Compilation	Water
8	Dr George James T	Associate Professor, Physics	Coordinator	
9	Anju M S	2Nd Bsc Physics	Data Collection	Energy
10	Rugma Raveendran	2Nd Bsc Physics	Data Collection	Energy
11	Thertha .S	3Rd Bsc Physics	Data Collection	Energy
12	Gissmol Saji	2Nd Bsc Physics	Data Collection	Energy
13	Albin Saju	2Nd Bsc Physics	Data Collection	Energy
14	Amlin Ann Jose	2Nd Bsc Physics	Data Collection	Energy
15	Aadish Kumar	2Nd Bsc Physics	Data Collection	Energy
16	Alwin Saju	2Nd Bsc Physics	Data Collection	Energy
17	Athulya M S	2Nd Bsc Physics	Data Collection	Energy
18	Malavika Manoj	2Nd Bsc Physics	Data Collection	Energy
19	Chithira K Vijay	2Nd Bsc Physics	Data Collection	Energy
20	Ansu Benny	2Nd Bsc Physics	Data Collection	Energy
21	Manjima Jijo	2Nd Bsc Physics	Data Compilation	Energy
22	Anuja Rose	3Rd Bsc Physics	Data Compilation	Energy
23	Ashitha Thankachan	3Rd Bsc Physics	Data Compilation	Energy
24	Aadish Kumar	2Nd Bsc Physics	Data Collection	Carbon Audit
25	Alwin Saju	2Nd Bsc Physics	Data Collection	Carbon Audit
26	Athulya M S	2Nd Bsc Physics	Data Collection	Carbon Audit
27	Malavika Manoj	2Nd Bsc Physics	Data Compilation	Carbon Audit
28	Chithira K Vijay	2Nd Bsc Physics	Data Compilation	Carbon Audit
29	Dr. N Shibin Mohanan	Assistant Professor, Botany	Coordinator	Green Audit
30	Dr.Sibi C Varghese	Assistant Professor In Contract, Botany	Coordinator	Green Audit
31	Merin Jose	3Rd Botany	Data Collection and Compilation	Green Audit
32	Muhammed Shahinkhan	3Rd Botany	Data Collection and Compilation	Green Audit
33	Aleena Johnson	3Rd Botany	Data Collection	Green Audit
34	Krishna Venu	3Rd Botany	Data Collection	Green Audit
35	Amalendu S	3Rd Botany	Data Collection	Green Audit
36	Anaswara Sasi	3Rd Botany	Data Collection	Green Audit
37	Geena Johny	3Rd Botany	Data Collection	Green Audit
38	Bhagya M Nair	3Rd Botany	Data Collection	Green Audit
39	Divya Dinesan	3Rd Botany	Data Compilation	Green Audit
40	Abhiraj M N	3Rd Botany	Data Collection	Green Audit
41	Don Jose	2Nd Botany	Data Collection	Green Audit
42	Shibin Varghese	1St Bsc Botany	Data Collection	Green Audit

### **3.3. The Green Audit Process:**

1. Selection of area/activities/parts of the campus.
2. Planning of visit to campus to discuss about the audit process.
3. Scope of audit process was identified in consultation with the auditee.
4. A meticulous plan of action was designed.
5. A team consisting of teachers, non-teaching staff and students was constituted with specific tasks and a proper time schedule.
6. Data pertaining to identified parameters for green auditing of the campus were collected directly through an on-site visit.
7. Available background information on the identified activities and other parameters were collected.
8. The role of each stakeholder in green related activities has been collected.
9. Historical aspects of green activities in the campus including flora fauna, water usage and waste generation, etc. were collected.
10. A questionnaire based on the preliminary visits and other evaluations was communicated to the authorities who are involved in the in house data collection.
11. Data collection based on questionnaire.
12. Visit to the campus by audit team.
13. Data analysis and evaluation.
14. Discussion on the findings.
15. Report preparation.

### **3.4. Onsite audit activities**

1. The preliminary visit and meeting with the campus authorities was the first step between the audit team and auditee.
2. Site inspection for determining parameters for audit.
3. Site visit and evaluation of collected information of the audit team.
4. Meeting with the Principal, IQAC coordinator, teachers, non-teaching staff and students.
5. Meeting with the in house audit team for evaluation and clarifications.

## **Chapter – 4**

### **Green Audit**

#### **4.1. Inspection**

The preliminary visit in connection with the pre-audit process to the campus had identified criteria for audit, parameters to be evaluated and time schedule of green audit of Nirmala College. It included meeting with the Principal, IQAC coordinator, teachers in charge of different green activities of the campus and students representing different departments, clubs and fora. This enabled the auditing to gather all necessary preliminary information that is useful in preparing pre auditing questionnaire and data sheets. The on-site audit team collected information based on questionnaire and data sheet.

#### **4.2. Questionnaire**

The detailed questionnaire (Annexure I, II III & IV) was handled by three different audit teams and information was gathered. Information pertaining to green activities, water management, energy management and carbon foot print was analysed under different titles and sub-titles. This was based on the parameters identified. The questionnaire was comprehensive covering qualitative and quantitative dimensions.

#### **4.3. Evaluation of documents and reports**

The audit visit to the campus evaluated documents and reports (departments, clubs and fora) that are necessary for the audit process. This further strengthened the claims made by the campus authority on green operations in the campus. To generate future action plan, the audit team had a detailed discussion with different in house team in the institute and a concluding discussion session with IQAC coordinator and Bursar was done to finalise the plans.

## **4.4. Findings and Analysis**

### **4.4.1. Analysis of Green Practices**

#### **4.4.1.1. Gardens**

Nirmala College is situated in a peri-urban area where farming and agriculture are still being practiced in and around the campus. The campus biodiversity (Table-1) is an example of how they have imbibed the local practices and culture in preserving local biodiversity within the campus. The college management and authorities who are responsible for greening the campus is aptly adopting methods to preserve local flora and fauna. The botanical garden and different concept based gardens (spice garden, star plants garden, medicinal plants garden, *Dasapushpam* garden, ayurvedic preparation based plants (eg. *Nalpamara*, *thripala*, etc.), are ideal for academic practices and learning while practicing.

<b>Table – I. Campus Flora</b>		
<b>Sl. No.</b>	<b>Name of plants</b>	<b>No. of plants</b>
1	<i>Abelmoschus esculentus</i>	50
2	<i>Acacia mangium</i>	10
3	<i>Acacia caesia</i>	5
4	<i>Acalypha wilkesiana</i>	5
5	<i>Achras sapota</i>	3
6	<i>Acorus calamus</i>	2
7	<i>Adenanthera pavonina</i>	5
8	<i>Adhatoda vasica</i>	5
9	<i>Agave sp.</i>	5
10	<i>Aglaonema sp.</i>	10
11	<i>Agrostistachys indica</i>	1

12	<i>Ailanthus excelsa</i>	5
13	<i>Albizia chinensis</i>	5
14	<i>Aleurites moluccana</i>	2
15	<i>Allamanda cathartica</i>	55
16	<i>Aloe vera</i>	5
17	<i>Alpinia galanga</i>	5
18	<i>Alpinia nutan</i>	5
19	<i>Alstonia scholaris</i>	3
20	<i>Alternanthera brasiliiana</i>	40
21	<i>Amorphophallus paeoniifolius</i>	10
22	<i>Anacardium occidentale</i>	5
23	<i>Ananas comosus (Pineapple)</i>	100
24	<i>Annona muricata</i>	1
25	<i>Anthocephalus cadamba</i>	2
26	<i>Anthurium species</i>	20
27	<i>Antidesma acidum</i>	3
28	<i>Antigonon leptopus</i>	2
29	<i>Aphanamixis polystachya</i>	1
30	<i>Aporosa lindleyana</i>	1
31	<i>Arachis pintoi</i>	500
32	<i>Aralia sp.</i>	10
33	<i>Areca catechu</i>	46

34	<i>Areca palma</i>	10
35	<i>Aristolochia indica</i>	5
36	<i>Artobotrys hexapetalus</i>	1
37	<i>Artobotrys odoratissimus</i>	1
38	<i>Artocarpus heterophyllus</i>	30
39	<i>Artocarpus hirsuta</i>	125
40	<i>Artocarpus integrifolia</i>	10
41	<i>Asparagus racemosus</i>	2
42	<i>Azadirachta indica</i>	2
43	<i>Bacopa monnieri</i>	50
44	<i>Baliospermum montanum</i>	2
45	<i>Bambusa glaucophylla</i>	2
46	<i>Bambusa sp.</i>	2
47	<i>Bauhinia variegata</i>	2
48	<i>Bauhinia acuminata</i>	2
49	<i>Bauhinia tomentosa</i>	1
50	<i>Begonia sp.</i>	10
51	<i>Bignonia sp.</i>	2
52	<i>Blumea mollis</i>	10
53	<i>Bombax malabaricum</i>	
54	<i>Bougainvillea sp.</i>	50
55	<i>Brassica oleracea</i>	25

