

**2021**

**KOGNITIVE  
STREET  
CONSULTING  
SOLUTIONS PVT.  
LTD.**

By Sachet  
Chitransh



**[GREEN AUDIT REPORT]**

# GREEN AUDIT REPORT 2021-22



---

Prepared By,  
(Environment Division)  
**KOGNITIVE STREET CONSULTING SOLUTIONS PVT LTD**

<b>Table of Contents</b>	<b>Page No.</b>
<b>Message by Vice Chancellor</b>	<b>(iii)</b>
<b>Message by Pro Vice Chancellor</b>	<b>(v)</b>
<b>Message by Prof. Chaubey</b>	<b>(vi)</b>
<b>Message by Prof. Bindu Sharma</b>	<b>(viii)</b>
<b>Certificate</b>	<b>(ix)</b>
<b>Executive Summary</b>	<b>(x)</b>
<b>CHAPTER 1 - INTRODUCTION</b>	<b>1</b>
<b>CHAPTER 2 - GREEN AUDIT METHODOLOGY</b>	<b>25</b>
<b>CHAPTER 3 - WATER &amp; WASTE WATER AUDIT</b>	<b>35</b>
<b>CHAPTER 4 - ENERGY AUDIT</b>	<b>45</b>
<b>CHAPTER 5 - SOLID WASTE AUDIT</b>	<b>49</b>
<b>CHAPTER 6 - ENVIRONMENT QUALITY AUDIT</b>	<b>56</b>
<b>CHAPTER 7 - CARBON FOOTPRINTS</b>	<b>80</b>
<b>CHAPTER 8 - GREEN INITIATIVES</b>	<b>85</b>

<b>CHAPTER 9 - SUMMARY &amp; CONCLUSION</b>	<b>87</b>
<b>CHAPTER 10 - ACKNOWLEDGEMENT</b>	<b>90</b>

## MESSAGE BY VICE CHANCELLOR



India, the oldest civilization and the oldest nation of the world, inherits a rich tradition of intellectual exploration. The Rigveda prayer: ' आ नो भद्रा क्रतवो यन्तु विश्वतः' (Let the noble ideas come to us from the entire world.) underlines the openness in Indian thinking since ancient times. Even in the ancient period, India led the higher education system of the world, attracting the student population from a number of countries to its famous seats of learning at Takshila and Nalanda.

Established in 1965, the Chaudhary Charan Singh University, Meerut (formerly known as Meerut University, Meerut) has been continuously engaged in the creation and dissemination of world-class knowledge by involving all the stakeholders, i.e., students, teachers, supporting staff, and the people from different walks of the society. Over the years, it has steadily evolved itself as one of the leading centers of comprehensive learning with its exposure to and linkages with its peers at national and international levels. With its state-of-the-art infrastructure, well-equipped laboratories, and highly qualified and dedicated faculty, the University is committed to the task of harnessing and cultivating the capabilities of young students to enable them to carve suitable space for themselves in the modern economic world.

Conscious of its social responsibility and accountability, the University since its inception has been striving hard to inculcate the right values among students

to develop them as socially sensitive citizens. Sustainable development and inclusiveness being our main mottos, the university encourages teaching and research programs addressing the issues of concern to contemporary society. Thus, the system encourages not only curricular activities but also promotes co-curricular, extracurricular, and extension activities through its outreach to and interaction with the local community.

While we have come a long way and our academic journey is marked by a number of path-breaking milestones, we have to keep pace with the fast-changing needs and expectations of society. The process of creating new knowledge and producing capable human beings dedicated to the upliftment of the nation and the world has to continue with renewed vigor in an unabated manner.

I extend my best wishes to all the students, teachers, and members of the administrative staff who are part of the University and to those also who intend to join us in our endeavor to liberate humanity with the help of the powerful tool of knowledge.

**Prof. Narendra Kumar Taneja**  
**Vice Chancellor**  
**Chaudhary Charan Singh University**

## MESSAGE BY PRO VICE CHANCELLOR



Like the phrase “every square is a rectangle, but not every rectangle is a square;” action is awareness, but awareness is not action. You can have awareness without action, but you cannot have action without awareness. The important message to take out of this environment awareness in order to make our campus green & sustainable.

By conducting the green audit University has taken great steps for energy conservation, water conservation & environmental sustainability.

**Prof. Y. Vimala**  
**(Pro Vice Chancellor)**

## **MESSAGE BY PROF. A. K. CHAUBEY**



In this climate-changing scenario, we as the University recognize the severe stain that has been put on mother Earth. In the face of the crisis that the world is now racing, excuses no longer stand and we must change policy and practice at every level in order to avert ecological catastrophe on a global scale.

Chaudhary Charan Singh University has often been at the forefront of environmental campaigning, social change, and international development. Chaudhary Charan Singh University's history is evidence of that, providing leadership, support, and arena of debate for its members to become engaged and able to constantly question and challenge the existing status while pushing for progressive change. The green audit is an ethical and environmental stance has always been a shining example of this.

University has already taken some steps to conserve the energy as well as to avoid loss of energy through various programs Solar Panels, Garbage Electrical Vehicle and to aware students about No use of plastic, conservation of energy, and biodiversity of the campus.

The staff of the University, students, and members are committed to undertaking this GREEN AUDIT as a means to continually improve its environmental performance and standards in recognition of the immediate and serious threat that



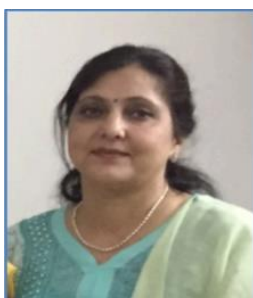
climate change poses to the Earth and its population, however, undertaking this audit is the first step towards the green approach and needs to be pushed for continuous improvement. The university should run a campaign and aim to change not just ourselves, but all those around us, from our students, faculty staff of the university, academic institutions, society, and ultimately the world. It is the bottom-up approach combined with a real and progressive governmental policy that we stand a chance to prevent runaway climate change.

I am very happy and congratulate Chaudhary Charan Singh University for efforts taken for Green Audit 2020-21. Now, it becomes the responsibility of all the stakeholders of the university to follow the proposed management plan suggested in the report to reduce our carbon footprints.

**Prof. A K Chaubey**

**Dept. of Zoology**

## MESSAGE BY PROF. BINDU SHARMA



Over the past few years university has adopted various new and advanced technologies which are eco-friendly; such as solar electricity projects, rooftop rainwater harvesting, solid waste management system, and water purification system for the Plantation of local plant species on the campus. The university has installed solar electrical panels, electrical vehicles for garbage collection on the campus to reduce its carbon emissions. With the National agenda, the university has taken the Clean and Green Campus mission as well minimize the use of Plastic on the campus. The university has taken lead in Tree plantation and planted huge quantities of trees on campus which will support the reduction of carbon footprints of the university.

I am very happy to forward this Green Audit Report 2020-21 of Chaudhary Charan Singh University, Meerut, I would like to give my special thanks to Taneja Sir for the initiative taken for Conducting Green Audit. I hope the report will be helpful to all concerned in the university and will motivate all to put green steps ahead in the future.

**Prof. Bindu Sharma**

**Dept. of Zoology**

## MESSAGE BY PROF. VIJAY MALIK



We are rapidly reaching the point of no return for the planet. We face a triple environmental emergency –biodiversity loss, climate disruption and escalating pollution.

For too long, humanity has cut down the Earth's forests, polluted its rivers and oceans, and ploughed its grasslands into oblivion.

We are ravaging the very ecosystems that underpin our societies. And, in doing so, we risk depriving ourselves of the food, water and resources we need to survive. The degradation of the natural world is already undermining the well-being of 3.2 billion people – or 40 per cent of humanity.

Luckily, the Earth is resilient. But she needs our help. We still have time to reverse the damage we have done.

That is why, our small steps towards the conservation of nature and environment to protect our earth are very important in order to sustain humanity in the planet. By conducting the green audit, energy audit and environment audit we can meet the goals.

**(Prof. Vijay Malik)**

**HOD, Dept. of Botany**

## **CERTIFICATE**

This is to certify that Chaudhary Charan Singh University has conducted a detailed “Green Audit” for its campus during the academic year 2020-2021. The green audit was conducted in accordance with the applicable standards prescribed by the Central Pollution Control Board, New Delhi, and the Ministry of Environment, Forest and Climate Change, New Delhi. The audit involves water, wastewater, energy, air, green inventory, solid waste, etc., and gives an 'Environmental Management Plan', which the university can follow to minimize the impact on the institutional working framework. In an opinion and to the best of our information and according to the information given to us, said green audit gives a true and fair view in conformity with environmental auditing principles' accepted in India.

## EXECUTIVE SUMMARY

Green auditing is the process of identifying and determining whether institutions' practices are eco-friendly and sustainable. The main objective to carry out a green audit is to check green practices followed by the university and to conduct a well-formulated audit report to understand where we stand on a scale of environmental soundness.

The initiative taken by **Chaudhary Charan Singh University** to conduct a **Green Audit** of the university campus is a commendable sustainable goal. The strategies followed were the preparation of questionnaires and subsequent action plans to implement the project. Questionnaires prepared to conduct the green audit were based on the guidelines, rules, acts, and formats set by the Government of India, Ministry of Environment and Forest, New Delhi, and Central Pollution Control Board, New Delhi. Questionnaires were prepared for solid waste, energy, water, hazardous waste, and e-waste. For audit purposes and suitability analysis of data, the study area is grouped into various Blocks and Departments. The audit was carried for solid waste, electricity and energy, water and wastewater, hazardous waste, air quality, and green inventory including and carbon footprints. It also indicates the green initiatives taken by the university to save environmental resources. The “Green Audit” also presents the “Environmental Management Plan”.

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.



# CHAPTER 1 – INTRODUCTION

## **1.1 Green Audit - *An Effective Efforts towards Environment Sustainability & Energy Conservation***

The modernization and industrialization are the two important outputs of twentieth century which have made human life more luxurious and comfortable. Simultaneously, they are responsible for voracious use of natural resources, exploitation of forests and wildlife, producing massive solid waste, polluting the scarce and sacred water resources and finally making our mother Earth ugly and inhospitable. Today, people are getting more familiar to the global issues like global warming, greenhouse effect, ozone depletion and climate change etc. Now, it is considered as a final call by mother Earth to walk on the path of sustainable development. The time has come to wake up, unite and combat together for sustainable environment.

Considering the present environmental problems of pollution and excess use of natural resources, Hon. Prime Minister, Shri. Narendra Modiji has declared the Mission of Swachch Bharat Abhiyan. Also, University Grants Commission has mentioned “Green Campus, Clean Campus” mission mandatory for all higher educational institutes. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

Green Audit is the most efficient ecological tool to solve such environmental problems. It is a process of regular identification, quantification,

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.



documenting, reporting and monitoring of environmentally important components in a specified area. Through this process the regular environmental activities are monitored within and outside of the concerned sites which have direct and indirect impact on surroundings. Green audit can be one of the initiative for such institutes to account their energy, water resource use as well as wastewater, solid waste, hazardous waste generation. Green Audit process can play an important role in promotion of environmental awareness and sensitization about resource use. It can create consciousness towards ecological values and ethics. Through green audit, one can get direction about how to improve the condition of environment.

## **1.2 Why Green Audit:**

Green auditing is the process of identifying and determining whether institution's practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. But over the period of time excess use of resources like energy, water, chemicals are become habitual for everyone especially, in common areas. Now, it is necessary to check whether our processes are consuming more than required resources? Whether we are handling waste carefully? Green audit regulates all such practices and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion it is necessary to verify the processes and convert it in to green and clean one. Green audit provides an approach for it. It also increases overall consciousness among the people working in institution towards an environment.

## **1.3 Goals of Green audit:**

University has conducted a green audit with specific goals as:

- Assess facility of different types of waste management.
- Increase environmental awareness throughout campus.
- Identification and documentation of green practices followed by university.
- Identify strength and weakness in green practices.
- Conduct a survey to know the ground reality about green practices.
- Analyze and suggest solution for problems identified from survey.
- Identify and assess environmental risk.
- The long term goal of the environmental audit program is to collect baseline data of environmental parameters and resolve environmental issues before get complex.
- To motivate staff for optimized sustainable use of available resources.

#### **1.4 Objectives of Green audit:**

To examine the current practices which can impact on environment such as of resource utilization, waste management etc.

- To prepare an Environmental Statement Report on green practices followed by different departments, support services and administration building.
- Setup goal, vision and mission for Green practices in campus.
- To identify and analyze significant environmental issues.
- Establish and implement Environmental Management Plan in various departments.
- Continuous assessment for better performance in green practices and its evaluation.

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Dicky Ametun*



## 1.5 About Criteria 7 of NAAC

Universities are playing a key role in development of human resources worldwide. Higher education institutes campus run various activities with aim to percolate the knowledge along with practical dimension among the society. Likewise different technological problems higher education institutes also try to give solution for issues related to environment. Different types of evolutionary methods are used to assess the problem concerning environment. It includes Environmental Impact Assessment (EIA), Social Impact Assessment(SIA), Carbon Footprint Mapping, Green audit etc.

National Assessment and Accreditation Council (NAAC) which is a self governing organization that declares the institutions as Grade according to the scores assigned at the time of accreditation of the institution. Green Audit has become mandatory procedure for educational institutes under Criterion VII of NAAC. The intention of green audit is to upgrade the environmental condition inside and around the institution. It is performed by considering environmental parameters like water and wastewater accounting, energy conservation, waste management, air, noise monitoring etc. for making the institution more eco-friendly.

Students are the major strength of any academic institution. Practicing green action any educational institution will inculcate the good habit of caring natural resources in students. Many environmental activities like plantation and nurturing saplings and trees, Cleanliness drives, Bird watching camps, No vehicle

day, Rain water harvesting, etc. will make the students good citizen of the country. Through Green Audit, higher educational institutions can ensure that they contribute towards the reduction of Global warming through Carbon Footprint reduction measures.