56	<i>Bridelia retusa</i>	2
57	<i>Brunfelsia calycinae</i>	1
58	<i>Cactus sp.</i>	2
59	<i>Caesalpinia coronaria- divi-divi</i>	2
60	<i>Caesalpinia pulcherrima</i>	3
61	<i>Calliandra rheedii</i>	2
62	<i>Callistemon lanceolatus</i>	1
63	<i>Calophyllum inophyllum- Punna</i>	1
64	<i>Cananga odorata</i>	2
65	<i>Canarium strictum</i>	1
66	<i>Canna indica</i>	15
67	<i>Capscicum annum</i>	10
68	<i>Capsicum frutescens</i>	15
69	<i>Carallia brachiata</i>	1
70	<i>Carica papaya</i>	15
71	<i>Cascabela thevetia</i>	1
72	<i>Cassia fistula</i>	13
73	<i>Casuarina equisetifolia</i>	5
74	<i>Centella asiatica</i>	28
75	<i>Chrysanthemum sp.</i>	5
76	<i>Chrysophyllum cainito</i>	2
77	<i>Cinnamomum verum –Lauraceae- Edana</i>	2

78	<i>Cinnamomum zeylanicum</i>	1
79	<i>Cissus quadrangularis</i>	1
80	<i>Citharexylum spinosum- Parijatham</i>	1
81	<i>Citrus limon</i>	3
82	<i>Clematis elliptica</i>	2
83	<i>Clerodendrum thomsoniae</i>	10
84	<i>Clitoria ternatea</i>	2
85	<i>Coccinia grandis</i>	2
86	<i>Cocos nucifera</i>	360
87	<i>Codiaeum variegatum</i>	2
88	<i>Coffea arabica</i>	150
89	<i>Coleus aromaticus</i>	5
90	<i>Colocasia esculenta</i>	25
91	<i>Coriandrum sativum</i>	5
92	<i>Costus pictus</i>	5
93	<i>Couroupita guianensis</i>	1
94	<i>Crossandra infundibuliformis</i>	1
95	<i>Croton sp.</i>	25
96	<i>Cuphea minuta</i>	10
97	<i>Curcuma longa</i>	2
98	<i>Cuscuta reflexa</i>	2
99	<i>Cycas circinalis</i>	1

100	<i>Cycas revoluta</i>	1
101	<i>Cymbopogon citratus</i>	2
102	<i>Cyrtostachys renda- Red palm</i>	5
103	<i>Dalbergia latifolia</i>	1
104	<i>Dalbergia sissoo</i>	1
105	<i>Datura metel</i>	1
106	<i>Delonix regia</i>	1
107	<i>Derris trifoliata</i>	1
108	<i>Dieffenbachia sanguinea</i>	15
109	<i>Dillenia bracteolate</i>	1
110	<i>Dillenia indica</i>	1
111	<i>Dioscorea esculenta</i>	5
112	<i>Diospyros blancoi- velvet apple</i>	1
113	<i>Diospyros peregrine</i>	1
114	<i>Dracaena braunii</i>	5
115	<i>Dracaena fragrans</i>	2
116	<i>Dracaena sp.</i>	5
117	<i>Duranta plumieri</i>	2
118	<i>Duranta repens</i>	2
119	<i>Elettaria cardamomum</i>	10
120	<i>Emblica officinalis</i>	2
121	<i>Ervatamia coronaria</i>	1

122	<i>Erythrina indica</i>	1
123	<i>Erythroxylum monogynum-</i>	
124	<i>Eugenia jambos</i>	3
125	<i>Euodia lunu-ankenda</i>	1
126	<i>Euphorbia hirta</i>	50
127	<i>Euphorbia rothieri</i>	5
128	<i>Euphorbia sp.</i>	5
129	<i>Evodia lunu ankenda</i>	2
130	<i>Evodia roxburghiana</i>	1
131	<i>Excoecaria bicolor-</i>	1
132	<i>Filicium decipiens</i>	1
133	<i>Ficus asperrima</i>	2
134	<i>Ficus auriculata</i>	1
135	<i>Ficus bengalensis</i>	2
136	<i>Ficus benjamina</i>	1
137	<i>Ficus elastica</i>	4
138	<i>Ficus hispida</i>	10
139	<i>Ficus racemosa</i>	1
140	<i>Ficus religiosa</i>	2
141	<i>Filicium decipiens</i>	1
142	<i>Flacourtie montana</i>	1
143	<i>Garcinia gummi-gutta</i>	2

144	<i>Garcinia mangostana</i>	1
145	<i>Gardenia gummifera</i>	3
146	<i>Gardenia jasminoides</i>	5
147	<i>Gliricidia maculata</i>	1
148	<i>Glycosmis pentaphylla</i>	5
149	<i>Hamelia patens</i>	1
150	<i>Helicteres isora</i>	2
151	<i>Hevea brasiliensis</i>	200
152	<i>Hibiscus rosa-sinensis</i>	15
153	<i>Holmskioldia sanguinea</i>	1
154	<i>Holoptelea integrifolia</i>	2
155	<i>Holarrhena antidysenterica</i>	1
156	<i>Hopea parviflora</i>	2
157	<i>Humboldtia brunonis</i>	1
158	<i>Hylocereus undatus</i>	1
159	<i>Hypoestes phyllostachya</i>	1
160	<i>Impatiens balsamina</i>	10
161	<i>Indigofera sp.</i>	1
162	<i>Ixora chinensis</i>	5
163	<i>Ixora coccinea</i>	5
164	<i>Ixora philippinensis</i>	2
165	<i>Jasminum angustifolium</i>	1

166	<i>Jasminum grandiflorum</i>	5
167	<i>Jasminum rigidum</i>	2
168	<i>Justicia beddomei</i>	25
169	<i>Justicia gendarussa</i>	15
170	<i>Kaempferia galangal</i>	2
171	<i>Kleinhovia hospita</i>	2
172	<i>Kopsia fruticosa</i>	1
173	<i>Lagerstroemia flos reginae</i>	2
174	<i>Lagerstroemia microcarpa</i>	1
175	<i>Lannea coromandelica</i>	1
176	<i>Lantana camara</i>	25
177	<i>Lawsonia inermis</i>	2
178	<i>Lepisanthes tetraphylla</i>	1
179	<i>Lycopersicum esculentum</i>	25
180	<i>Macaranga peltata</i>	1
181	<i>Madhuca neriifolia</i>	1
182	<i>Mangifera indica</i>	40
183	<i>Manihot esculenta</i>	25
184	<i>Manilkara zapota</i>	2
185	<i>Marsilea quadrifolia</i>	5
186	<i>Meiogyne pannosa</i>	2
187	<i>Melastoma malabathricum</i>	10

188	<i>Mentha piperita</i>	2
189	<i>Mesua thwaitesii</i>	1
190	<i>Michelia champaca</i>	2
191	<i>Millingtonia hortensis</i>	2
192	<i>Mimusops elengi</i>	31
193	<i>Momordica charantia</i>	2
194	<i>Moringa oleifera</i>	5
195	<i>Morua alba</i>	5
196	<i>Murraya exotica</i>	5
197	<i>Murraya koenigii</i>	2
198	<i>Musa paradisiaca</i>	200
199	<i>Mussaenda erythrophylla</i>	5
200	<i>Mussaenda frondosa</i>	2
201	<i>Myristica fragrans</i>	12
202	<i>Naregamia alata</i>	5
203	<i>Nelumbium speciosum</i>	2
204	<i>Nephelium lappaceum</i>	11
205	<i>Nephelium lappaceum</i>	2
206	<i>Nerium indicum</i>	10
207	<i>Nymphaea pubescens</i>	5
208	<i>Ochna obtusata</i>	4
209	<i>Ocimum basilicum</i>	10