### **1.6 Benefits of Green Audit to an Educational Institute:**

There are many advantages of green audit to an Educational Institute:

- It would help to protect the environment in and around the campus.
- Recognize the cost saving methods through waste minimization and energy conservation.
- Find out the prevailing and forthcoming complications.
- Empower the organization to frame a better environmental performance.
- It portrays good image of institution through its clean and green campus.
- More efficient resource management
- To create a green campus
- To enable waste management through reduction of waste generation, solid and - waste
- To create plastic free campus and evolve health consciousness among the stakeholder
- Recognize the cost saving methods through waste minimizing and managing
- Point out the prevailing and forthcoming complications
- Authenticate conformity with the implemented laws
- Empower the organizations to frame a better environmental performance
- Enhance the alertness for environmental guidelines and duties

- Impart environmental education through systematic environmental management approach and Improving environmental standards
- Benchmarking for environmental protection initiatives
- Financial savings through a reduction in resource use
- Development of ownership, personal and social responsibility for the University and its environment
- Enhancement of University profile
- Developing an environmental ethic and value systems in youngsters.
- Green auditing should become a valuable tool in the management and monitoring of environmental and sustainable development programs of the University.
- Finally, it will help to built positive impression for through green initiatives the upcoming NAAC visit.

## 1.7 ABOUT CHAUDHARY CHARAN SINGH UNIVERSITY

Chaudhary Charan Singh University (formerly, Meerut University) was established in 1965, to cater to the needs of higher education in western Uttar Pradesh. The University celebrated its silver jubilee in 1991. Presently, it is one of the premier educational institutions of the country encompassing a vast, beautiful and pollution-free campus which sprawls over 222 acres of land having vast playgrounds and experimental fields, botanical garden, rose garden with life-size statue of the late Prime Minister Ch. Charan Singh, Gymnasium, Indoor Stadium, well equipped Library, Hostels for both girls and boys, Administrative Block, Spacious Auditorium, Guest House, Community Center, Medical Center, Residential Quarters for faculty members and employees, Canteen, Bank and Post office.

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Dicky Anand*

The teaching department belonging to different faculties, are housed in spacious buildings and have well-equipped laboratories and advanced facilities. The University also has a separate engineering University, which is currently offering courses leading to B.Tech. Degree in several different branches of engineering.

Initially, the M.Phil and Ph.D. programs were started in 1969 taking credit of becoming first University in the country to introduce M.Phil. Program. In 1973, Post Graduate level courses were also introduced with the modernized syllabi. Since then, the University has been progressing at a steady rate. During the VIII five years plan, introduction of self-financed courses keeping in pace with the changing demands of the society and also for human resources development, were planned. Now, there are five faculties with 22 UGC sponsored and 35 self-financed/job oriented courses being run in the campus. 252 professional universities/institutions 109 Universities and one constituent University are affiliated to Chaudhary Charan Singh University.

**Location:**

Chaudhary Charan Singh University is located at the center of the Meerut City which is just 2.6 Km from Meerut Garh Bus Station so getting to the University is easy going travel.

It is 10 Km from Meerut Railway Station connected by various Public Transports, Cabs, Auto Rickshaws etc.

## Total Campus Area & University Building Spread Area:

University campus is spread over a total area of 221 acres. Out of this, 37.4 acre is the built up area of all Buildings –

1. Administrative Buildings,
2. Departments Buildings,
3. Hostel Buildings,
4. Residential Buildings

17.68 acres area is ground coverage.

Details of all departments and faculties are mentioned in the below table of Buildings:-

<b>Administrative Buildings</b>	Adam Block, Administrative Block SCRIET, Answer Book Building-1, Answer Book Building -2, Badminton Court (Indoor), Bank, Bhraspati Bhawan, Canteen, Central Evaluation Building, Community Centre, Computer Centre, Computer Centre (Ext.), Electrical Section & Post Office, Engineering Section, Examination & Confidential, Kushti Stadium, Library SCRIET, Metrological Station, Netaji Subhash Chandra Boss Auditorioum, Raja Mahendra Pratap Library, SCRIET Canteen, Student Grievance Cell, Swami Kalyandev Swasthya Kendra, VC Secretariat
---------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.



<p><b>Department Buildings</b></p>	<p>Applied Science, MCA, Food Science &amp; technology and Plant Protection, Bio-technology, Home Science &amp; Commerce, Chemistry (Block-1 &amp; Block -2), History &amp; Legal Studies, History &amp; Legal Studies, Horticulture, Sanskrit &amp; Yoga, Microbiology, Physical Education, Psychology, Fine Arts &amp; Statistics, Russian, Dean Student Welfare Office &amp; Chief Proctor Office, Sociology, MSW English and Seed Science Technology, Animal House, Botany, Dept. of IBS, MBA(HA) and Mass Communication, Education, Economics &amp; Political Science, Hindi, Hounarable Kanshiram Jee Sodh Peeth, Library &amp; Information Science, Madan Mohan Vidya Mandir School, Mathematics, genetics &amp; Plant Breeding, New Journalism &amp; Mass Communication, Physics &amp; Geography, SCRIET Block (EC &amp; EI Engg.), SCRIET (CS &amp; IT Engg.), SCRIET Block C(Agriculture Engg.), SCRIET Block ( Mechanical &amp; Chemical Engg.), SCRIET Workshop, URDU, Zoology, Toxicology</p>
<p><b>Hostel Buildings</b></p>	<p>Durga Bhabhi Girls Hostel, Kailash Prakash Boys Hostel, Late Rajesh Pilot Sports Hostel, Maharana Pratap Boys Hostel, Pandit Deendayal Upadhyay Boys Hostel, R K Singh Boys Hostel, Rani Laxmi Bai Girls Hostel</p>
<p><b>Residential Buildings</b></p>	<p>Guest House (21 Rooms, Kitchen, Dining Area), Residence - Vice Chancellor, Residence (A1-A6), Residence (AB1-AB5), Residence (B1 - B11), Residence (S1-S8 &amp; S37-S52), Residence (S9-S36 &amp; S53-S56), Residence (C1-C24), Residence (D1-D8), Residence (D25-D28), Residence (D9-D24), Residence (H1-H16)</p>

There is separate campus named SCRJET Engineering University.

The University has also adopted the 'Green Campus' system for environmental conservation and sustainability.

The 'Green Campus' has been active since last 7 years both as an assembly group of sub committees that actively promote the various projects. The University administration works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management and Paperless Work.

### **1.1 Campus Infrastructure**

The University Campus from the outside looks great and is quite unique keeping the architecture of Universitys. Chaudhary Charan Singh University has a very good and systematic building infrastructure. All class rooms are fully ventilated, they are fully comfortable. The University from the outside looks good and is quite unique keeping the architecture of other universities in mind. And the University has an interesting historical legacy which is interesting to learn about.

The University Campus is itself is combination of all standards and amenities required as far as great educational infrastructure is concerned ; however residential areas including hostels are full of amenities link Bank, School, Health Centre etc.

Badminton Court, Computer Centres are center of attraction. The

library is very vast and there are enough books available to issue or read in the library itself. There is ample seating space also available. Students can get Internet access at the library, power back up, University have provided Wi-Fi facility available in the all students. The University Campus also has a book bank facility that enables students to use the books, for the entire academic session. There is separate library for SCRIET Engg. University and the computer laboratories have access to advance web activity with its subscription to E-resources through digital Network that links students and faculty researchers to the data bases needed for research. There's a separate girl's & boy's Hostels. The campus also has sports facilities which include well maintained Cricket ground, football ground and a basketball court, and carom for indoor sports. Students also use this platform for their cultural competitions etc. University has a medical building with all the necessary first aid. University has facilities for both outdoor and indoor games.

Existing facilities are continuously upgrading and improving.



# CHAUDHARY CHARAN SINGH UNIVERSITY CAMPUS AT A GLANCE

## Department of Botany



PREPARED BY-  
KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR. *Dicky Anand*

## Ecology & Research Lab



PREPARED BY-  
KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR. *Dicky Ametia*

## Physiology & Tissue Culture Lab



## Biochemistry Lab



## AG Botany Lab



## Plant Taxonomy & Pathology Lab



# Department of Zoology



PREPARED BY-  
KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR. *Dicky Anand*

## Department of Nematology



PREPARED BY-  
KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR. *Dicky Anand*

## Chronology Lab



## Laboratory of Molecular Parasitology





## Department of Toxicology



## Molecular Biology & Plant Virology Lab



# Department of Mathematics



## Department of Microbiology



PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Dicky Ametani*

## Fermenter Room



PREPARED BY-  
KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR. *Dicky Anand*

## Pathogenic Microorganism Lab



## Department of Horticulture



**Department of Chemistry, Department of Biotechnology,  
Department of Commerce & Department of Foreign  
Languages**



## Facilities at CCS University

### **Auditorium**



The university has an auditorium with a capacity of more than a 1000 seats. The auditorium is well equipped with light and sound systems for cultural functions, etc.

### **Bank Facility**

A separate branch of Allahabad bank is available to the students in the University Campus, which provides all facilities to the students for submitting their fee & other banking services.

### **Canteen**

To cater the need of the students, the university has a spacious student's canteen that has the necessary infrastructure.

## Guest House



The University has a well-maintained and fully furnished guest house in the Campus premises. The Guest House has 17 rooms with all facilities and four special suits to cater to the needs of the visiting faculty members, subject experts, examiners and other guests. Dr. Vijay Malik Chaubey is the Incharge of the Guest House.

## Dhan Singh Kotwal Community Centre

The University Campus has a well-maintained Community Center Established for the purpose of providing a platform for the community interaction of the University fraternity. The Center has got sufficient furniture and other facilities in the Center along with two big halls and two well-furnished bedrooms. Most of the teachers and employees of the University make of the Community Center for their family ceremonies.



## Hostel



The university has Eight fully furnished hostels separately for boys and girls, equipped with round the clock power back, wi-fi connection, water heaters, RO water cooler etc. which provide excellent hostel accommodation for full-time students of the university departments. Reading rooms and additional sports facilities like table-tennis rooms, chess and carrom etc are also available in each hostel. Hostel rooms are available on double occupancy. Admission to the hostels are made against the available vacant seats allotted by the Wardens of the hostels according to University Hostel Rules. The overall charge of student's discipline and hostel administration vests in the Chief Warden.

## Other departments

**Electricity and Civil Supplies Department**

**Fully W-Fi campus**

**Healthcare Centre**

**Internet Facilities**

**Placement Cell**

**Post Office**

**Sports & Games**

**Women's Cell**

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Dicky Ametia*

## CHAPTER 2 – GREEN AUDIT METHODOLOGY

### 1.1 The Audit Team

SI No.	Name	Department
1	Prof. Y Vimla	Dept. of Botany
2	Prof. A K Chaubey	Dept. of Zoology
3	Prof. Jitendra Dhaka	Dept. of Horticulture
4	Prof. Bindu Sharma	Dept. of Zoology
5	Prof. Vijay Malik	Dept. of Botany
6	Er. Maneesh Mishra	University Engineer section

### 2. Pre Audit Stage

A pre-audit meeting provided an opportunity to reinforce the scope and objectives of the audit and discussions were held on the practicalities associated with the audit. This meeting is an important prerequisite for the green audit because it is the first opportunity to meet the auditee and deal with any concerns. It was held with the Vice-Chancellor regarding initiatives taken by the University and regarding the last NAAC Green Audit conducted by the University. The meeting was an opportunity to gather the information that the audit team can study before arriving on the site.

The audit protocol and audit plan was handed over at this meeting and discussed in advance of the audit itself. The pre-audit meeting was conducted successfully and necessary documents were collected directly from the

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.



University before the initiation of the audit processes. Actual planning of audit processes was discussed in the pre-audit meeting. Audit team was also selected in this meeting with the help of staff and the University management. The audit protocol and audit plan were handed over at this meeting and discussed in advance of the audit itself.

## 2.1 Management Commitment

The Management of the University has shown a commitment towards green auditing during the pre-audit meeting. They were ready to encourage all green activities. It was decided to promote all activities that are environment friendly such as awareness programs on the environment, campus farming, planting more trees on the campus, etc., after the green auditing. The management of the University was willing to formulate policies based on green auditing report.

## 2.2 Objectives of the study

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues.

Green Audit is the most efficient and ecological way to manage environmental problems. It is a kind of professional care that is the responsibility of each individual who is the part of economic, financial, social, environmental factors. It is necessary to conduct green audit on a University campus because students become aware of the green audit, its advantages to save the planet and

they become a good citizen of our country. Thus Green audit becomes necessary at the University level.

**The broad objectives are: –**

- Diagnosing the environmental problems to eliminate them.
- Environmental education through a systematic environmental management approach.
- Improving environmental standards.
- Benchmarking for environmental protection initiatives.
- Efficient utilization of resources.
- Financial savings through a reduction in resource use.
- Curriculum enrichment through practical experience.
- Development of ownership, personal and social responsibility for the University and its environment.
- Enhancement of University's profile.
- Developing an environmental ethics and value systems in young people.
- Providing certain recommendations based on environmental audit report.
- Ensuring compliance, not only with laws, regulations, and standards but also with company policies and the requirements of an Environmental Management System (EMS) standard.
- Enabling environmental problems and risks to be anticipated.
- To demonstrate that University is aware of its impact upon the environment.

### **3. Audit Stage**

Green Audit was done with the help of co-associates involving different student

groups, teaching, and non-teaching staff. The green audit began with the teams walking through all the different facilities at the University, determining the different types of appliances and utilities as well as measuring the usage per item (Watts indicated on the appliance or measuring water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and learners were interviewed to get details of usage, frequency, or general characteristics of certain appliances. Data collection was done in the sectors such as Energy, Waste, Green Area, Carbon footprint, and Water use. Universities records and documents were verified several times to clarify the data received through survey and discussions.

### **3.1 Methodology**

The Management of the University has shown the commitment towards the green auditing during the pre-audit meeting. They were ready to encourage all green activities. It was decided to promote all activities that are environment friendly such as awareness programs on the environment, campus farming, planting more trees on the campus etc., after the green auditing. The management of the University was willing to formulate policies based on green auditing report.

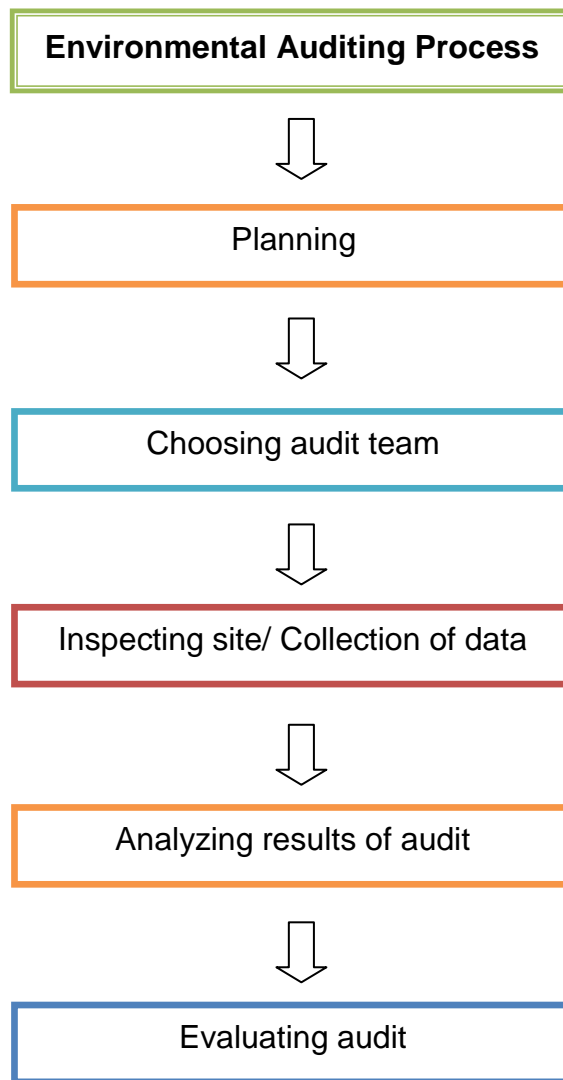
In order to perform green audit, the methodology included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following areas to summarize the present status of environment management in the campus:

- Energy Management
- Water Management
- Waste Management
- Environment Management

### **Methodology – Step By Step**

The audit process was carried out in three phases. At first, all the secondary data required for the study was collected from various sources, like concerned departments as engineering, garden etc. A broad reference work was carried out to clear the idea of green auditing. Different case studies and methodologies were studied and the following methodology was adopted for present audit.

The methodology of present study is based on onsite visits, the personal observations and questionnaires survey tool. Initially, based on data requirement, sets of questionnaires were prepared. The surveyors then visited all the departments of the university and the questionnaires were filled. The generated data is subsequently gathered and used for further analysis. From the outcome of the overall study, a final report is prepared.



### Survey by Questionnaire:

Baseline data for green audit report preparation was collected by questionnaire survey method. Questionnaires prepared to conduct the green audit in the university campus is based on the guidelines, rules, acts and formats prepared by Ministry of Environment, Forest and Climate Change, New Delhi, Central Pollution Control Board and other statutory organizations. Most of the guidelines and formats are based on broad aspects and some of the issues or formats were not applicable for University campus. Therefore, using these guidelines and formats, combinations,

modifications and restructuring was done and sets of questionnaires were prepared as solid waste, energy, water, hazardous waste, and e-waste.

All the questionnaires comprises of group of modules. The first module is related to the general information of the concerned department, which broadly includes name of the department, month and year, total number of students and employees, visitors of the department, average working days and office timings etc. The next module is related to the present consumption of resources like water, energy, or the handling of solid and hazardous waste. Maintaining records of the handling of solid and hazardous waste is much important in green audit.

There are possibilities of loss of resources like water, energy due to improper maintenances and assessment of this kind of probability is necessary in green audit. One separate module is based on the questions related to this aspect. Another module is related to maintaining records, like records of disposal of solid waste, records of solid waste recovery etc. For better convenience of the surveyor, some statistics like, basic energy consumption characteristics for electrical equipment etc. was provided with the questionnaires itself.

### **Onsite visit and observations:**

The Chaudhary Charan Singh University has vast built up area comprising of various departments, administrative building, teachers and staff quarters, student hostels, guest house, sports complex and health center. All these amenities have different kind of infrastructure as per their requirement. All these buildings were visited by the surveyors and the present condition is checked with the help of the questionnaires. Personal observations were made during the onsite visit. All the amenities were clubbed in as per their similarities and differences, which makes the



survey and further analysis easier.

For the data compilation purpose the University Departments and support services were clubbed into Four Types of Buildings and given names as Administrative Building, Departments Buildings, Hostel Buildings and Residential Buildings. The details of the Buildings are as follows:

### **Details of each building including the various departments**

Sr. No.	Name of the Buildings
1.	Administrative Buildings
2.	Department Buildings
3.	Hostel Buildings
4.	Residential Buildings

After collection of secondary data, the reviews related to each environmental factor were taken by the green audit team. The data was tabulated, analyzed and graphs were prepared. Depending upon the observations and data collected, interpretations were made. The lacunas and good practices were documented. The Environmental Management Plan (EMP) was prepared for the next academic year in order to have better environmental sensitization. Finally, all the information was compiled in the form of Green Audit Report.

### 3.2 Data analysis and final report preparation:

A proper analysis and presentation of data produced from work is a vital element. In case of green audit, the filled questionnaires of the survey from each group, were tabulated as per their modules, in Excel spreadsheets. The tabulated data is then used for further analysis. For better understanding of the results and to avoid complications, averages and percentages of the tables were calculated. Graphical representation of these results was made to give a quick idea of the status. Interpretation of the overall outcomes were made which incorporates all the primary and secondary data, references and interrelations within. Final report preparation was done using this interpretation.

#### **Categorization of University Departments & Support Services at Chaudhary Charan Singh University Campus**

<b>Administrative Buildings</b>	Adam Block, Administrative Block SCRIET, Answer Book Building-1, Answer Book Building -2, Badminton Court (Inddor), Bank, Bhraspati Bhawan, Canteen, Central Evaluation Building, Community Centre, Computer Centre, Computer Centre (Ext.), Electrical Section & Post Office, Engineering Section, Examination & Confidential, Kushti Stadium, Library SCRIET, Metrological Station, Netaji Subhash Chandra Boss Auditorioum, Raja Mahendra Pratap Library, SCRIET Canteen, Student Grievance Cell, Swami Kalyandev Swasthya Kendra, VC Secretariat
---------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<p><b>Department Buildings</b></p>	<p>Applied Science, MCA, Food Science &amp; technology and Plant Protection, Bio-technology, Home Science &amp; Commerce, Chemistry (Block-1 &amp; Block -2), History &amp; Legal Studies, History &amp; Legal Studies, Horticulture, Sanskrit &amp; Yoga, Microbiology, Physical Education, Psychology, Fine Arts &amp; Statistics, Russian, Dean Student Welfare Office &amp; Chief Proctor Office, Sociology, MSW English and Seed Science Technology, Animal House, Botany, Dept. of IBS, MBA(HA) and Mass Communication, Education, Economics &amp; Political Science, Hindi, Hounarable Kanshiram Jee Sodh Peeth, Library &amp; Information Science, Madan Mohan Vidya Mandir School, Mathematics, genetics &amp; Plant Breeding, New Journalism &amp; Mass Communication, Physics &amp; Geography, SRIET Block (EC &amp; EI Engg.), SRIET (CS &amp; IT Engg.), SRIET Block C(Agriculture Engg.), SRIET Block ( Mechanical &amp; Chemical Engg.), SRIET Workshop, URDU, Zoology, Toxicology</p>
<p><b>Hostel Buildings</b></p>	<p>Durga Bhabhi Girls Hostel, Kailash Prakash Boys Hostel, Late Rajesh Pilot Sports Hostel, Maharana Pratap Boys Hostel, Pandit Deendayal Upadhyaya Boys Hostel, R K Singh Boys Hostel, Rani Laxmi Bai Girls Hostel</p>
<p><b>Residential Buildings</b></p>	<p>Guest House (21 Rooms, Kitchen, Dining Area), Residence – Vice Chancellor, Residence (A1-A6), Residence (AB1-AB5), Residence (B1 – B11), Residence (S1-S8 &amp; S37-S52), Residence (S9-S36 &amp; S53-S56), Residence (C1-C24), Residence (D1-D8), Residence (D25-D28), Residence (D9-D24), Residence (H1-H16)</p>

## CHAPTER 3 – WATER & WASTE WATER AUDIT

Water which is precious natural national resource available with fixed quantum. The availability of water is decreasing due to increasing population of nation, as per capita availability of utilized water is going down. Due to ever rising standard of living of people, industrialization, urbanization, demand of fresh water is increasing day by day. The unabated discharge of industrial effluent in the available water bodies is reducing the quality of these ample sources of water continuously. Hence, the national mission on water conservation was declared by the then Hon. Prime Minister Narendra Modi as 'Jal Shakti Abhiyan' and appealed to all citizens to collectively address the problem of water shortage, by conserving every drop of water and suggested for conducting water audit for all sectors of water use.

Water audit can be defined as a qualitative and quantitative analysis of water consumption to identify means of reducing, reusing and recycling of water. Water Audit is nothing but an effective measure for minimizing losses, optimizing various uses and thus, enabling considerable conservation of water in irrigation sector, domestic, power and industrial as well. A water audit is a technique or method which makes possible to identify ways of conserving water by determining any inefficiencies in the system of water distribution. The measurement of water losses due to different uses in the system or any utility is essential to implement water conservation measures in such an establishment.

### **Importance of Water Audit:**

- Systematic process
- May yield some surprising results
- Easier to work on solutions when the problems are identified.

- A tracking mechanism can be put into place .audit team

It is observed that a number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology to determine the requirement of water. The community which has a population between 20,000 to 1,00,000 requires 100 to 150 liters per person (capita) per day. The communities with a population over 1,00,000 requires 150 to 200 liters person (capita) per day. As per the standards provided by WHO Regional office for South East Asia Schools require 2 liters per student; 10-15 liters per student if water-flushed toilets, Administration requires (Staff accommodation not included) 50 liters per person per day, Staff accommodation requires 30 liters per person per day and for sanitation purposes it depends on technology.

### **3.1 Water Audit:**

Water usage can be defined as water used for all activities which are carried out on campus from different water sources. This includes usage in all residential halls, academic buildings, on campus and on grounds. Wastewater is referred as the water which is transported off the campus. The wastewater includes sewerage, residence, hall water used in cooking, showering, clothes washing as well as wastewater from chemical and biological laboratories which ultimately going down in sink or drainage system.

### **University water resources**

The major resource for the Water in the university is self-reliant water boring system installed in the campus in mass scale. Water storage tanks with

capacity (2X 250 Kilo Litres and 2X 400 Kilo Litres) installed in the University Campus which covers the daily consumption of water in the Campus including Drinking, Bathroom, Toilet, Kitchen, Garden, Urinals, Wash Basin, Laboratory etc. In the total population of 3800 of the University campus, the daily water need of the university is 266 Kilo Litres/ Day.



### 3.1.1 Water Consumption in the University:

From the data collected for water audit of Chaudhary Charan Singh University, Meerut, the water distribution and water consumption pattern is noticed as follows.

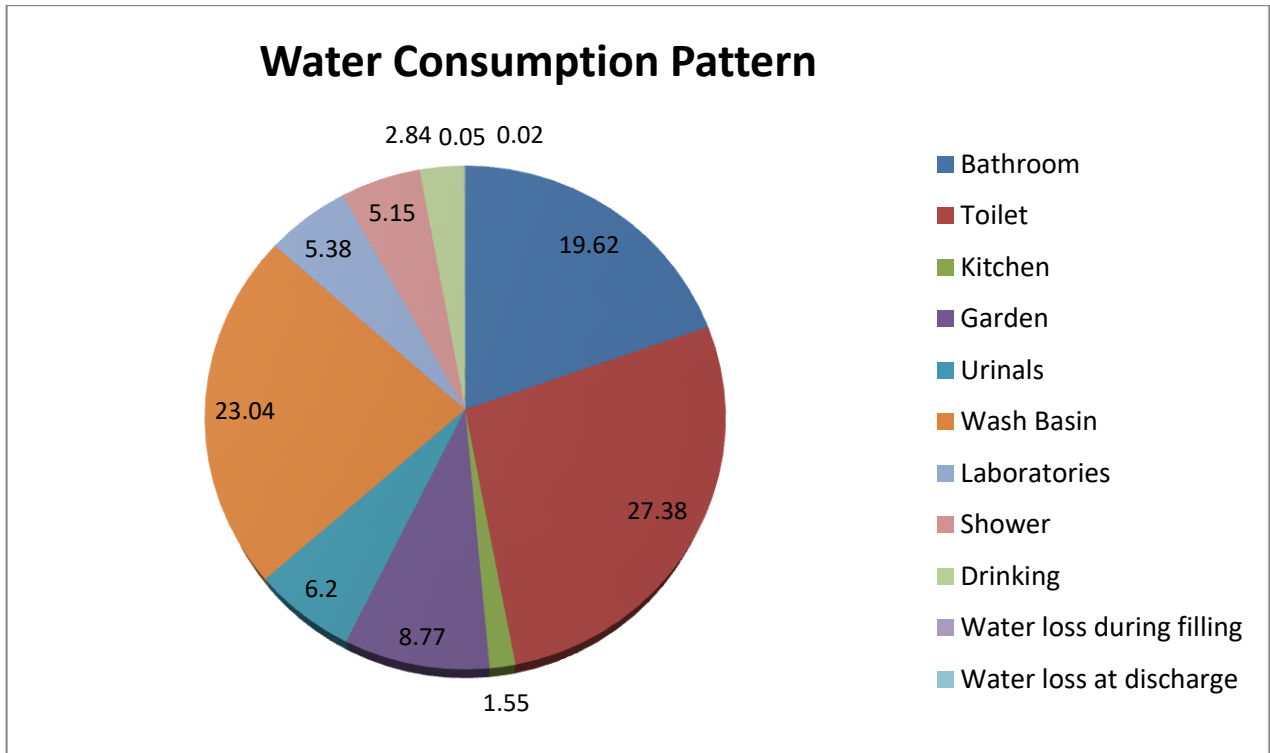
**Table: Yearly Average Water Consumption at Chaudhary Charan Singh University**