210	<i>Olea dioica</i>	6
211	<i>Olea dioica</i> - Karivetti	1
212	<i>Oroxylum indicum</i>	2
213	<i>Ocimum sanctum</i>	10
214	<i>Osmoxylon lineare</i>	10
215	<i>Oxalis purpurea</i>	50
216	<i>Pachystachys lutea</i>	5
217	<i>Palm sp.</i>	2
218	<i>Pandanus odoratissimus</i>	2
219	<i>Passiflora miniata</i>	2
220	<i>Passiflora sp</i>	5
221	<i>Pedilanthus tithymaloides</i>	10
222	<i>Peltophorum ferrugineum</i>	35
223	<i>Peltophorum pterocarpum</i>	10
224	<i>Peltophorum roxburghii</i>	10
225	<i>Phaseolus vulgaris</i>	5
226	<i>Pholidota imbricata</i>	1
227	<i>Pimenta dioica</i>	2
228	<i>Piper longum</i>	5
229	<i>Piper nigrum</i>	5
230	<i>Pithecellobium saman</i>	2
231	<i>Plinia cauliflora</i>	1

232	<i>Plumbago indica</i>	5
233	<i>Plumbago zeylanica</i>	2
234	<i>Plumeria acutifolia</i>	4
235	<i>Plumeria indica</i>	5
236	<i>Poeciloneuron indicum</i>	1
237	<i>Poinsettia pulcherrima</i>	2
238	<i>Polyalthia longifolia</i>	5
239	<i>Poncirus trifoliata</i>	2
240	<i>Pongamia glabra</i>	5
241	<i>Pongamia pinnata</i>	2
242	<i>Pouteria campechiana</i>	1
243	<i>Psidium guajava</i>	15
244	<i>Punica granatum</i>	1
245	<i>Quisqualis indica</i>	2
246	<i>Rauvolfia serpentina</i>	2
247	<i>Rhoeo discolor</i>	10
248	<i>Ricinus communis</i>	2
249	<i>Rivina humilis</i>	5
250	<i>Rosa sp.</i>	5
251	<i>Roystonea regia</i>	10
252	<i>Salacia fruticosa</i>	2
253	<i>Salvia officinalis</i>	5

254	<i>Sansevieria sp.</i>	10
255	<i>Saraca india</i>	2
256	<i>Sauropolis quadrangularis</i>	5
257	<i>Schefflera arboricola</i>	10
258	<i>Schleichera oleosa</i>	2
259	<i>Simarouba glauca</i>	2
260	<i>Solanum melongena</i>	5
261	<i>Spathodea campanulata</i>	2
262	<i>Spathoglottis sp</i>	10
263	<i>Spathiphyllum</i>	3
264	<i>Spondias indica</i>	2
265	<i>Stereospermum suaveolens</i>	1
266	<i>Stereospermum colais</i>	2
267	<i>Strelitzia reginae</i>	1
268	<i>Strobilanthes ciliates</i>	15
269	<i>Strychnos nux-vomica</i>	1
270	<i>Swietenia mahagoni</i>	100
271	<i>Symplocos cochinchinensis</i>	2
272	<i>Synsepalum dulcificum</i>	1
273	<i>Syngonium podophyllum</i>	50
274	<i>Syzygium aqueum</i>	1
275	<i>Syzygium aromaticum</i>	1

276	<i>Syzygium cumini</i>	8
277	<i>Syzygium malaccense</i>	1
278	<i>Syzygium zeylanicum</i>	1
279	<i>Tabernaemontana dichotoma</i>	5
280	Tamarindus indica	7
281	Tecoma stans	2
282	Tectona grandis	15
283	Terminalia arjuna	2
284	<i>Terminalia bellirica</i>	2
285	<i>Terminalia catappa</i>	10
286	<i>Terminalia paniculata</i>	5
287	<i>Theobroma cacao</i>	5
288	<i>Thevetia peruviana</i>	2
289	<i>Thottea siliquosa</i>	3
290	<i>Thuja sp.</i>	2
291	<i>Thunbergia erecta</i>	5
292	<i>Thunbergia laurifolia</i>	1
293	<i>Thymus vulgaris</i>	10
294	<i>Trema orientalis</i>	2
295	<i>Trichosanthes cucumerina</i>	2
296	<i>Uvaria narum</i>	2
297	<i>Vanilla planifolia</i>	5
298	<i>Vateria indica</i>	1

299	<i>Vigna radiata</i>	25
300	<i>Vinca rosea</i>	50
301	<i>Woodfordia fruticosa</i>	2
302	<i>Zingiber officinale</i>	10

Students of related subjects are actively involved in gardening, maintenance, etc. of gardens within the campus. Further, they find the garden an apt place for discussions, combined studies, practicals, aesthetic purposes, spending leisure time, etc. Students are learning garden techniques by working in the garden with the help of teachers concerned. Garden makes ample space and scope for them to conduct practicals including budding, grafting, lawn making, etc. for students of Botany and Environmental studies. They also find this as a good opportunity to observe and learn about birds and butterflies. Students from department of Zoology learn about insects and their role in pollination by observing the same in the botanical garden. So far, 67 plants are identified and maintained in the garden (Table – 2). Students of Botany are doing bee keeping and are learning the bee preference towards plants from the garden. Preparation of vermi-compost and training on the same for those who are interested are conducted in the garden. There are enough resources (species of flora and fauna) available in different gardens and these resources are being utilized by the Botany and Zoology students for project works.

**Table – 2. Plants in the Botanical Garden**

Sl.No	Name of Plants	Number of Plants
1	<i>Adenanthera pavonina</i>	1
2	<i>Adhatoda vasica</i>	3
3	<i>Aglaonema sp.</i>	10
4	<i>Allamanda cathartica</i>	5
5	<i>Anthurium species</i>	5

6	<i>Arachis pintoi</i>	>200
7	<i>Aralia sp.</i>	5
8	<i>Asparagus racemosus</i>	1
9	<i>Bambusa glaucophylla</i>	1
10	<i>Bauhinia tomentosa</i>	2
11	<i>Bauhinia variegata</i>	1
12	<i>Begonia sp.</i>	2
13	<i>Bougainvillea sp.</i>	10
14	<i>Cactus sp.</i>	5
15	<i>Callistemon lanceolatus</i>	1
16	<i>Canna indica</i>	5
17	<i>Clematis elliptica</i>	2
18	<i>Clitoria ternatea</i>	2
19	<i>Cocos nucifera</i>	5
20	<i>Costus sp.</i>	7
21	<i>Costus pictus</i>	2
22	<i>Crossandra infundibuliformis</i>	1
23	<i>Croton sp.</i>	11
24	<i>Cuphea ignea</i>	7
25	<i>Cycas circinalis</i>	1
26	<i>Datura metel</i>	1
27	<i>Dieffenbachia sanguinea</i>	1
28	<i>Dracaena braunii</i>	2
29	<i>Dracaena fragrans</i>	3
30	<i>Duranta plumieri</i>	1

31	<i>Duranta repens</i>	2
32	<i>Ervatamia coronaria</i>	2
33	<i>Poinsettia pulcherrima</i>	1
34	<i>Gardenia gummifera</i>	3
35	<i>Gardenia jasminoides</i>	2
36	<i>Hamelia patens</i>	1
37	<i>Hibiscus rosa-sinensis</i>	3
38	<i>Holmskioldia sanguinea</i>	1
39	<i>Hypoestes phyllostachya</i>	3
40	<i>Ixora chinensis</i>	2
41	<i>Ixora philippinensis</i>	1
42	<i>Jasminum grandiflorum</i>	1
43	<i>Kopsia fruticosa</i>	1
44	<i>Lantana camara</i>	10
45	<i>Melastoma malabathricum</i>	5
46	<i>Murraya exotica</i>	2
47	<i>Nelumbium speciosum</i>	3
48	<i>Nerium indicum</i>	2
49	<i>Nymphaea pubescens</i>	2
50	<i>Osmoxylon lineare</i>	6
51	<i>Pachystachys lutea</i>	4
52	<i>Pandanus odoratissimus</i>	2
53	<i>Passiflora sp</i>	1
54	<i>Piper longum</i>	2

55	<i>Piper nigrum</i>	3
56	<i>Plumeria indica</i>	1
57	<i>Quisqualis indica</i>	2
58	<i>Rivina humilis</i>	4
59	<i>Rosa sp.</i>	2
60	<i>Salvia officinalis</i>	2
61	<i>Sansevieria roxburghiana</i>	5
62	<i>Schefflera arboricola</i>	3
63	<i>Thevetia peruviana</i>	1
64	<i>Thuja sp.</i>	3
65	<i>Thunbergia laurifolia</i>	2
66	<i>Uvaria narum</i>	1
67	<i>Woodfordia fruticosa</i>	1

It would be nearly impossible to learn taxonomy and morphology for Botany students if plants are not available nearby. Different species of plants in the garden make this possible. Students are keen in maintaining species that are dealt with in their syllabus for practicals and further observation.