Sr. No.	Sector	Total Daily Use (liter)	Total Monthly use (kl)	Total yearly use (kl)	Percentage %
1	Bathroom	52,189.20	1,565,676.00	18,788,112.00	19.62
2	Toilet	72,830.80	2,184,924.00	26,219,088.00	27.38
3	Kitchen	4,123.00	123,690.00	1,484,280.00	1.55
4	Garden	23,328.20	699,846.00	8,398,152.00	8.77
5	Urinals	16,492.00	494,760.00	5,937,120.00	6.2
6	Wash Basin	61,286.40	1,838,592.00	22,063,104.00	23.04
7	Laboratories	14,310.80	429,324.00	5,151,888.00	5.38
8	Shower	13,699.00	410,970.00	4,931,640.00	5.15
9	Drinking	7,554.40	226,632.00	2,719,584.00	2.84

*Dicky Anand*

10	Water loss during filling	133.00	3,990.00	47,880.00	0.05
11	Water loss at discharge	53.20	1,596.00	19,152.00	0.02
<b>Total</b>		<b>266,000.00</b>	<b>7,980,000.00</b>	<b>95,760,000.00</b>	<b>100</b>

**Graph: Yearly Average Water Consumption at Chaudhary Charan Singh University**



Graph shows the total percent of water consumed by all the Building Blocks of Chaudhary Charan Singh University, Meerut. The graph shows toilets, wash basin and bathrooms as the major sources of water utilization comprising 27.38 %, 23.04 %, and 19.62 % respectively. The other uses namely garden, urinals, laboratory and



shower consume water with yearly water requirement of 8.77 %, 6.20 %, 5.38 % and 5.45 % respectively. Further also includes water required for drinking purpose, water required for kitchen activity and loss of water during filling and during discharge which is 2.84%, 1.55%, 0.05% and 0.02%. It was observed that the water required for drinking purpose is 2.84 % while for kitchen it is 1.55 %. In case of filling loss of water observed 0.05 and % while during discharging water loss is about 0.02 % respectively.

### **3.1.2 Sustainable Water Practices (SWP):**

#### **Watershed Management Practices at Chaudhary Charan Singh University campus.**

Chaudhary Charan Singh University, Meerut has taken many initiatives in water conservation and management of water available on the campus. Now, university is self-reliant through decentralized water conservation and management practices.

### **3.1.3 Water Filtration Unit:**

The university has huge campus with its administrative setup and there is lot of waste collected and disposed to the Garbage Unit. University has constructed Mini Water Filtration Unit on the campus. This filter house used to filter the wastewater from Garbage Unit into potable water stored in Tank constructed near Garbage Unit. This water is utilized for further trees and plants in the university campus as self-filtered water throughout the year.





### 3.1.4 Rain Water Harvesting Units:

The underground water table is decreasing day by day & minute by minute. The reason is that no attempt is made to replenish the ground water table with rainwater during the monsoon & other rainy days. The Rainwater harvesting is the simple collection or storing of water through scientific techniques from the areas where the rain falls. It involves utilization of rain water for the domestic or the agricultural purpose. The method of rain water harvesting has been into practice since ancient times.

It is as far the best possible way to conserve water and awaken the society towards the importance of water. The method is simple and cost effective too. It is especially beneficial in the areas, which faces the scarcity of water. We can see that the People usually make complaints about the lack of water. During the monsoons lots of water goes waste into the gutters. And this is when Rain water Harvesting proves to be the

most effective way to conserve water. We can collect the rain water into the tanks and prevent it from flowing into drains and being wasted. It is practiced on the large scale in the metropolitan cities. Rain water harvesting comprises of storage of water and water recharging through the technical process.

The university program of rain water harvesting is spreaded in mass scale which covers the total 46 units including roof top RWH available at Different Buildings. These units are also functional for storing and reuse.

<b>List of Rain Water Harvesting Units</b>			
<b>SI No.</b>	<b>Name of the Building</b>	<b>Type of RWH</b>	<b>No. of Units</b>
1	Applied Science		2
2	Hon. Kashi Ram Sodh Peeth		2
3	History & Law Dept.		2
4	Physics Dept.		2
5	Dr. R K Singh Hostel		2
6	K P Hostel		1
7	Security - Home Guard Office		2
8	Near Statue of Swami Vivekanand		2
9	In Front of Rsidance A6		1
10	New Answer book hall building (In Park)	Roof Top RWH	1
11	Botany Dept.		2
12	AG Botany Dept.		1
13	Answer Book Hall		1
14	Art Block		1
15	MBA/ IBS Dept.		2
16	Mass Communication Dept.	Roof Top RWH	1
17	VSMP Hostel		2

*Dicky Anand*

18	Pt. DDU Hostel		1
19	Phycology Dept.		1
20	Sports Field		2
21	Physical Education Dept.		2
22	Chemistry Dept.		1
23	Biotechnology Dept.		1
24	Sociology Dept.		1
25	Dean Student Welfare Office		1
26	Computer Cente Building	Roof Top RWH	1
27	Horticulture Dept.		1
28	Fine Art Dept.		1
29	Statistics Dept.	Roof Top RWH	1
30	B.Com Honours	Roof Top RWH	1
31	Hindi Dept.	Roof Top RWH	1
32	Library & Information Science	Roof Top RWH	1
33	Engg. Section (Civil)	Roof Top RWH	1
34	Legal studies Building Extension	Roof Top RWH	1
	<b>TOTAL</b>		<b>46</b>

### Recommendations:

University should consider following recommendations for improving campus environment:-

- Non-teaching staff or peons in the concerned section should take responsibility of monitoring the overflow of water tanks.
- Large amount of water is wasted during the practical process in Science laboratories. Designs of small water recycle system helps to reuse of water.
- Producing distilled water in the laboratories required large amount of water to

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Vinay Kr.*

distillate. To produce 1 liter of distilled water required more than 33 liters of water. To avoid more wastage university should design common distillation plant for Science Department.

- Reduce chemical waste formation in Chemistry laboratory; adopt the principles of green chemistry to reduce chemical waste.
- Pipes, overhead tanks and plumbing system should be maintained properly to reduce leakages and wastages of water.
- University should install its own Sewage Treatment Plant (STP). By doing so there will be a great reduction in water usage, as the water after treatment can be used for various purposes in the University.

## CHAPTER 4 – ENERGY AUDIT

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Also it can be said as “the strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempt to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

### 4.1 Energy audit:

Energy resources utilized by all the departments, support services and the administrative buildings of Chaudhary Charan Singh University, Meerut campus include Electricity, Solar Roof Top systems and Diesel Generators installed in the campus.

Grid Electricity **Source** is from PVVNL (*PASHCMINCHAL VIDYUT VITRAN NIGAM LIMITED*) with two source connections having load 700KW each. And third major source is through Solar Roof Top System with total capacity of 1260 KW which covers 90% of the total university requirement. The other source includes various DG systems installed at areas named as Substation A, Substation B, Substation C, Substation D, Residential and Auditorium. The capacity of DG sets installed at Substation A is 180 KVA, 250 KVA and 320 KVA, while at Substation B is 380 KVA and 180 KVA. On the other hand capacity at Substation C & Substation D is 380 KVA &

250 KVA respectively. The capacity of GS sets at Residential and Auditorium set is 250 KVA and 500 KVA respectively.

The major use of the energy is at office area, canteen, hostel, residential area and laboratories, for lightings, fans, water coolers, air conditioners, and laboratory & workshop instruments.

### **Electricity consumption in the University Campus**

Total electricity consumption is 44,56,980 Kwh per year and average monthly consumption is 3,71,415 Kwh which is combination of 88,600 Kwh through Grid Source 1, 166,005 Kwh through Grid Source 2 and approx.. 116,810 are from Solar Roof Top System.

Lighting systems are mostly linear fluorescent, with compact florescent used in corridors and foyers. All the departments and common facility centers are equipped with LED lamps. Quantities is distributed from Fan, Exhaust Fan and tube lights are 458, 180 and 667 numbers respectively, whereas the quantities of number of water coolers are slightly less as 144. Four to Five star air-conditioners are 524 numbers and other various depts. includes 3484 no.s Fans, 2695 no's Exhaust Fans, 4412 no's Tubelight and 1127 no's LED lamps. Besides this, equipment like Computers are used with power saving mode.

Also, campus administration runs switch-off drill on regular basis. In science department like Physics, Chemistry, Mathematics, Botany and Zoology electricity was shut downed after occupancy time is one of green practices for energy conservation.

A billing analysis has been used to create an energy usage profile of the University to

document each building of the campus. Department Buildings and Residential Buildings are major electricity users because of maximum no. of lights, computers & fans. Moreover, other Buildings have been observed with slight lesser energy consumptions.

All of the machines have an energy saver facility which sets the machine to energy save mode after a programmable time period of inactivity. The time period is currently set at the maximum of hours and is centrally programmed for those machines connected to the network.

University Campus currently has a policy of enabling the Energy star facility on all computers where appropriate and phasing in lower energy consuming liquid crystal monitors as leases expire. Most of the time runs on standby modes.

### **Recommendations:**

- University has many areas where lighting is not required at all times. Installing sensor based lighting in such areas can generate massive rewards. This is one of the easiest ways to save energy at university.
- If most systems in computer laboratory and instrumentation laboratory are based on old technology, they might be consuming more power than new technology.
- Replacing old computers and instruments with ones having energy efficiency certifications is the easiest way to conserve energy at university.
- By installing more solar energy panels generate more electricity and minimize their electricity bill. In the hostels increase use of solar water heater is needed.
- Investment in solar lights for outdoor lighting can generate long term benefits.





- A huge amount of energy is wasted because no one really cares about switching off the fans and lights when not required. Hence, planning workshops on energy conservation to educate students, faculty and staff can generate huge results.
- Unplug overhead projectors, computers, and smart boards when not in use. This simple way to conserve energy can help save large amount of power and money in the long run.

## CHAPTER 5 – SOLID WASTE AUDIT

Solid waste is the unwanted or useless solid material generated from the human activities in residential, industrial or commercial area. Solid waste management reduce or eliminates the adverse impact on the environment and human health. A number of processes are involved in efficiently managing waste for a organisation. It is necessary to manage the solid waste properly to reduce the load on waste management system.

Solid waste generation and its management is a burning issue in current days. The rate of generation of solid waste is very high and yet we do not have adequate technology to manage the generated waste. Unscientific handling of solid waste can create threats to public health and environmental safety issues. Thus, it is necessary to manage the solid waste properly to reduce the load on waste management system. The purpose of this audit is to find out the quantity, volume, type and current management practice of solid waste generation in the Chaudhary Charan Singh University campus. This report will help for further solid waste management and to go for green campus development.

### 4.1 Generation of solid waste in Chaudhary Charan Singh University, Meerut:

Chaudhary Charan Singh University campus solid waste data is collected from all the Building areas. There are different types of waste are recorded such as paper waste, plastic waste, biodegradable waste, construction waste and glass waste etc.

**Table: Status of solid waste generation in Chaudhary Charan Singh University Campus:**

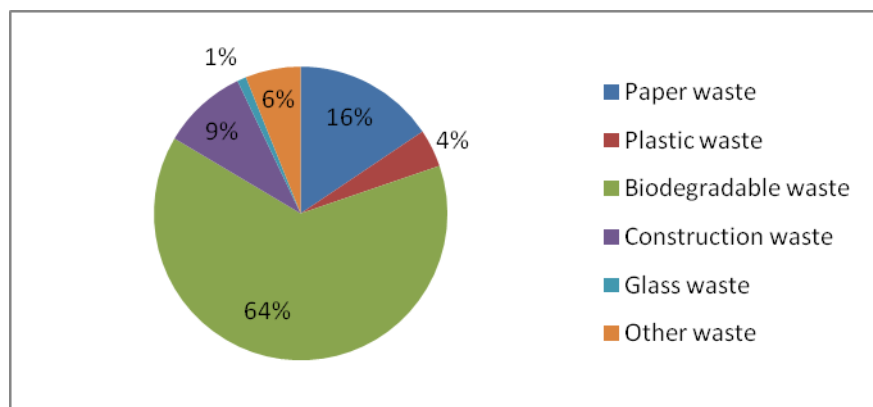
SI No.	Month	Total Waste Kg/ Month
1	Oct-20	3551
2	Nov-20	3558
3	Dec-20	4186

4	Jan-21	3976
5	Feb-21	4051
6	Mar-21	4184
7	Apr-21	4674
8	May-21	4704
9	Jun-21	4733
10	Jul-21	4897
11	Aug-21	4305
12	Sep-21	4439

**Table: Solid Waste Generation at University Campus (kg / month)**

Category of waste	Paper waste	Plastic waste	Biodegradable waste	Construction waste	Glass waste	Other waste	Total waste kg/month	Total waste kg/year
Quantity	683.44	170.86	2733.76	384.43	42.71	170.86	4271.5	51258
Percentage	16	4	64	9	1	4	100	

**Graph: Solid waste Generation at University Campus**



During the study period total 4271.5 kg/month of solid waste is generated. Among this highest quantity of solid waste is biodegradable waste and it is 2733.76 kg/month, which is 64 % of total solid waste. Paper waste is at second place amounting 683.44 kg/month and is 16%. Glass waste is lowest and is 42.75 kg/month and is 1%. The total waste generated on university campus is 51257.8 kg/year and 51.25 tones /year.