The authorities are keen in developing the garden to higher levels by getting funds from sources such as spices board. The grants in aid was rightly spent in developing a spice garden with respective identification names and other details pertaining to the species in the spice garden.

The department of Botany and Nature Club initiated an agriculture garden where different species such as ginger, turmeric, chilli, etc are grown (Table-3). The vegetables harvested from the vegetable garden are utilised either in different

messes or sell it out among the staff and students. A portion is shared among the volunteers.

**Table – 3. Vegetables and other Crop Plants**

<b>Sl. No.</b>	<b>Species of plants</b>	<b>Approximate Yield (kg)</b>
1	<i>Abelmoschus esculentus</i> – ladies finger	30
2	<i>Amaranthus spp</i> – cheera	15
3	<i>Amorphophallus paeoniifolius</i> – chena	50
4	<i>Benicasa hispoida</i> – kumblanga	50
5	<i>Brassica oleracea</i> var. <i>boattrytis</i> – cauliflower	10
6	<i>Brassica oleracea</i> var. <i>capitata</i> – cabbage	15
7	<i>Capicum annum</i> – chilly	5
8	<i>Carica papaya</i> – papaya	75
9	<i>Coccinia grandis</i> – koval	60
10	<i>Colocasia esculenta</i> – chembu	180
11	<i>Cucumis sativus</i> – cucumber	220
12	<i>Cucurbita mellonina</i> – pumkin	250
13	<i>Curcuma longa</i> – turmeric	25
14	<i>Dioscorea alata</i> – cherukizhangu	40
15	<i>Dioscorea esculenta</i> – kachil	90
16	<i>Lagenaria siceraria</i> – bottle gourd	20
17	<i>Lycopersicum esculentum</i> – tomato	18
18	<i>Manihot esculenta</i> – tapioca	150

19	<i>Momordica charantia</i> – bitter gourd	30
20	<i>Moringa oleifera</i> – drum stick	20

#### 4.4.1.2. Arboretum

Nirmala College is maintaining an arboretum where natural species of plants are maintained (Table – 4). The plant diversity in the arboretum includes star plants, concept oriented plants based on *ayurvedic* preparations, etc. It is a place to conserve endemic plant species as well. The college authority is keen to enrich the arboretum by adding plants of different values.

**Table – 4. List of Plants in the Arboretum**

<b>Sl. No.</b>	<b>Species of plant</b>	<b>Number of Plants</b>
1	<i>Garcinia gummi-gutta</i>	2
2	<i>Cinnamomum verum</i>	2
3	<i>Mangifera indica</i>	1
4	<i>Saraca asoca</i>	1
5	<i>Annona muricata</i>	1
6	<i>Calophyllum inophyllum</i>	1
7	<i>Terminalia bellirica</i>	1
8	<i>Simarouba glauca</i>	1
9	<i>Bauhinia variegata</i>	1
10	<i>Stereospermum colais</i> var. <i>colais</i>	2
11	<i>Mimusops elengi</i>	2
12	<i>Artocarpus heterophyllus</i>	2
13	<i>Careya arborea</i>	1

14	<i>Terminalia cuneata</i>	2
15	<i>Briedelia retusa</i>	3
16	<i>Racosperma mangium</i>	1
17	<i>Swietenia macrophylla</i>	4
18	<i>Artocarpus hirsutus</i>	3
19	<i>Bombax malabaricum</i>	1
20	<i>Pongamia glabra</i>	2
21	<i>Delonix regia</i>	3
22	<i>Pithecellobium saman</i>	1
23	<i>Terminalia catappa</i>	1
24	<i>Syzygium cumini</i>	2
25	<i>Macaranga peltata</i>	1
26	<i>Holorrhena antidysenterica</i>	1
27	<i>Michelia champaca</i>	1
28	<i>Oroxylum indicum</i>	1
29	<i>Adenanthera pavonina</i>	1
30	<i>Lagerstroemia speciosa</i>	2
31	<i>Alstonia scholaris</i>	1
32	<i>Ficus benjamina</i>	1
33	<i>Millingtonia hortensis</i>	1
34	<i>Diospyros peregrine</i>	1
35	<i>Hopea parviflora</i>	1
36	<i>Ficus carica</i>	1
37	<i>Chrysophyllum cainito</i>	1
38	<i>Toona ciliata</i>	1

#### **4.4.1.3. Fruit Yielding Plants**

Currently, in Kerala, there is a trend in cultivation of different species of fruit yielding plants in farms and orchards. Nirmala College is also giving emphasis in adding new species and varieties of different fruit yielding plants in their campus. This would add value and awareness among students and staff about such plants. There are about 20 different fruit yielding species are available in the campus (Table – 5). Although the fruit yielding species are cultivated at different places in a scattered manner, they are properly labelled and displayed.

**Table – 5. List of Fruit Yielding Plants**

<b>Sl. No.</b>	<b>Species of plants</b>	<b>Number of Plants</b>
1	<i>Ananus comosus</i>	5
2	<i>Annona muricata</i>	4
3	<i>Annona squamosa</i>	3
4	<i>Artocarpus integrifolia</i>	8
5	<i>Artocarpus hirsutus</i>	5
6	<i>Citrus limon</i>	4
7	<i>Garcinia mangostana</i>	3
8	<i>Hylocereus undatus</i>	2
9	<i>Mangifera indica</i>	3
10	<i>Morus alba</i>	2
11	<i>Musa paradisiaca</i>	1
12	<i>Nephelium lappaceum</i>	2
13	<i>Nephelium mutabile</i>	1

14	<i>Passiflora edulis</i>	2
15	<i>Phyllanthus emblica</i>	4
16	<i>Psidium guajava</i>	5
17	<i>Punica granatum</i>	6
18	<i>Spondias pinnata</i>	2
19	<i>Syzygium jambos</i>	3
20	<i>Syzygium samarangense</i>	4
21	<i>Tamarindus indica</i>	2

#### 4.4.1.3. Medicinal Plants

The diversity of medicinal plants in any place, especially in an academic campus is indicative the emphasis that the institute given towards traditional knowledge. This would be a platform for awareness, learning, and source for local usage. Nirmala College is maintaining a medicinal plant garden that consists of a good wealth of plant species. The present status of flora that have medicinal importance is representative of regional and local floristic diversity. About 89 plant species in the medicinal plant garden were found maintained on the campus (Table – 6).

**Table – 6. Medicinal Plants**

Sl. No.	Name of Plants	No. of Plants
1	<i>Achyranthes aspera</i>	2
2	<i>Adenanthera pavonina</i>	5
3	<i>Adhatoda vasica</i>	1
4	<i>Aerva lanata</i>	6
5	<i>Aloe vera</i>	5

6	<i>Alpinia calcarata</i>	6
7	<i>Alpinia galanga</i>	3
8	<i>Alstonia scholaris</i>	4
9	<i>Andrographis paniculata</i>	2
10	<i>Anisomeles indica</i>	6
11	<i>Asparagus racemosus</i>	2
12	<i>Azadirachta indica</i>	3
13	<i>Bacopa monnieri</i>	4
14	<i>Biophytum sensitivum</i>	3
15	<i>Boerhavia diffusa</i>	5
16	<i>Butea monosperma</i>	2
17	<i>Calotropis gigantea</i>	2
18	<i>Cardiospermum halicacabum</i>	5
19	<i>Careya arborea</i>	8
20	<i>Cassia fistula</i>	4
21	<i>Cassia occidentalis</i>	2
22	<i>Catharanthus roseus</i>	3
23	<i>Centella asiatica</i>	6
24	<i>Chasalia curviflora</i>	3
25	<i>Cinnamomum zeylanicum</i>	6
26	<i>Clerodendrum viscosum</i>	3
27	<i>Clitoria ternatea</i>	5
28	<i>Cocos nucifera</i>	2

29	<i>Coffea arabica</i>	2
30	<i>Coriandrum sativum</i>	3
31	<i>Costus pictus</i>	4
32	<i>Curcuma longa</i>	1
33	<i>Cycas circinalis</i>	2
34	<i>Datura metel</i>	3
35	<i>Datura stramonium</i>	5
36	<i>Diospyros sp.</i>	4
37	<i>Duranta plumieri</i>	5
38	<i>Eclipta alba</i>	2
39	<i>Elephantopus scaber</i>	2
40	<i>Elettaria cardamomum</i>	3
41	<i>Emblica officinalis</i>	2
42	<i>Emelia sonchifolia</i>	3
43	<i>Euphorbia hirta</i>	2
44	<i>Evolvulus alsinoides</i>	2
45	<i>Ficus benghalensis</i>	4
46	<i>Ficus microcarpa</i>	4
47	<i>Ficus racemosa</i>	3
48	<i>Ficus religiosa</i>	2
49	<i>Garcinia mangostana</i>	5
50	<i>Heliotropium indicum</i>	2
51	<i>Hemidesmus indicus</i>	1

52	<i>Hibiscus rosa-sinensis</i>	3
53	<i>Holoptelea integrifolia</i>	6
54	<i>Holarrhena antidysenterica</i>	4
55	<i>Hopea parviflora</i>	8
56	<i>Ipomoea sepiaria</i>	3
57	<i>Ixora coccinea</i>	6
58	<i>Kaempferia galangal</i>	5
59	<i>Lannea coromandelica</i>	4
60	<i>Leucas aspera</i>	2
61	<i>Mimosa pudica</i>	3
62	<i>Murraya koenigii</i>	2
63	<i>Myristica fragrans</i>	5
64	<i>Nelumbium speciosum</i>	3
65	<i>Ocimum basilicum</i>	5
66	<i>Ocimum sanctum</i>	4
67	<i>Oxalis corniculata</i>	2
68	<i>Phyllanthus niruri</i>	3
69	<i>Pimenta dioica</i>	6
70	<i>Piper longum</i>	5
71	<i>Plumbago rosea</i>	2
72	<i>Pongamia pinnata</i>	3
73	<i>Psidium guajava</i>	4
74	<i>Rauvolfia serpentina</i>	2

75	<i>Rosa indica</i>	3
76	<i>Sansevieria roxburghiana</i>	1
77	<i>Saraca indica</i>	3
78	<i>Scoparia dulcis</i>	1
79	<i>Strobilanthes ciliatus</i>	2
80	<i>Strychnos nux vomica</i>	3
81	<i>Syzygium aromaticum</i>	2
82	<i>Terminalia catappa</i>	5
83	<i>Tinospora cordifolia</i>	6
84	<i>Tragia involucrata</i>	4
85	<i>Tridax procumbens</i>	2
86	<i>Vateria indica</i>	3
87	<i>Vernonia cinerea</i>	5
88	<i>Vitex negundo</i>	2
89	<i>Zingiber officinale</i>	2

#### 4.4.1.4. Awareness Programs

Several significant and fruitful awareness programs both students and staff of the campus are arranged every year in the campus. Reflections from students are evident how effective such awareness programs conducted in the campus.

Major programs conducted in the campus during the last three years are:

#### Environment Related

1. Nature camps.
2. Field visits to different types of ecosystems.
3. Observances of Environment Day, Wetland day, Ozone day etc.

4. Arranging seminars and symposiums on awareness and conservation by nature and natural systems.

### **Conservation Activities**

5. Collection and distribution of saplings.
6. Bird and Butterfly watching.
7. Sapling Planting etc.

### **Best Practices**

8. 2016-2017 organic farming
9. 2016-2017 Paddy cultivation
10. Engaging students in maintaining spices garden
11. Engaging students in maintaining herbal garden and medicinal garden.
12. Maintaining of *shanthistal*
13. Participation of teachers in different orientation program
14. Initiation of vermi-compost.
15. Initiation of bio gas plant.

### **Trainings and Workshops**

16. Mushroom cultivation workshop.
17. Apiculture workshop
18. Flower arrangements workshop
19. Workshop on eco-friendly carry bags

### **Campaigns**

20. Plastic free campaign
21. Nature camps, field trips and

Some of these activities are year round programs and others are regular year wise or semester wise or any other stipulated time bound programs. This indicates that students and teachers concerned are actively involved in green activities in the campus.

## **4.4.2. Water Management**

### **4.4.2.1. Major Findings.**

- The ponds and other water resources in the college are well maintained.
- Separate tanks were installed for different blocks and for different purposes. This enables to use water with maximum potential control.
- The college has rain water harvesting mechanism which is to be appreciated. This will help generate awareness about the importance of water conservation and shall act as a model system to be followed by other institutions as well.
- Wick irrigation farming and drip irrigation systems present in the campus were found to be effective in reducing the amount of water used in agriculture sector.
- The college organizes awareness programmes on water conservation frequently to spread the message of significance of conserving water.
- Students who are involved in green committees are doing a good job in water related awareness programmes.
- 92304 L of water is used per day by the college for its different uses (Table – 7).
- 200 L of water per day is lost through the leaking of pipes (Table – 7).
- The water consumption in the summer season is significantly high compared to other months.

**Table- 7. Details of water analysis of Nirmala College**

<b>Activity</b>	<b>Average use per activity in liters</b>	<b>Number of activity/day</b>	<b>Water use/person/day (L)</b>	<b>Number of persons using water</b>	<b>Total water consumption/day(L)</b>
Washing hands and face	6L	thrice	2L/head	3009	18054L
Bath	60L	twice	30L/head hostel only	390	23400L

Washing clothes	20L	once	20L/head hostel only	390	7800L
Toilet flush	10L	at least 3	10L/head	500	5000L
Leaking/dripping( 1 drop/second /day)	nil	nil	nil	nil	200L
Garden use	1500L	twice	nil	nil	3000L
Cooking (average)	3000L	four times	nil	500	12000L
Cleaning Floor	10000L	once	nil	nil	10000L
Cleaning college bus	nil	nil	nil	nil	nil
Lab uses	2.5L	twice	5L	360	850L
Construction work	3000L	twice	nil	nil	6000L
Any other activity	3000L	twice	nil	nil	6000L
Total water use					92304L

#### 4.4.2.2. Suggestions

- There is no particular mechanism to find the water wastage. This has to be dealt with utmost care without delay and has to be included in the future action plan.
- There is no water consumption monitoring system in the college.
- The college does not have waste water treatment for waste water generated from laboratories, canteen, hostel kitchen, toilets, bathrooms and office rooms.
- The waste water from canteen and kitchens is not suitably controlled and is not used for gardening. This has to be addressed and suitable action plans have to be evolved.

- No adequate facilities available in the college to treat the waste water from chemical laboratories.
- Water fountain in the college was found to be dysfunctional. This need to be activated.

#### **4.4.3. Energy Management**

An assessment of energy consumption, energy sources used, energy management, lighting devices used and other appliances used by the campus community is an important aspect of sustainability of the community. Hence this is a relevant aspect of the assessment. The audit team assessed the number of electrical appliances and their respective uses in terms of consumption of energy per month in KWh. This indicates the energy management of the campus. Based on the assessment we made suggestions and recommendations.

<b>Table- 8. List Electrical Instruments</b>		
<b>Sl. No.</b>	<b>Name Instruments</b>	<b>No. of Instruments</b>
1	Heating Mantle	23
2	Power Supply	66
3	UV-Disinfection System	54
4	Magnetic Stirrer	19
5	Function Generator	18
6	Fridge	12
7	Fume Exhaust Hood	12
8	Exhaust Fan	7
9	Centrifuge	6
10	Mixer Grinder	5
11	Stabilizer	5
12	Conductivity Meter	4
13	Digital Potentiometer	4
14	Furnace	4
15	Network Switch	4
16	Weighing Balance	4
17	Incubator	2

18	Mixer Galvan	2
19	Photoelectric Colorimeter	2
20	Concentric Rig Bath	1
21	Distil Unit	1
22	Electric Kettle	1
23	Electron Microscope	1
24	Laminar Air Flow	1
25	Mixer	1
26	pH Meter	1
27	Pump	1
28	Rota Evaporator	1
29	UV Spectrophotometer	1
30	Computer	397
31	Hot Air Owen	2
32	Iron Box	2
33	Oven	2
34	Hot Air Owen	1
35	Induction Cooker	1
36	Water Bath	1
37	Wax Bath	1
38	LCD TV	21
39	Cooler	8
40	Freezer	1
41	Street Light (Led)	71
42	Street Light (Sodium)	6
43	Street Light (Tube)	1
44	Inverter	6
45	Ups	3
46	Fan	890
47	Tube	400
48	Led Bulb	845
49	Led Tube	171
50	Cfl	154
51	Speaker	48
52	Projector	30
53	Ac	25
54	Bulb	24
55	Printer	22
56	LPG Per Month	11
57	Amplifier	10

58	Wi-Fi Modem	7
59	Photocopier	5
60	Aquarium	1
61	Scanner	3
62	Barcode Reader	2
63	Electric Bell	2
64	Server	2
65	Blue Ray Player	1
66	Coffee Machine	1
67	Duplicator	1
68	I Mac	1
69	Washing Machine	1
70	Treadmill	1
71	Server Unit	1
72	Tailoring Machine	1

#### **4.4.3.1. Renewable Source of Energy – Solar Power Plants**

The college has established a 20 KW solar power plant, of which 15 KW is shared on common grid (KSEB) and 5KW is utilised in the campus itself. The beneficiary of the solar power plant is the MCA building. At present it is working with its fullest establishment capacity and the campus is making maximum use out of it. By learning the importance and power conservation by tapping energy from renewable energy sources, the management plan to extend the capacity of the solar power plant by installing more solar power plants in the campus.