## 4.2 Waste Management

Further University has taken initiative for waste management to compost using processes like Dry & Wet Waste Management.

Under the waste management scheme, segregation is done for total waste into Dry Waste & Wet Waste. Micro level segregation techniques is used for Dry Waste management where in it is segregated into 25-30 layers, dry material recovered is sent to recyclers. On the other hand wet waste is further processed to compost bin for 15-20 days in summer and 25-30 days at winters.



**Table: Detailed data on Waste Management**

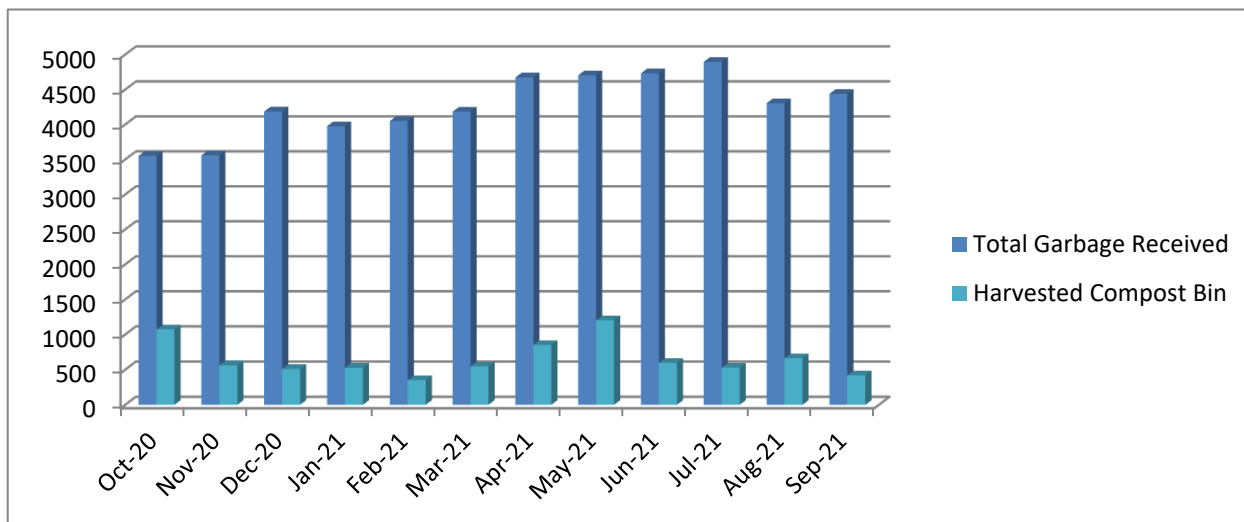
SI No.	Month	Total Garbage Received (In kg)	Total Inert Quantity (In Kg)	Wet Garbage Process (In Kg)	Dry Material Recovered (In Kg)	Harvested Compost Bin (In Kg)	Compost Consumed as Absorbent (In Kg)
1	Oct-20	3551	1081	2470	460.9	1073	261
2	Nov-20	3558	1028	2330	510.5	562	194
3	Dec-20	4186	1580	2606	373	511	206
4	Jan-21	3976	1532	2444	259	528	201
5	Feb-21	4051	1777	2274	285	351	196
6	Mar-21	4184	1843	2341	314	546	216
7	Apr-21	4674	2043	2631	333	850	230
8	May-21	4704	2104	2600	229	1203	233
9	Jun-21	4733	2057	2676	361	597	227
10	Jul-21	4897	2207	2690	288	529	233
11	Aug-21	4305	2068	2237	283	663	218
12	Sep-21	4439	2156	2283	463	419	224

PREPARED BY-

KOGNITIVE STREET CONSULTING SOLUTIONS PVT. LTD  
NOIDA TESTING LABORATORIES VINAY KR.

*Vinay Kr.*

Below graph shows total harvested compost at bin out of total Garbage received. Approx. 20% of waste is harvested compost during the process.



**Table: Departments generating highest and lowest quantity of solid waste.**

Waste	Quantity	Quantity kg/month	Quantity kg/year
Paper waste	Max.	683.44	8,201.3
	Min	22.8	273.4
Plastic waste	Max.	170.86	2,050.3
	Min	5.7	68.3
Biodegradable waste	Max.	2733.76	32,805.1
	Min	91.1	1,093.5
Construction waste	Max.	384.43	4,613.2
	Min	12.8	153.8
Glass waste	Max.	42.75	513.0
	Min	1.425	17.1

*Diby Jaiswal*

### **Initiatives taken by the University for Waste Management:**

- Biodegradable waste is a major solid waste generated in campus is mostly from canteen, hostels and guest house kitchens. Canteen waste is collected and some biodegradable waste is treated by composting process.
- Glass waste is generated from laboratory mainly in the form of bottles; Many times bottles are reused for storing of other chemicals.
- Maximum e waste due to Computer laboratory, MCA and other courses. E-waste generated at Chaudhary Charan Singh University is sent for recycling and reuse.
- Hazardous waste generated in solid and liquid state during experiments in laboratory is disposed properly.

### **Recommendations:**

- Metal scrap should be segregated separately by respective departments and should send for recycling.
- Provision for the E-waste management should be introduced in the University Campus.
- Paper waste like answer sheets, old bills and confidential reports should be sent for shredding, pulping and recycling after completion of their preservation period.
- University has signaled less use of plastic for any administrative as well as other purpose and scheme like no use of plastic should be implemented in the University.
- Chaudhary Charan Singh University saves maximum paper sheet per year through less paper convocation application. It saves number of trees per year and reduces Carbon foot print of 5.6168 ton CO<sub>2</sub>.
- Reduce the absolute amount of waste that it produced from University staff offices.

- Make full use of all recycling facilities provided by City Municipality and private suppliers, including glass, cans, white, colored and brown paper, plastic bottles, batteries, print cartridges, cardboard and furniture.
- Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated.
- Single sided papers to be used for writing and photocopy
- Important and confidential papers after their validity to be sent for pulping.



## CHAPTER 6 – ENVIRONMENT QUALITY AUDIT

This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards. This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programmes.

### 6.1 Environment Quality Audit

To keep the greeneries in the campus, the University regularly maintains the gardens which are looked after by concerned staff under the guidance of higher authorities of the University.

Activities organized to create greenery and its conservation at University campus is as follows-

- 1) Plantation of diversified species, Vegetative propagation, Uses of medicinal plants, Identification of plants species, Plantation of diversified species:
- 2) Waste management plan and disposal facility
- 3) Awareness of carbon consumption and carbon foot print programme

To create- green cover, Eco-friendly atmosphere, pure oxygen at the University campus, plantation program is organized every year with involving all students, principal, and all departments faculty members. In this session program was organized and about more than 100 ornamental, avenue, medicinal plant with rare and exotic beautiful trees were planted in the green areas and other parts of University campus. To keep the greeneries in the University, campus regularly maintains the gardens which are looked after by paid staff under the guidance of garden committee members. Moreover, every year campus try to plant new trees.

Campus is located in the vicinity of approximately more than 200 types (species) trees. Various tree plantation programs are being organized during the year at University campus and surrounding villages. This program helps in encouraging eco-friendly environment which provides pure oxygen within the institute and awareness among villagers. The plantation program includes various types of indigenous species of ornamental and medicinal wild plant species. The plants have medicinal value, which faculty members of botany department help students to identify with scientific name and give information about medicinal uses of the plants.

### **Campus Involvement**

For sustainable use of resources and for the mission of “GO-GREEN” it is necessary that the students, faculty and administration welcome it. Chaudhary Charan Singh University is an environment that invites opportunities to better its community through campus organizations. The green initiative started in the campus many years ago. The University students are actively participating and solely concerned with environment. These students under the guidance of faculties strive to create an environmentally friendly campus. Their purpose is to create awareness and eventually act on that awareness. University is also actively conducting environmental awareness programs in campus regularly.

### **Efforts for Carbon Neutrality**

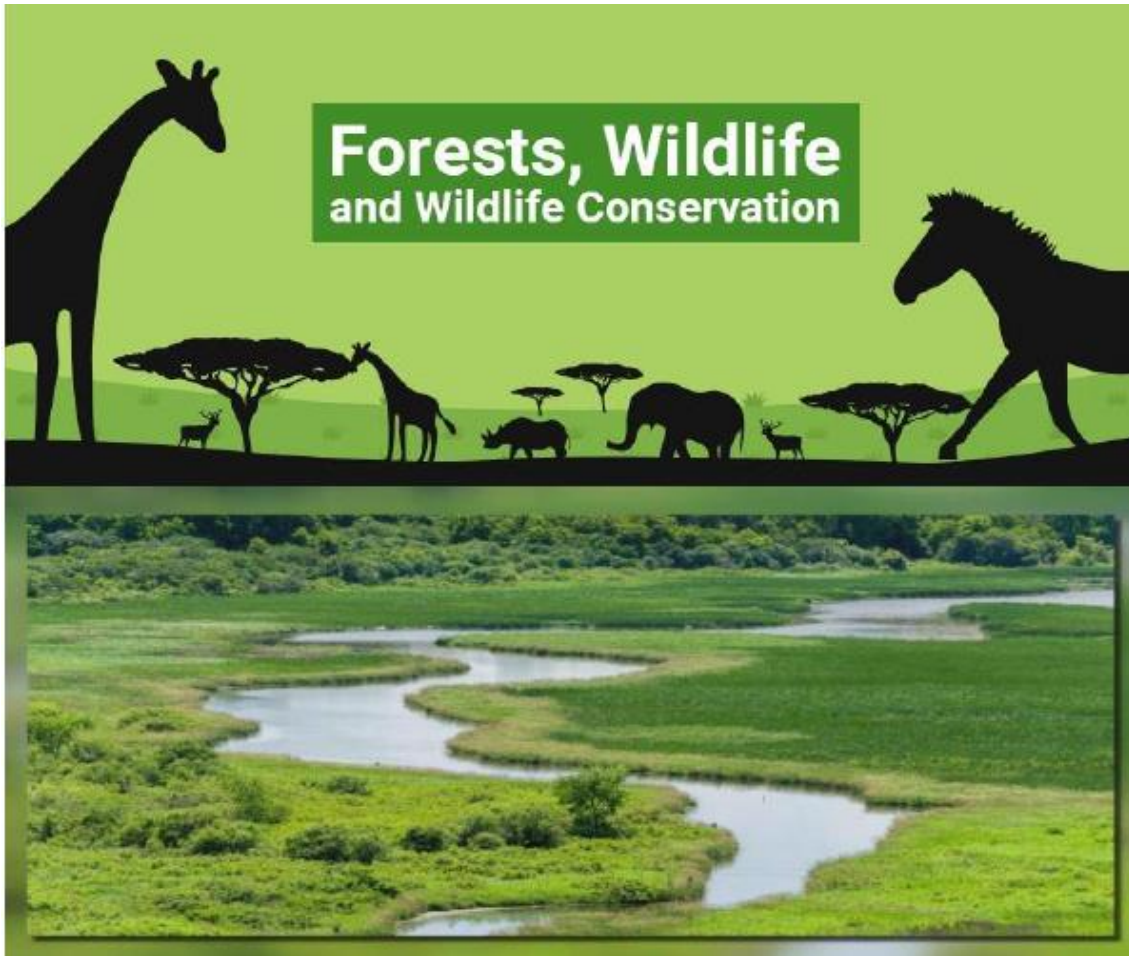
Air pollution is a matter of serious concern in the campus owing to its urban location. Government Science University as a responsible institution understands the importance of its carbon footprint and developed a plan to reduce greenhouse gas emissions in all its activities. Strictly ban on burning of dried leaves and waste paper in University.

## **Environmental Conservation Programme**

University is very active in practical education of the students with regard to the environmental conservation.

The University has arranged visits to their faculties to the Wildlife Institute of India (WII), Botanical Garden, Sanctuaries, Zoological park Sacred grooves in order to educate their students.

The University also took their students to different National Park in order to educate the students about in situ Conservation of Wildlife.



#### 4.1. National Ambient Air Quality Program (NAAQM)

Central Pollution Control Board, New Delhi initiated National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984 to get spatial and temporal variation of ambient air concentrations for a wide range of pollutants that are considered relevant for evolving strategic management plan. The program was subsequently renamed as NAMP (National Air Quality Monitoring Program). Under NAMP, three air pollutants viz., Sulphur dioxide (SO<sub>2</sub>), Nitrogen dioxides (NO<sub>2</sub>) and Respirable Suspended Particulate Matter (RSPM/PM<sub>10</sub>) have been identified for regular monitoring at three locations. Monitoring of pollutants has carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) as per CPCB monitoring protocol. One Respirable Dust Sampler

(RDS) machine is installed at the Main Gate of the University Campus which monitored the changes in ambient air quality during 24- Hrs.

Chaudhary Charan Singh University, Meerut monitors air pollution regularly under National Ambient Air Quality Monitoring Program, Central Pollution Control Board, New Delhi.

**Ambient air quality in the Chaudhary Charan Singh University is given in the below Table: -**

**Ambient Air Quality status in Chaudhary Charan Singh University**

S.No	Parameters▶	Unit	Result	Requirement permissible limits	Test Method
1	Particulate Matter, PM10	µg/m <sup>3</sup>	91.2	100	IS:5182 (P-23) : 2006
2	Particulate Matter, PM 2.5	µg/m <sup>3</sup>	50.4	60	SOP1/Ambient Air/01/010416
3	Sulphur Dioxide ( as SO <sub>2</sub> )	µg/m <sup>3</sup>	6.0	80	IS:5182 (P-2) : 2006
4	Carbon Monoxide (as CO)	mg/m <sup>3</sup>	0.860	04	IS:5182 (P-10) : 1999
5	Oxide of Nitrogen ( as NO <sub>2</sub> )	µg/m <sup>3</sup>	16.2	80	IS:5182 (P-6) : 2006

Central Pollution Control Board, New Delhi has set guidelines to monitor and analyze the air pollution quality parameters. The trees cover in campus are the leading sources to absorb CO<sub>2</sub> and releasing enough fresh O<sub>2</sub> across the University Campus. Result shows that Chaudhary Charan Singh University Campus air quality status is good as compared to other locations.