Following are the details of generation and utilization of power generated out of solar power plants.

- Total energy produced by the solar panels during 2018-19 – 32850 KWh
- Energy supplied to the KSEB grid – 21250 KWh
- Energy utilised from the KSEB supply – 11600 KWh

Using the full establishment capacity of the solar power plant, the college generates 32850 KWh that is apparently 90KWh /day. About 15.9% of the total energy requirement is met with this power generation using renewable energy source.

Other than this, the biogas plant installed in the campus generates about 288kg of biogas that is being utilised in the campus itself. This reduces the total cost of their cooking gas expenditure to about Rs. 30000 during the year 2018-19.

It is a good practice and model for the campus community to aim at generating the required power and cooking gas inside the campus itself by using renewable energy sources.

#### **4.4.3.2. Findings**

- Electricity charges – Rs.142392.5/month.
- Number of gas cylinders used – Rs. 77.5/month.
- Cost of Gas cylinders used – Rs. 520800/year (Rs.560/cylinders).
- Monthly amount paid for electricity and gas – Rs. 185792.5 (2016).
- Average monthly amount paid for electricity during the last three years – Rs. 108963.2
- Change in energy cost per month from 2016 = Rs. -33429. 28
- Cost of generator fuel – Rs.1000/month.
- Biogas generated per month = 24kg (288 kg during 2018-19 which is equivalent to 20 cylinders of cooking gas).
- Energy generated by the biogas plant per month = equivalent to 1.5 LPG cylinders.
- With the establishment of solar power plant the campus management could reduce the dependency on public electricity supply and the cost has come down to 108963.2. This enabled them to save about Rs. 33429.28 per month.

**Table-9 Nonth wise Energy Consumption in KWh**

<b>Sl. No</b>	<b>Name of the Instrument</b>	<b>Energy Consumption, kWh/month</b>
1	Heating Mantle	12.65
2	Power Supply	52.27
3	Uv-Disinfection System	89.10
4	Magnetic Stirrer	20.90
5	Function Generator	4.95

6	Fridge	33.00
7	Fume Exhaust Hood	158.40
8	Exhaust Fan	69.30
9	Centrifuge	30.36
10	Mixer Grinder	165.00
11	Stabilizer	27.50
12	Conductivity Meter	2.20
13	Digital Potentiometer	1.32
14	Furnace	132.00
15	Network Switch	1.32
16	Weighing Balance	0.44
17	Incubator	6.60
18	Photoelectric Colorimeter	0.66
19	Concentric Rig Bath	16.50
20	Distill Unit	33.00
21	Electric Kettle	22.00
22	Electro Microscope	1.10
23	Laminar Air Flow	11.00
24	Mixer	5.50
25	Ph Meter	0.22
26	Pump	7.70
27	Rota Evaporator	16.50
28	Uv Spectrophotometer	5.50
29	Computer	3493.60
30	Hot Air Owen	22.00
31	Iron Box	22.00
32	Oven	132.00
33	Hot Air Oven	11.00
34	Induction Cooker	1.65
35	Water Bath	11.00
36	Wax Bath	3.30
37	Lcd Tv	69.30
38	Cooler	220.00
39	Freezer	44.00
40	Inverter	0.49
41	Ups	0.01
42	Fan	4895.00
43	Tube	704.00
44	Led	334.62
45	Led Tube	300.96
46	Cfl	81.31
47	Speaker	2.64
48	Projector	165.00
49	Ac	550.00
50	Bulb	63.36

51	Printer	24.20
52	Amplifier	88.00
53	Wifi Modem	5.54
54	Photocopier	27.50
55	Aquarium	52.80
56	Scanner	0.17
57	Barcode Reader	0.22
58	Electric Bell	0.09
59	Server	132.00
60	Blue Ray Player	0.02
61	Coffee Machine	110.00
62	Duplicator	5500.00
63	I Mac	2.75
64	Washing Machine	2.20
65	Treadmill	110.00
66	Server Unit	33.00
67	Tailoring Machine	8.80

Out of 1648 lighting fixtures, there are 1087 LED based lights, which is a positive step taken towards the conservation of energy. In spite of a sylvan campus, there are 890 fans which consumes about 4895 units per month. This can be controlled by enhancing natural air circulation via proper ventilation. There are 397 full-fledged PCs which require about 3493 units of electricity for their operation. The water distribution system of the campus is a well-designed one. The water tanks kept in optimum locations, resulting in minimum energy wastage. There is a functional biogas plant, inside the campus, which aids in saving few LPG cylinders used for cooking/heating.

Monthly Energy Utilization by Different appliances in the campus	
Item	Total Energy in KWh
Bulb	1507.44
CFL Bulb	813.12
Fans	7832
Air conditioners	4785

Other Cooling apparatus	675
Computers	10917.5
Photocopier machines	82.5
Inverters	1584
TV	283.5
<b>Total</b>	<b>28480.1</b>

#### **4.4.4. Carbon Footprint Audit**

The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent

greenhouse gas, comprising 402 ppm of the Earth's atmosphere. Each human being is contributing towards adding green-house gases to the atmosphere depending upon his day to day activities and usage of instruments and machineries for different purpose.

Release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon footprint. An understanding about the same of any institute where large number of anthropogenic activities are happening is important to assess the contribution of emission of gases that are responsible for Green House Effect. Auditing for carbon footprint of Nirmala College Campus was done using a detailed questionnaire, so that the impact of the community on global environment can be assessed.

##### **4.4.4.1. Major Findings**

1. Total number of Students – 2682
2. Total number of Teachers – 143
3. Number of non-teaching staff – 20
4. Number of persons using cars - 27 (30L fuel per day)
5. Number of persons using two wheelers - 104 (50L fuel per day)
6. Number of persons using public transport – 1539, 21 km per day, average (180 L of fossil fuel per day)

7. Number of cycles used in the campus– 0
8. LPG usage - 77.5 Cylinders per month
9. Total fossil fuel usage per day - 260 L, apart from LPG and fuel for generators

It is evident that majority of the campus community are relying on public transport system for commutation leading to the expense of 180 L of fuel per day. This shall be considered as a very conservative approach. Assuming that 20 persons travel together combined with number of motorcycles and cars lead to the usage of 260L of fuel per day. This causes the emission of about 702kg of CO<sub>2</sub> per day. This measurement is excluding the natural emission of Co<sub>2</sub> by human by breathing (ie. 1140g/day). Consumption of one litre LPG releases about 1.5kg of CO<sub>2</sub>. At the rate of 77.5 cylinders per month the college is using about 1085 L of LPG that releases 1627.5kg CO<sub>2</sub> per month. Since there is no data from similar institution available a comparison of carbon footprint is not attempted.

## **Chapter – 5**

### **Recommendations**

#### **5.1.General recommendations**

1. All the lists of plants shall be uploaded in the college site.
2. A file shall be maintained to assess and analyse the usage of garden by different stakeholders.
3. There shall be a digital platform where students and staff shall get details about plants and animals in the campus. This may include name, information of systematic position as per standard classifications, usage, value, further references, etc.
4. The name boards shall be updated with QR code technology that enable the students and staff to scan the QR code to access relevant information of the taxa.
5. There shall be a discussion forum in the campus where a discussion on green activites is possible by students, alumni, staff, etc. and the moderator of the group shall update the information in the digital repository accordingly.
6. Students and staff shall take initiative to start live campus discussion groups where green conservation and awareness shall be the main agenda.
7. The deliberations shall be shared among students and other stakeholders through campus/social media.

#### **5.2. Water Management**

1. Strengthening awareness on water conservation among student and teacher communities.
2. Observe ‘world water day’ on March 22<sup>nd</sup> with different programmes (cycle rally, street play, flash-mob, poster, elocution etc. can be conducted).
3. Apply for *Bhoomithrasena* club (This is an initiative of Directorate of Environment and Climate Change, Govt. of Kerala) to get financial assistance.
4. ‘Save Water’ posters to be affixed in the classrooms, hand washing areas.
5. Repair water leaks and leaky toilets immediately.

6. Install water aerators and automatic shut-off devices on faucets.
7. Use low-flow shower heads and timer shut-off devices with automatic sensors to reduce water use during showers.
8. Bring a water bottle to college. At the end of the day, any leftover can be poured onto the garden.
9. Set up an efficient water recycling system in the college canteen.
10. Install more rain water harvesting systems.
11. Install waste water system for chemistry labs.
12. Use green solvents and green methods (e.g., double burette titration) in the chemical laboratories.

### **3.5. Energy Management**

1. The on grid solar power plant can bring down electricity costs and might prove to bring in financial benefits in the long run. Being at a relatively high lying area of the town, there would be no issues with sunshine, particularly in summer.
2. Gradual replacement of existing non LED based lights to LEDs can further bring down costs for lighting.
3. Replacement of existing electric fans with BLDC fans can significantly reduce power consumption and help in a good reduction in electricity charges.
4. Instead of using desktop workstations, we could consider desktop virtualization, wherever possible which could lead to reduced power consumption and reduced power costs.

### **5.4 Carbon Footprint**

1. Operate a college bus, with an optimal route planning, could reduce fossil fuel consumption.
2. Encourage the use of bicycles and public transport system by the community, particularly the student community.
3. Planting of trees to negate the effect of burning of fossil fuels.
4. Carpooling, wherever possible, particularly by those who are using cars should be encouraged.

## **Chapter – 6**

### **Future Action Plans**

1. Year wise internal audit on green, water and energy to be conducted by respected teachers.
2. Proper management and month wise mapping of water and energy usage to be conducted by monitoring the same in the records.
3. Department wise awareness programs to be organised by department staff representative to each committee.
4. Proper waste water management
5. Proper monitoring and disposal of waste discharge from chemical laboratories
6. Implementation of sign boards and indications of water and energy usage.
7. Energy maintenance by proper usage of electrical appliances.
8. A timber garden and museum to be implemented
9. Vegetable and agriculture crop planting has to be increased using advanced technologies.
10. Promotion of visit to agriculture farm lands and processing centres.
11. Marketing of vegetables and crops cultivated in the campus.

The students and staff who are active in green related activities have a clear vision about how and what should be planned for a greener campus. They think that planting of more saplings during the world environment day would cater more awareness and enthusiasm in students who join afresh each year. The college is also planning to initiate plant a tree/adopt a tree program where each student will be planting a sapling and taking care of it during his or her stay in the college. Although the college follow a university curriculum by implementing several such awareness program in their academic and non-academic activities promote more students turn to green activities.

## **6.1. Conclusions**

1. The management and other authorities are keen to make the campus a green campus
2. Nirmala College is making learning process by practical approach. This is fulfilled by setting different types of gardens, arboretum concept based garden and conservation of water and energy.
3. Staff and students are aware about the commitment of the institute towards the society.
4. Green audit at times makes the campus authority to understand the effect of implications towards greenness and conservation of water and energy.
5. The evaluation process proved that the authorities have applied implications suggested in the previous audit.
6. The campus community functions are oriented with an eco-friendly approach that enables the student community to develop a genuine approach on conservation of nature, and natural resources.
7. The results presented in the present report would be helpful for the authorities to make future action plans to develop more sophisticated ideas in bringing more values in future efforts towards conservation of biodiversity, water and energy.
8. We, the Heartian Green Audit team, submitting the comprehensive audit report to the authorities of Nirmala College Campus. We hope the audit finding would help them implement better management plan to achieve a complete green campus, save maximum water and energy for a better future.

We suggest the college management to conduct the next audit after three years, ie. March 2021. This would help them understand whether they are heading forward by achieving the set forth plans and goals.

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## **Acknowledgements**

The Heartian Green Audit team thanks the Management and the Principal of Nirmala College, Muvattupuzha for entrusting us the green audit of their campus. We wholeheartedly thank the teaching and non-teaching staff and students for their timely support rendered to the green audit team at different stages of the process that helped us to complete the audit in time. We also thank heads of various departments and the teacher in charge from each department for sharing documents and information in time. The support from different clubs and fora was adequate and timely. We thank the teacher and student coordinators of different clubs and fora for the same. The support from the office staff during visit to the campus for verification of documents is also highly appreciated.

## Plate I



Plate I. A. The campus of Nirmala College from entry point.



Plate I. B. Another view of the campus of Nirmala College from entry point in front of the Library

## **Plate II**



Plate II. A. An aerial of Nirmala College campus.



Plate II. B. Another view evidentially indicating the attempt to make the campus green

### **Plate III**



Plate III. A. Students carrying out experiments and practicals in the arboreatum



Plate III. B. Students are involved in learning process using the resources in the medicinal plant garden

## Plate IV



Plate IV. A. A view of Agriculture garden where vegetables are maintained.



Plate IV. A. Students are involved in watering and maintaining the campus garden

### **Plate V**



Plate V. A. The Solar Power plants installed in Nirmala College.



Plate V. B Students and teachers inspecting the Solar Power plants installed in Nirmala College.

## Plate V



Plate V. A. The Green Audit visiting Nirmala College Arboretum.



Plate V. B The Green Audit team with the internal supporting members.

**Annexure – I**

**Green auditing of Nirmala College, Muvattupuzha**

**Auditing for Green campus management**

1. Is there a garden in your college? Area?
2. Is there concept based garden (star plants, medicinal plants, endemic species, agriculture, etc.), specify area for each.
3. Do students spend time in the garden? If so, approximate time and purpose. (Lists with priority Annexure-I).
4. List the plants (scientific names, Family, etc.) in the garden, with approx. numbers of each species (Annexure-II).
5. List of campus flora (attach a list of plants with details, including scientific name, family, approximate number of plants, etc.) in your campus
6. Name and number of the medicinal plants in your college campus.
7. Any threatened plant species planted/conserved (provide a list with their threat status).
8. List the plants to be planted on your campus in the next three years. (**Trees, vegetables, herbs, etc.**)
9. List the species planted by the students, with numbers (Annexure –III).
10. Have you got any external funding for developing gardens in the campus? If yes, year, agency, and amount of funding.
11. Explain how you utilized funds for gardens.
12. Whether you have displayed scientific names of the plants in the Campus?
13. What are the vegetables cultivated in your vegetable garden?  
(Mention the quantity of harvest in each season).
14. How much water is used in the vegetable garden and other gardens?
15. Mention the source and quantity of water used (per month).
16. Are you using any type of recycled water in your garden?

17. Who is in charge of gardens in your college?
  18. Is there any permanent staff to look after gardens in the campus?
  19. List the name and quantity of pesticides and fertilizers used in your gardens?
  20. Are you doing any organic practice in your campus? List them?
  21. Do you have any composting pit (specify what compost) in your college? If yes, what you do with the compost generated?
  22. Do you have a vegetable garden on the campus?
  23. If yes, how the harvested vegetables are utilized? Do you have any market in the campus?
  24. Is there a nature club in your college? If yes what are the activities?
  25. Is there any arboretum in your college? If yes details of the trees planted.
  26. Is there any fruit yielding plants in your college? If yes details of the trees planted.
  27. Is there any groves in your college? If yes details of the trees planted.
  28. Is there any irrigation system in your college?
- 
29. What is the type of vegetation in the surrounding area of the college?
  30. What are the nature awareness programs conducted in the campus? (2014-19). Provide a list (annexure-IV)
  31. What are the involvement of students in the green cover maintenance?  
Planting saplings and maintenance
  32. What is the total area of the campus under tree cover? Or under tree canopy?
  33. Share your future plans for further improvement of green cover.
  34. Have you incorporated green conservation aspects in your curriculum?
  35. How often you conduct public programs on green conservation?
  36. Do students reach out to the public in conveying the message of nature conservation?