It is identified that Chaudhary Charan Singh University's campus is a green campus. University campus observed minimum air pollution as compared to other Ambient Air Pollution Centers located in different part of the city.

*Vinay Kr.*

### Precautionary measures:

- Use of bicycles for transportation in the campus.
- Avoid using diesel generators.

### 4.2 Ambient noise monitoring status:

Chaudhary Charan Singh University is located in the center of the city. The major source of noise on university is automobile noise. At the main gate of the Campus, the human communication and transportation are producing high level sound. A variety of sound come from Trucks, Buses, Bikes and other work processes going on at the Main Gate of the Campus.

Ambient noise monitoring was carried out in different areas of Chaudhary Charan Singh University campus like at University campus entry, Departments, Mechanical working places, Canteens, Boys and Girls hostels. The sampling was carried out using calibrated Sound Level Meter (AZ 8921) by logarithmic scale in Decibels (dB). The noise readings were collected in the University campus and calculated. The details of noise status in University campus are given in below table.

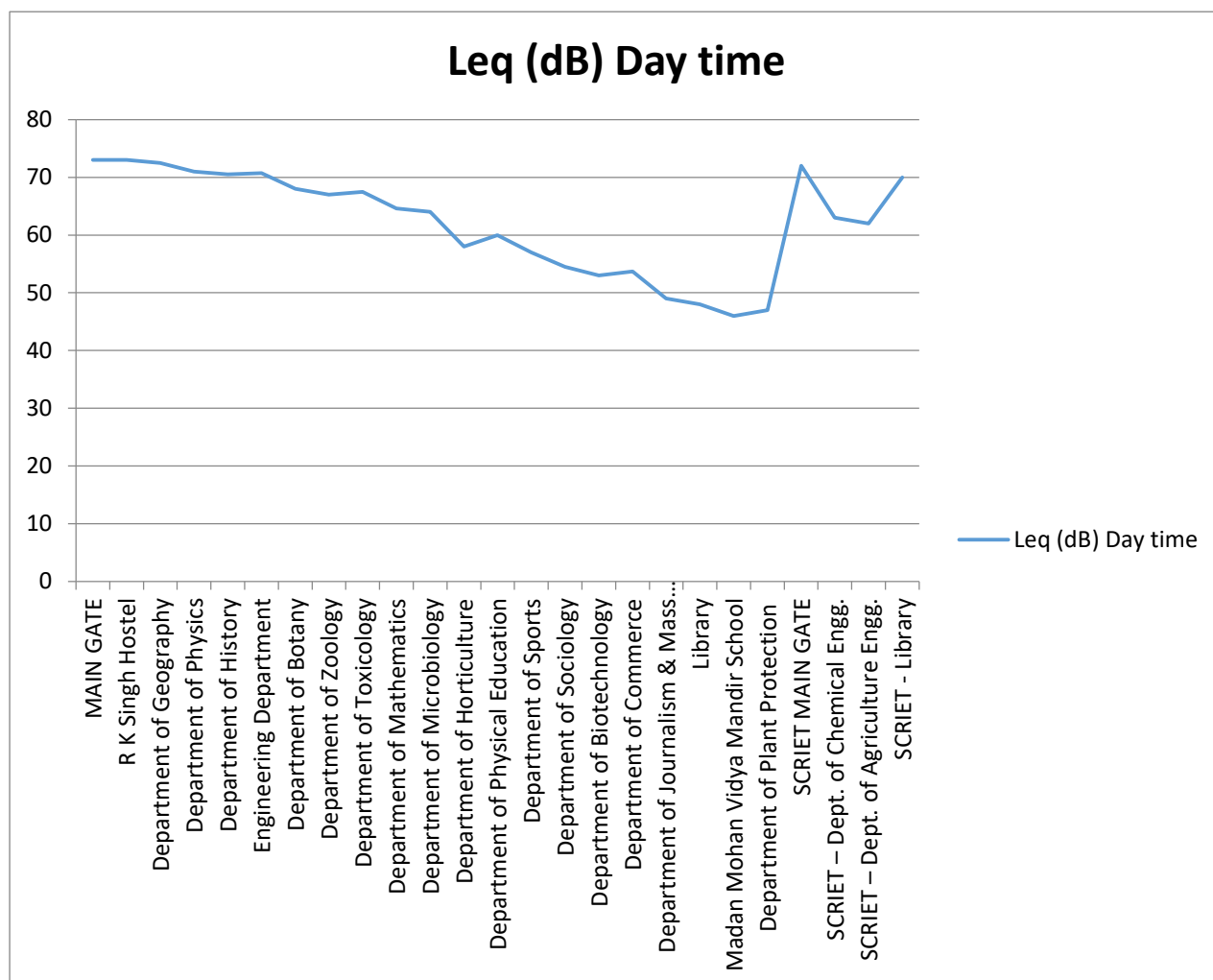
### Ambient Noise levels in Chaudhary Charan Singh University

Sr.No	Department Name	Leq (dB) Day time
1	MAIN GATE	73.00
2	R K Singh Hostel	73.00
3	Department of Geography	72.50
4	Department of Physics	71.00
5	Department of History	70.50

6	Engineering Department	70.70
7	Department of Botany	68.00
8	Department of Zoology	67.00
9	Department of Toxicology	67.50
10	Department of Mathematics	64.60
11	Department of Microbiology	64.00
12	Department of Horticulture	58.00
13	Department of Physical Education	60.00
14	Department of Sports	57.00
15	Department of Sociology	54.50
16	Department of Biotechnology	53.00
17	Department of Commerce	53.70
18	Department of Journalism & Mass Communication	49.00
19	Library	48.00
20	Madan Mohan Vidya Mandir School	46.00
21	Department of Plant Protection	47.00
22	SCRIET MAIN GATE	72.00
23	SCRIET – Dept. of Chemical Engg.	63.00
24	SCRIET – Dept. of Agriculture Engg.	62.00
25	SCRIET – Library	70.00

**Note:** - 1. All parameters expressed in dB (A) Leq.  
Monitoring is carried during day time.

**Graph: Ambient Noise levels in Chaudhary Charan Singh University, Meerut**



The graph shows that the University MAIN GATE Campus and SCRIET MAIN Gate found major noise levels as compared to other University areas.

**Recommendations**

- University Campus should follow the Environmental aware laws for different aspect of Environmental management.
- Campus should make the rule & poster the slogan in campus for protecting the environment



## List of Trees – BIO DIVERSITIES in CCS University

SI NO.	BOTANICAL NAME	SYNONYMS	COMMON NAME	FAMILY	HABIT
1	<i>Abrus precariosus</i> L.	<i>Glycine abrus</i> L.; <i>minor</i> Desv.	Ratti	Fabaceae	Climber
2	<i>Acacia auriculiformis</i> Benth.	<i>Acacia moniliformis</i> Griseb.; <i>Racosperma auriculiforme</i> (Benth.) Pedley	Earleaf acacia	Fabaceae	Tree
3	<i>Acacia catechu</i> (L.f.) wild.	<i>Mimosa catechu</i> L.f.; <i>Acacia wallichiana</i> DC.	Black cutch tree	Fabaceae	Tree
4	<i>Acalypha wilkesiana</i> Mull.Arg.	<i>Acalypha trocolor</i> Seem.; <i>Acalypha mosaics</i> Auct.	Copperleaf	Euphorbiaceae	Shrub
5	<i>Adansonia digital</i> L.	<i>Adansonia intergrifolia</i> Raf.; <i>Adansonia sculata</i> Steud.	Baobab	Malvaceae	Tree
6	<i>Adenantha pavonina</i> L.	<i>Adenantha polite</i> Miq.; <i>Corallaria parvifolia</i> Rumph.	Peacock flower fence	Fabaceae	Tree
7	<i>Eagle marmelos</i> (L.) Correa	<i>Creteva marmelos</i> L.; <i>Feronia pellucida</i> Roth.	Indian Bael	Rutaceae	Tree
8	<i>Agathis robusta</i> (C.Moore ex F.Muell.) F.M.Bailey	<i>Dammara bidwillti</i> Guilfoyle; <i>Dammara palamerstonii</i> F. Muell	Queensland kauri pine	Araucaceae	Tree
9	<i>Albizia lebbeck</i> (L.) Beth	<i>Mimosa lebbeck</i> L.; <i>Albizia latifolia</i> B.Boivin	Woman's tongue tree	Fabaceae	Tree
10	<i>Albizia procera</i> (Roxb.) Benth.	<i>Mimosa procera</i> Roxb.; <i>Mimosa elata</i> Roxb.	White siris	Fabaceae	Tree
11	<i>Albizia saman</i> (Jacq.) Merr.	<i>Mimosa saman</i> Jack.; <i>Inga saman</i> (Jacq.)	Monkey pod	Fabaceae	Tree
12	<i>Allamonda</i>	<i>Allamonda latifolia</i>	Golden trumpet	Apocynaceae	Tree

	<i>cathartic</i> L.	<i>C.Presl; Orelia grandiflora</i> <i>Aubl.</i>			
13	<i>Alstonia scholars</i> (L.) R.Br.	<i>Echites scholaris</i> L.; <i>pala</i> <i>scholaris</i> (L.) Roberty	Devil tree	Apocynaceae	Tree
14	<i>Amoora rohituka</i> Walp.	<i>Aphanamixis polystachya</i> (Wall.) R.Parker; <i>Andersonia rohituka</i> Roxb.	Pithraj tree	Rubiaceae	Tree and shrub
15	<i>Annona squamosa</i> L.	<i>Annona asiatica</i> Vahl; <i>Annona forsakalii</i> DC	Sugar apple	Annonaceae	Tree and shrub
16	<i>Antigonon leptopus</i> Hook.& Arn.	<i>Antigonon platypus</i> Hook. & Arn.; <i>Antigonon</i> <i>amabie</i> K. Koch	Mexican creeper	Polygonaceae	Vine
17	<i>Araucaria</i> <i>heterophylla</i> (Saliva.) Franco	<i>Eurasia heterophylla</i> <i>Salisb.</i> ; <i>Eutacta excelsa</i> <i>Carriere</i>	Christmas tree	Araucariaceae	Tree
18	<i>Artabotrys</i> <i>hexapetalus</i> (L.f.) Bhandari	<i>Artabotrys</i> <i>odorantissimus</i> R.Br.; <i>Unona uncata</i> (Lour.) <i>Dunal</i>	Green champa	Annonaceae	Shrub
19	<i>Artocarpus</i> <i>heterophyllus</i> Lam.	<i>Artocarpus brasiliensis</i> <i>Ortega: Artocarpus</i> <i>maximus</i> Blanco	Jack tree	Moraceae	Tree
20	<i>Artocarpus lacucha</i> Buch.- Ham.	<i>Artocarpus ficifolius</i> W.T. <i>Wang: Artocarpus</i> <i>lakoocha</i> Roxb.	Monkey jack	Moraceae	Tree
21	<i>Averrhoa</i> <i>carambola</i> L.	<i>Sarcotheca philippica</i> (Villar) Happier f.: <i>Averrhoa acutangula</i> <i>stokes</i>	Star fruit	Oxalidaceae	Tree
22	<i>Azadirochta indica</i> A. Juss.	<i>Melia azadirachta</i> L.; <i>Melia indica</i>	Neem	Meliaceae	Tree

		(A.Juss)Brandis			
23	<i>Barleria lupulina</i> Lindl.	<i>Barleria macrostachya</i> Bojer: <i>Dicliptera spinosa</i> Lodd.Ex Ness	Snake bush	Acanthaceae	Shrub
24	<i>Barleria prionitis</i> L.	<i>Barleria spicata</i> Roxb.; <i>Prionitis hystrix</i> Miq.	Porcupine flower	Acanthaceae	Shrub
25	<i>Beaucarnea recurvata</i> Lem.	<i>Nolina recurvata</i> ( Lem.) Hemsl.; <i>Dasyllirion</i> <i>inermis</i> S.Watson	Elephant's foot palm	Asparagaceae	Tree
26	<i>Bauhinia purpurea</i> L.	<i>Bauhinia triandra</i> Roxb; <i>Bauhinia violates</i> Corner	Kachnar	Fabaceae	Tree
27	<i>Bombaunguris-y</i> <i>ceibs</i> L.	<i>Melaleuca grandifolia</i> Blanco; <i>Bombax</i> <i>aculeatum</i> L.	Silk- cotton tree	Malvaceae	Tree
28	<i>Bougainvillea</i> <i>spectabilis</i> Willd.	<i>Bougainvillea virescens</i> Choisy; <i>Bougainvillea</i> <i>speciosa</i> Schnizl.	Bougainvillia	Nyctaginaceae	Climber
29	<i>Brunfelsia</i> <i>pauciflora</i> (Cham.& Schltdl.) Benth	<i>Besleria inodora</i> Vell.;; <i>franciscea augusta</i> Regel	Brazil raintree	Solanaceae	Shrub
30	<i>Butea monosperma</i> (Lam.) Taub.	<i>Butea frondosa</i> Wills.;; <i>Butea braamania</i> DC.	Dhak	Fabaceae	Tree
31	<i>Caesalpinia bonduc</i> (L.) Roxb.	<i>Guilandina bonduc</i> L.;; <i>Bonduc minus</i> Medik.	Fever nut	Fabaceae	Climber
32	<i>Cajanus cajan</i> (L.) Millsp.	<i>Cajanus flavus</i> DC.;; <i>Cajanus bicolor</i> DC.	Pigeon pea	Fabaceae	Shrub
33	<i>Calliandra</i> <i>haematocephala</i> Hassk.	<i>Calliandra novaesii</i> Hoehne; <i>Calliandra</i> <i>inaeuilatera</i> Rusby	Red powder puff	Fabaceae	Tree and shrub
34	<i>Callicarpa</i>	<i>Callicarpa cana</i> Gamble;	Large-leaf beauty	Lamiaceae	Tree and

	<i>macrophylla</i> Vahl	<i>Callicarpa dunniana</i> H.Lev.	berry		shrub
35	<i>Callistemon viminalis</i> (Sol.ex Gaetrn.) G.Don	<i>Melaleuca viminalis</i> ( Sol. ex.Gaetrn.) Byrnes; <i>Melaleuca viminalis minor</i> Byrnes	Weeping bottlebrush	Myrtaceae	Small tree
36	<i>Calotropis gigantea</i> ( L.) Dryand	<i>Asclepias gigantea</i> L. ; <i>Calotropis gigantea</i> ( L.) R. Be.Ex.Schult.	Crown flower	Apocynaceae	Shrub
37	<i>Calotropis procera</i> ( Aiton) Dryand	<i>Calotropis heterophylla</i> Wall.; <i>Asclepias patula</i> Decene	Apple of sodom	Apocynaceae	Shrub
38	<i>Campsis radicals</i> (L.) Seem.	<i>Bignonia radicans</i> L. ; <i>Camprsis curtisii</i> Seem.	Humming Bird vine	Bognoniaceae	Vine
39	<i>Carica papaya</i> L.	<i>Papaya Africa</i> Gaetrn. ; <i>Carica carandus</i> (L.) Baill.	Papaya	Caricaceae	Tree and Shrub
40	<i>Carissa carandus</i> L.	<i>Carissa salicina</i> Lam. ; <i>Arduina carandas</i> (L.) Baill.	Christ thorn	Apocynaceae	Shrub
41	<i>Caryota urens</i> L.		Solitary fishtail palm	Arecaceae	Tree
42	<i>Cascabela thevetia</i> (L.) Lippold	<i>Thevetia peruviana</i> (Pers) K. Schum. ; <i>Thevetia linearis</i> A. DC.	Yellow oleander	Apocynaceae	Shrub
43	<i>Cassia fistula</i> L.	<i>Cassia fistuloides</i> Collar. ; <i>Cassia excelsa</i> kunth.	Golden shower tree	Fabaceae	Tree
44	<i>Casuarina equisetifolia</i> L.	<i>Casuarina africana</i> Lour. ; <i>Casuarina brunoniana</i> Miq	Australian pine tree	Casuarinaceae	Tree
45	<i>Ceiba speciosa</i> ( A.St. - Hil.) Ravenna	<i>Chorisia speciosa</i> A.St.- Hil; <i>Chorisia speciosa</i> var. Minor Chodat.	Silk floss tree	Malvaceae	Tree

46	<i>Cestrum nocturnum</i> L.	<i>Cestrum graciliflorum</i> Dunal; <i>Chiococca</i> <i>nocturna</i> Jacq.	Night - blooming jasmine	Solanaceae	Shrub
47	<i>chukrasia tabularis</i> A. Juss	<i>chukrasia velutina</i> M.Roem. ; <i>Chickrassia</i> <i>nimmonii</i> J. Graham ex Wight	Chittagong	Meliaceae	Tree
48	<i>cinnamomum</i> <i>camphora</i> ( L.) J.Presl.	<i>Camphora officinarum</i> Nees; <i>Camphora vera</i> Raf.	Camphor tree	Lauraceae	Tree
49	<i>Cinnamomum</i> <i>tamala</i> (Buch- Ham) T. Nees & Eberm.	<i>Laurus albiflora</i> Wall.;; <i>Laurus tamala</i> Buch- Ham.	Indian bark	Lauraceae	Tree
50	<i>Citrus aurantifolia</i> (christm.) swingle	<i>Citrus × acida</i> pers.;; <i>Citrus lima lunan</i>	West indian lime	Rutaceae	Tree and shrub
51	<i>Citrus limon</i> L. Osbeck	<i>Citrus limonia</i> osbeck; <i>Citrus × bergamota</i> Raf.	Mandarin lime	Rutaceae	Tree
52	<i>Citrus medica</i> L.	<i>Citrus pyriformis</i> Hassk.;; <i>Citrus cedra</i> Link	Pita- sara	Ruraceae	Tree and shrub
53	<i>Clerodendrum</i> <i>infornately</i> L.	<i>Clerodendrum calycinum</i> Turez.	Hill glory bower	Lamiaceae	Tree and shrub
54	<i>Clerodendrum</i> <i>splendens</i> G.Don	<i>Siphonanthus splendens</i> (G.Don) Hiern; <i>Oxydectes</i> <i>aurantium</i> G.Don	Flaming glorybower	Lamiaceae	Tree and shrub
55	<i>Codiaeum</i> <i>variegatum</i> ( L.) Rumph. Ex A. Juss	<i>Croton variegatus</i> L. <i>Oxydectes variegata</i> (L.) Kuntze	Garden croton	Euphorbiaceae	Tree and shrub
56	<i>Combretum indium</i> (L.) DeFilipps	<i>Quisqualis indica</i> L.;; <i>Quisqualis sinensis</i> Lindl.	Chinese honey suckle	Combretaceae	Shrub
57	<i>Commiphora muskil</i> (Hook.Ex Stocks)	<i>Balsamea mukul</i> Baill.;; <i>Balsamodendrum wightii</i>	Guggul	Burserceae	Tree

	Engl.	Arn.			
58	<i>Cordyline fruticosa</i> L. A.Chev.	<i>Convallaria fruticosa</i> L.; <i>Dracaena sepiara</i> Seem.	Palm lily	Asparagaceae	Shrub
59	<i>Cordia myxa</i> L.	<i>Cordia officinalis</i> Lam.; <i>Cordia paniculata</i> Roth	Assyrian	Boraginaceae	Tree
60	<i>Crateva religiosa</i> G. Forst	<i>Crateva brownii</i> korth. Ex Miq.; <i>Crateva speciosa</i> Volkens	Devil- pepper	Capparaceae	Tree
61	<i>Crotalaria</i> <i>verrucosa</i> L.	<i>Phaseolus bulai</i> Blanco ; <i>Quirosia anceps</i> Blanco	Blue rattlepod	Leguminosae	Shrub
62	<i>Cupressus</i> sp.		Chinese weeping cypress	Cupressaceae	Tree
63	<i>Cycas circinalis</i> L.	<i>Palma polypodiifolia</i> Mill.; <i>Cycas wallichii</i> Miq.	Sago palm	Cycadaceae	Tree and shrub
64	<i>Cycas revoluta</i> Thunb.	<i>Cycas miquelii</i> Warb.; <i>Epicycas miquelii</i> (Warn.) de Laub.	Sago palm	Cycadaceae	Tree and shrub
65	<i>Dalbergia sissoo</i> DC.	<i>Amerimnom sissoo</i> (Roxb.)Kuntze	Sheesham	Fabaceae	Tree
66	<i>Delonix regia</i> (Hook.) Raf.	<i>Poinciana regia</i> Hook.	Gulmohar	Fabaceae	Tree
67	<i>Diospyrous</i> <i>malabarica</i> (Desr.) Kostel.	<i>Diospyrous biflora</i> Blanco <i>Embryopteris glutinifolia</i> Link	Indian persimmon	Ebenaceae	Tree
68	<i>Dolichandra unguis-</i> <i>cati</i> (L.) L.G.Lohmann	<i>Bignonia gracilis</i> Lodd.; <i>Bignonia unguis</i> L.	Claw creeper	Bignoniaceae	Tree
69	<i>Dracaena fragrans</i> (L.) Ker Gawl	<i>Aletris fragrans</i> L. ; <i>dracaena deremensis</i> Engl.	Corn plant	Asparagaceae	Shrub
70	<i>Dracaena reflexa</i> Lam	<i>Draco reflexa</i> (Lam.) Kuntze ; <i>Pleamele reflexa</i>	Song of india	Asparagaceae	Shrub

		(Lam.) N.E.Br.			
71	<i>Durante erecta</i> L.	<i>Durante repens</i> L. ; <i>Duaranta inermis</i> L.	Golden dewdrop	Verbenaceae	Tree and shrub
72	<i>Dypsis intescens</i> (H. Wendl.) Beentje & J. Dransf.	<i>Areca flavescens</i> Voss ; <i>Chrysalidocarpus lutescens</i> H.Wendl.	Areca palm	Asparagaceae	Tree
73	<i>Elaeocarpus serratus</i> L.	<i>Elaeocarpus ganitrus</i> Roxb. Ex G.Don ; <i>Monocera serrata</i> Turez.	Rudraksh	Elaeocarpaceae	Tree
74	<i>Enterolobium contortisiliquum</i> (Vell.) Morong	<i>Enterolobium glaucescens</i> Mart. ; <i>Mimosa contortisiliqua</i> Vell.	Eardrop tree	Fabaceae	Tree
75	<i>Ephedra foliata</i> Boiss.ex. C.A. Mey.	<i>Ephedra alte</i> Brandis ; <i>Ephedra kokanica</i> Regel	Shrubby horsetail	Ephedraceae	Shrub
76	<i>Erythrina variegata</i> L.	<i>Erythrina indica</i> Lam. ; <i>Erythrina lobulata</i> Miq.	Indian coral tree	Fabaceae	Tree
77	<i>Euphorbia cotinifolia</i> L.	<i>Aklema continifolia</i> (L.) Millsp. ; <i>Tithymalus continifolius</i> (L.) Haw.	Smoke tree	Euphorbiaceae	Tree and shrub
78	<i>Euphorbia leucocephala</i> Lotsy		Japanese poinsettia	Euphorbiaceae	Tree and shrub
79	<i>Euphorbia milii</i> Des Moul.	<i>Euphorbia bojeri</i> Hook. ; <i>Tumalis bojeri</i> (Hook.) Raf.	Christ plant	Euphorbiaceae	Shrub
80	<i>Euphorbia tithymaloides</i> L.	<i>Pedilanthus tithymaloides</i> (L.) Poit. ; <i>tithymalus tithymaloides</i> (L.) Croizat	Devil's backbone	Euphorbiaceae	Tree,shrub and climber
81	<i>Euphorbia umbellata</i> (Pax) Bruyns	<i>Synadenium umbellatum</i> Pax ; <i>Synadenium grantii</i> Hook.f.	African milk bush	Euphorbiaceae	Shrub

82	<i>Fernandoa adenophylla</i> (Wall.ex G.Don) Steenis	<i>Haplophragma adenophyllum</i> (Wall.Ex G.Don) Dop; <i>spathodea adenophylla</i> A.DC.	Marod phalli	Bignoniaceae	Tree
83	<i>Ficus benghalensis</i> L.	<i>Ficus krishnae</i> C.DC.; <i>Ficus banayana</i> Oken	Banyan fig	Moraceae	Tree
84	<i>Ficus benjamina</i> L.	<i>Ficus pendula</i> Link ; <i>Ficus comosa</i> Roxb.	Weeping fig	Moraceae	Tree and shrub
85	<i>Ficus elastica</i> Roxb.	<i>Urostigma karet</i> Miq, ; <i>Urgastigma odoratum</i> Miq,	Rubber tree	Moraceae	Tree
86	<i>Ficus krishnae</i> C.DC.	<i>Ficus benghalensis</i> L.	Krishna badh	Moraceae	Tree
87	<i>Ficus hydrata</i> Warb.		Leaf fig	Moraceae	Tree
88	<i>Ficus racemosa</i> L.	<i>Ficus glamerata</i> Roxb. : <i>Ficus acidula</i> King	Fig tree	Moraceae	Tree
89	<i>Ficus religiosa</i> L.	<i>Ficus peepul</i> Griff. ; <i>Ficus caudata</i> Stockes	Peepal tree	Moraceae	Tree
90	<i>Ficus retusa</i> L.	<i>Urostigma nitidum</i> Miq. ; <i>Perula retusa</i> Raf.	Indian laurel fig	Moraceae	Tree and shrub
91	<i>Ficus vitrens</i> Aiton	<i>Ficus infectoria</i> Willd. ; <i>Ficus pilhasi</i> Sm.	White fig	Moraceae	tree
92	<i>Furcraea foetida</i> (L.) Haw	<i>Aloe foetida</i> (L.) Crantz ; <i>Agave bulbosa</i> K.Koch	mauritus hemp	Asparagaceae	Shrub
93	<i>Gimngo biloba</i> L.	<i>Ginko marcophylla</i> Reyn. ; <i>Salisburia macrophylla</i> Reyn.	Maidenhair tree	Ginkgoaceae	Tree
94	<i>Grevillea robusta</i> A.Cunn.ex R.Br.	<i>Grevillea umbratica</i> A.Cunn.ex Meisn. ; <i>Stylurus robustus</i> (A.Cunn.) O.Deg.	Southern silky oak	Proteaceae	Tree
95	<i>Grewia asiatica</i> L.	<i>Grewia hainesiana</i> Hole ;	Phalsa	Malvaceae	Tree and