## **Annexure – II**

### **Green Auditing of Nirmala College, Muvattupuzha**

### **Questionnaire for Water Management Auditing**

1. What is the total Area of the campus?
2. Number of total teachers, non- teaching staff and students in the campus.
3. Provide a list with different uses of water in the campus (Annexure 2-I).
4. Name different sources of water in your college?
5. How many wells are there in your college?
6. Number of electric motors used for pumping water from each well?
7. What is the total horse power of each motor?
8. What is the depth of each well?
9. What is the present depth of water in each well?
10. How does your college store water?
11. Capacity of the overhead water tank/s in the campus? (in litres)
12. Quantity of water pumped every day? (in litres)
13. How do you justify that the water usage is judicious in the campus?
  
14. Is there any water wastage? If yes, specify why and how.
15. Is there any mechanism to identify water wastage in the campus, explain (Annexure 2-II)
16. What are the possible ways to check wastage of water?
17. Is there any waste water generation happening in the campus?
18. What are the possible sources of waste water in the campus?
19. Where does the waste water go?
20. Are you reusing the waste water after recycling it?
  
21. What are the systems of management of water used in your labs, especially Chemistry lab (or labs where experiments are happening involving chemicals)?
22. Does this water get mixed with ground water?
23. Is there any treatment for the lab water after usage?
24. Is there a system of practice of green chemistry in your campus? Give details.
  
25. Write down four ways that could reduce the amount of water used in your college.

26. Record of water use from the college water meter for six months.
27. Amount, if any, as charges towards water paid for water connections.
28. Number of water coolers in the campus. Amount of water used per day? (in litres)
29. Number of water purifiers in the campus, if any.
30. Number of water taps in the campus. Amount of water used per day?
31. Number of bath rooms and toilets separately for staff rooms, common, hostels (Annexure 2- III).
32. Number of toilets?
33. Amount of water used per day in the toilets?
34. Number of water taps in the canteen. Amount of water used per day?
35. Amount of fire-wood used in the canteen kitchens?
36. How much ash collected after burning fire wood per day in the canteen?
37. Amount of water used per day for irrigation purpose.
38. Number of water taps in laboratories. Amount of water used per day in each lab?
39. Number of taps in hostels.
40. Total use of water in each hostel?
41. Provide a list of month wise water usage in different areas in the campus
42. Is there any water used for agricultural purposes?
43. Is there any rain water harvest system in the campus? If yes, details of the storage capacity?
44. Report on the status of their functioning.
45. Provide number of damaged taps in the campus? Amount of water lost due to damaged taps or water supply system per day?
46. How do you convey the message of water conservation in the campus?
47. How many water fountains are there? \_\_\_\_\_
  
48. How often the garden is getting irrigated?
49. Amount of water used to water the ground?
50. Amount of water used for college bus cleaning? (litres per day)
51. Is there any other way by which water is being utilized?.
52. Area of the college land which is under concrete tiles.
53. Is there any future plan for the water management in the campus?
54. Are there any water saving techniques followed in your college? Explain?
55. Is there any mechanism by which message on water conservation is been conveyed to staff and students.

**Annexure – III**

**Green auditing of Nirmala College, Muvattupuzha**

**Questionnaire for Energy Management Audit**

1. List out ways of energy usage in the campus. (Electricity electric stove, kettle, microwave, incinerator; LPG, firewood, Petrol, diesel and others).
2. Electricity bill amount for the last three years.
3. Amount paid for LPG cylinders for last three years.
4. Any other payments towards energy related matters for last three years in the campus
5. Weight of firewood used per month and amount of money spent? Also mention the amount spent for petrol/diesel/others, if any?
6. Are there any energy saving methods employed in your college? If yes, please specify.
7. What are the types of bulbs used in the campus?
8. Provide a list of number of bulbs of each types.
9. Provide the total energy utilization by each types of bulb per month.
10. How many CFL bulbs has your college installed? Mention use (Hours used/day for how many days in a month)
11. Energy used by each bulb per month? (For example- 60 watt bulb x 4 hours x number of bulbs = kWh).
12. How many LED bulbs has your college installed? Mention use (Hours used/day for how many days in a month)
13. How many incandescent (tungsten) bulbs has your college installed? Mentions use (Hours used/day for how many days in a month)
14. How many fans installed in the campus? Mention use (Hours used/day for how many days in a month)
15. Energy used by all fans per month? (kwh)
16. How many air conditioners are in use in the campus? Mention time of their usage (Hours used/day for how many days in a month).
17. Energy used by all air conditioners per month? (kwh).
18. How many electrical equipments including weighing balance used in the campus? Mention use (Hours used/day for how many days in a month)
19. Energy used by each such electrical equipment per month? (kwh).
20. How many computers were in use in the campus? Mention the energy use. (Hours used/day for how many days in a month)
21. Energy usage by all computers per month? (kwh)

22. How many photocopier machines are installed and in use at present in the campus? Mention use (Hours used/day for how many days in a month).
23. Energy used by all photocopier per month? (kwh) Mention use (Hours used/day for how many days in a month)
24. How many cooling apparatus present in the campus? Mention use (Hours used/day for how many days in a month)
25. Energy used by all cooling apparatus per month? (kwh) Mention use (Hours used/day for how many days in a month).
26. How many inverters your college installed? Mentions use (Hours used/day for how many days in a month)
27. Energy used by each inverter per month? (kwh)
28. How many electrical equipment used in different labs (methods that are not included in the above calculations) in the campus? Mentions use (Hours used/day for how many days in a month)
29. How many electrical equipments are available in all labs in the campus?
30. Energy used by all equipments together per month? (kwh)
31. How many heaters used in the canteen of your college? Mention their use (Hours used/day for how many days in a month)
32. Energy used by each heater per month? (kwh)
33. Number of street lights in your college?
34. Energy used by all street lights per month? (kwh)
35. Number of televisions in your college and hostels?
36. Energy used by all TVs per month? (kwh)
37. Any other items that uses energy (Please write the energy used per month) Mention the application (Hours used/day for how many days in a month)
38. Does the camp us have any alternative energy sources/nonconventional energy sources? ( photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.
39. Do you run “switch off” drills at college?
40. Are your computers and other equipment put on power-saving mode?
41. Does your machinery (TV, AC, Computer, weighing balance, printers, etc.) run on standby modes most of the time? If yes, how many hours?
42. What are the energy conservation methods adapted by your college?
43. Is there any public awareness systems informing necessity of energy conservation in the campus?
44. Write a note on the methods/practices/adaptations by which you can reduce the energy use in your college campus in future.

# **Green Auditing of Nirmala College, Muvattupuzha**

## **Questionnaire for Carbon footprint Auditing**

1. Total number of students and teachers in your College?

Gender	No of students	No of Teachers	No of non-teaching staff
Male			
Female			
Transgender			
Total			

2. Total Number of vehicles used by the stakeholders of the college/per day.
3. No. of cycles used/day in the campus.
4. No. of two wheelers used (average distance travelled, cc of two wheelers and quantity of fuel and amount used/day). (C.F-Annexure-I).
5. No. of cars used (average distance travelled, power of engine (cc) and quantity of fuel and amount used/day). (C.F-Annexure-II).
6. No. persons using common (public) transportation (average distance travelled and quantity of fuel and amount used/day).
7. No. of persons using college conveyance (general transportation) by the students, non-teaching staff and teachers (average distance travelled and quantity of fuel and amount used per day)
8. Number of parent-teacher meetings in a year? Parents turned up (approx.)
9. Mention their mode of travel and give approximate cost of their commutation.
10. Number of visitors with vehicles per day?
11. Number of generators used/day (hours). Provide quantity and amount for fuel usage/day.
12. Number of LPG cylinders used in the campus. Provide quantity and amount of fuel used /day.
13. Quantity of kerosene used in the canteen/labs (Provide quantity and amount of fuel used per day and amount spent).
14. Amount of taxi/auto charges paid and the amount of fuel used per month for the transportation of vegetables and other materials to the campus.

15. Amount of taxi/auto charges paid per month for the transportation of office goods to the college.
16. Amount of taxi/auto charges paid per month by the stakeholders of the college.
17. Use of any other fossil fuels in the college (Give the amount of fuel used per day and amount spent). (C.F-Annexure-III).
18. What are the methods you might adopt in the future to reduce the quantity of fuel used by the stakeholders/students/teachers/non-teaching staff of the college.

Audited by



Heartian Green Audit Team  
Sacred Heart College Thevara  
Cochin-13



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## **NIRMALA COLLEGE MUVATTUPUZHA**

Ranked on the 91<sup>st</sup> position among the colleges in India  
by the NIRF Rankings 2017 and accredited by NAAC with B++ grade

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