		<i>Grewia subinaequalis</i> DC.			shrub
96	<i>Hamelia patens</i> Jacq.	<i>Hamelia intermedia</i> Urb. & Ekman ; <i>Hamelia erecta</i> Jacq.	Humming bird bush	Rubiaceae	Tree and shrub
97	<i>Hibiscus rosa-</i> <i>sinensis</i> L.	<i>Hibiscus boryanus</i> DC. ; <i>Hibiscus cooperi</i> auct.	China rose	Malvaceae	Shrub
98	<i>Hibiscus</i> <i>schizopetlus</i> (Dyer) Hook.f.	<i>Hibiscus rosa-sinensis</i> Dyer	China rose	Malvaceae	Shrub
99	<i>Hibiscus tiliaceus</i> L.	<i>Hibiscus tiliifolius</i> Salisb. ; <i>Pariti tiliaceum</i> (L.) A.Juss.	Cotten tree	Malvaceae	Tree and shrub
100	<i>Holarrhena</i> <i>pubescens</i> Wall.ex G.Don	<i>Nerium sinense</i> Hunter ex Ridl. ; <i>Holarrhena</i> <i>macrocarpa</i> (Hassk.) Fern.-Vill.	Kuchi	Apocynaceae	Tree and shrub
101	<i>Holoptelea</i> <i>integrifolia</i> Planch.	<i>Ulmus integrifolia</i> Roxb.	Indian elm	Ulmaceae	Tree and Shrub
102	<i>Ipomea nil</i> (L.) Roth	<i>Convolvulus nil</i> L.: <i>Pharbitis nil</i> (L.) Choisy	Japanese morning glory	Convolvulaceae	Vine
103	<i>Ipomea quamoclit</i> L.	<i>Convolvulus pennatus</i> Desr.: <i>Quamoclit vulgaris</i> Choisy	Humming bird vine	Convolvulaceae	Shrub
104	<i>Ixora chinensis</i> Lam.	<i>Ixora stricta</i> Roxb.: <i>Ixora</i> <i>dubia</i> Schult.	Jungle flame	Rubiaceae	Tree and shrub
105	<i>Ixora coccinea</i> L.	<i>Pavetta coccinea</i> (L.) Blume	Flame of the woods	Rubiaceae	Tree
106	<i>Ixora finlaysoniana</i> Wall. Ex. G.don	<i>Ixora findlayana</i> B.S. Williams: <i>Ixora</i> <i>merguensis</i> F.N. Williams	Siamese white ixora	Rubiaceae	Tree
107	<i>Jacaranda</i> <i>mimosifolia</i> D. Don	<i>Jacaranda chelonia</i> Griseb. <i>Jacaranda</i>	Blue jacaranda	Bignoniaceae	Tree and Shrub

		<i>ovalifolia R.Br.</i>			
108	<i>Jacaranda ruscifolia</i> <i>Spreng.</i>		Bracelet wood	Theophrastaceae	Shrub
109	<i>Jasminum</i> <i>multiflorum</i> <i>(Burm.f.) Andrew</i>	<i>Nyctanthes pubescens</i> <i>Retz. Nyctanthus</i> <i>multiflora Burm.f.</i>	Winter Jasmine	Oleaceae	Shrub and vine
110	<b>BOTANIC NAME</b>	<i>Nyctanthes goa Steud.:</i> <i>Mogorium gimea</i> <i>Zuccagni</i>	Arabian jasmine	Oleaceae	Shrub and tree
111	<i>Ipomea nil (L.) Roth</i>	<i>Curcas indica A.Rich.:</i> <i>Ricinus jarak Thunb.</i>	Psyc nut	Euphorbiaceae	Tree and Shrub
112	<i>Ipomea quamoclit</i> <i>L.</i>	<i>Jatropha elegans Kl.:</i> <i>Jatropha jacquinii Baill.</i>	Bellayache bush	Euphorbiaceae	Tree and Shrub
113	<i>Ixora chinensis</i> <i>Lam.</i>	<i>Jatropha hastata Jacq.:</i> <i>Jatropha acuminata Desr.</i>	spicy katropha	Euphorbiaceae	Tree
114	<i>Ixora coccinea L.</i>		Buddha belly plant	Euphorbiaceae	Shrub
115	<i>Ixora finlaysoniana</i> <i>Wall. Ex. G.don</i>	<i>Adhatoda vasica Nees:</i> <i>Gendarussa adhatoda</i> <i>Steud.</i>	Malabar nut	Acanthaceae	Shrub
116	<i>Jacaranda</i> <i>mimosifolia D. Don</i>	<i>Dianthera subserrata</i> <i>Blanco: Ecbolium</i> <i>subserratum Kuntze</i>	Willow-leaved justicia	Acanthaceae	Tree and Shrub
117	<i>Jacaranda ruscifolia</i> <i>Spreng.</i>	<i>Kigelia pinnata</i> <i>(Jacq.)DC.; Kigelia trists</i> <i>A. Chev.</i>	Sausage tree	Bignoniaceae	Tree
118	<i>Jasminum</i> <i>multiflorum</i> <i>(Burm.f.) Andrew</i>	<i>Lagerstroemia minor</i> <i>Retz.; Lagerstroemia</i> <i>pulchra Salisb.</i>	Crape myrtle	Lythraceae	
119	<i>Lagerstroenia</i> <i>speciosa (L.Pers)</i>	<i>Lagerstroenia major Retz;</i> <i>Adambea globra Lam.</i>	Pride of india	Lythraceae	Tree

120	<i>Lawsonia inermis</i> L.	<i>Alcanna spinosa</i> (L.) Gaertn. <i>Lawsonia alba</i> Lam. nom	henna tree	Lythraceae	Tree
121	<i>Leucaena leucocephala</i> (Lam.) de Wit	<i>Acacia frondosa</i> Willd.; <i>Mimosa leucocephala</i> Lam.	lead tree	Fabaceae	Tree
122	<i>Limonia acidissima</i> L.	<i>Schinus limonia</i> L.; <i>Murraya odorata</i> Blanco	elephant-apple.	Rutaceae	Tree
123	<i>Litchi chinensis</i> Sonn. (Jacq.) R.Br. ex Mart		Litchi	Sapindaceae	Tree
124	<i>Livistona chinensis</i>	<i>Saribus subglobosus</i> Hassk.	palm tree	Arecaceae	Tree
125	<i>Loranthus longiflorus</i> Desr		Loranthus	Loranthaceae	Plant
126	<i>Madhuca longifoli</i> (J.Konig) J.F.Macbr.	<i>Madhuca indica</i> J.f.Gmel	mahua, mahwa	Sapotaceae	Tree
127	<i>Mangifera indica</i>	<i>Mangifera austroyunnanensis</i> Hu	Mango	Anacardiaceae	Tree
128	<i>Magnolia × alba</i> (DC.) Figlar	<i>Michelia longifolia</i> Blume <i>Michelia × alba</i> DC.	white champaca,	Magnoliaceae	Tree
129	<i>Magnolia grandiflora</i> L.	<i>Magnolia angustifolia</i> Millais	southern magnolia	Magnoliaceae	Tree
130	<i>Malus domestica</i> Borkh	<i>M. sylvestris</i> Mil. <i>Pyrus malus</i> L.	apple tree	Rosaceae	Tree
131	<i>Manilkara zapota</i> (L.) P.Royen	<i>Achras zapota</i> L.	zapota	Sapotaceae	Tree
132	<i>Mansoa alliacea</i> (Lam.) A.H.Gentry	<i>Bignonia alliacea</i> (basonym)	garlic vine	Bignoniaceae	Tree

133	<i>Melaleuca bracteata</i> F.Muell		black tea-tree,	Myrtaceae	Tree
134	<i>Melia azedarach</i> L.	<i>Melia japonica</i> G.Don; <i>Azedarca speciosa</i> Raf.	chinaberry tree,	Meliaceae	Tree
135	<i>Ocimum gratissimum</i>	<i>Geniosporum discolor</i>	clove basil	Lamiaceae	Shrub
136	<i>Oroxylum indicum</i> L.	<i>Spathodea indica</i>	Garlic pear	Bignoniaceae	Tree
137	<i>Passiflora vitifolia</i>	<i>Tacsonia sanguinea</i>	perfumed passionflower	Passifloraceae	Vine
138	<i>Petrea volubilis</i>	<i>Petrea retusa</i>	queen's wreath	Verbenaceae	Climber
139	<i>Phoenix dactylifera</i> L.	<i>Palm dactylifera</i>	Date palm	Arecaceae	Tree
140	<i>phyllanthus emblica</i>	<i>Emblica officinalis</i>	Indian gooseberry	Phyllanthaceae	Tree and shrub
141	<i>Pinus roxburghii</i>		Chir pine	Pinaceae	Tree
142	<i>Pithecellobium dulce</i>	<i>Albizia dulcis</i>	monkeypod	Fabaceae	Tree and shrub
143	<i>platanus orientalis</i>	<i>platanus palmata</i>	Chinar	Platanaceae	Tree
144	<i>Plumeria robusta</i>	<i>Plumeria apiculata</i>	singapore and raveyard flower	Apocynaceae	Tree
145	<i>plumeria rubra</i> L.	<i>Plumeria aurantia</i>	red jasmine	Apocynaceae	Tree
146	<i>Podranea ricasoliana</i>	<i>Tecoma ricasoliana</i>	pink trumpet vine	Bignoniaceae	Climber
147	<i>polyalthia longifolia</i>	<i>Uvaria longifolia</i>	False ashoka	Annonaceae	Tree
148	<i>pongamia pinnata</i>	<i>Millettia pinnata</i>	Indian beech	Fabaceae	Tree and shrub
149	<i>Populus deltoides</i>	<i>Populus angulosa</i>	European aspen	Salicaceae	Tree
150	<i>Prunus persica</i>	<i>Persica vulgaris</i>	peach	Rosaceae	Tree

151	<i>Psidium guajava</i>	<i>Psidium pomiferum</i>	guava	Myrtaceae	Tree and shrub
152	<i>Pterocarpus santalinus</i>	<i>Lingoum santalinum</i>	red sandalwood	Fabaceae	Tree
153	<i>pterospermum acerifolium</i>	<i>Pentapetes acerifolia</i>	Kanak Champa	Malvaceae	Tree and shrub
154	<i>Punica granatum</i>	<i>Punica nana L</i>	Pomegranate	Lythraceae	shrub
155	<i>Putranjiva roxburghii</i>	<i>putranjiva sphaerocarpa</i>	Lucky Bean Tree	Putranjivaceae	Tree
156	<i>pyrostegia venusta</i>	<i>Jacaranda echinata</i>	orange trumpetvine	Bignoniaceae	Vine
157	<i>pyrus communis</i>	<i>pyrus sativa</i>	common pear	Apocynaceae	Tree
158	<i>Rauvolfia serpentina</i>	<i>Rauvolfia trifoluta</i>	Indian snakeroot	Apocynaceae	shrub
159	<i>Rauvolfia tetraphylla</i>	<i>Rauvolfia heterophylla</i>	Devil Pepper	Apocynaceae	Tree
160	<i>Ravenala madagascariensis</i>	<i>Urnia speciosa</i>	traveler's palm	Strelitziaceae	Tree
161	<i>Ricinus communis</i>	<i>Croton spinosus</i>	castor of oil	Fabaceae	Tree and shrub
162	<i>Rosa indica</i>		Rose	Rosaceae	shrub
163	<i>Roystonea regia</i>	<i>Roystonea floridina</i>	Bottle Palm	Arecaceae	Tree
164	<i>Sanchezia speciosa</i>			Acanthaceae	shrub
165	<i>Santalum lanceolatum</i>		sandalwood	Santalaceae	Tree and shrub
166	<i>Saraca asoca</i>	<i>Jonasia confusa</i>	Ashoka tree	Fabaceae	Tree
167	<i>Schefflera arboricola</i>	<i>Heptopleurum arboricola</i>	Umbrella tree	aryliaceae	shrub
168	<i>Schleichera oleosa</i>	<i>Pistacia oleosa</i>	Kusum Tree	Sapindaceae	Tree
169	<i>Senna alata</i>	<i>cassia alata</i>	ring worm brush	Fabaceae	Shrub

170	<i>Senna occidentalis</i>	<i>cassia occidentalis</i>	ant brush	Fabaceae	Shrub
171	<i>Senna polyphylla</i>	<i>Cassia polyphylla</i>	desert cassia	Fabaceae	Tree and shrub
172	<i>Senna siamea</i>	<i>cassia sumatrana</i>	cassia tree	Fabaceae	Tree
173	<i>Senna sophera</i>	<i>cassia sophera</i>	kasunda	Fabaceae	shrub
174	<i>Senna tora</i>	<i>Cassia toras</i>	sickle pod	Fabaceae	Shrub
175	<i>Spathodea campanulata</i>	<i>Spathodea nilotica</i>	African tulip tree	Bignoniaceae	shrub
176	<i>Sterculia foetida</i>	<i>Sterculia ornata</i>	wild almond tree	fabaceae	Tree
177	<i>Streblus asper</i>		sand paper tree	<i>Moraceae</i>	Tree
178	<i>Syzygium cumini</i>	<i>Myrtas cumini</i>	Java plum	<i>Myrtaceae</i>	Tree
179	<i>Tabebuia heterophylla</i>	<i>Bignonia leucoxylon</i>	white cedar	<i>Bignoniaceae</i>	Tree
180	<i>Tabernaemontana divaricata</i>	<i>Tabernaemontana recuva</i>	crape jasmine	<i>Apocynaceae</i>	Shrub
181	<i>Tamarindus indica</i>	<i>Tamarindus occidentalis</i>	imli	<i>Fabaceae</i>	Tree
182	<i>Tecoma stans</i>	<i>Bignonia fruteceans</i>	Burmese brush	<i>Bignoniaceae</i>	Shrub
183	<i>Tectona grandis</i>	<i>Tectona theca</i>	Teak	<i>Lamiaceae</i>	Tree
184	<i>Terminalia arjuna</i>	<i>Pentaptera angustifolia</i>	Arjun tree	<i>Combretaceae</i>	Tree
185	<i>Terminalia bellirica</i>	<i>Terminalia punctata</i>	bahera	<i>Combretaceae</i>	Tree
186	<i>Terminalia catappa</i>	<i>Terminalia procera, Terminalia latifolia</i>	Sea almond	<i>Combretaceae</i>	Tree
187	<i>Terminalia muelleri</i>	<i>Myrobalanus muelleri</i>	Australian almond	<i>Combretaceae</i>	Tree
188	<i>Thuja orientalis L</i>	<i>Thuja revuculata</i>	northern white cedar	<i>Cupressaceae</i>	Tree
189	<i>Thunbergia alata</i>	<i>Thunbergia grandiflora</i>	Black-eyed Susan Vine	<i>Acanthaceae</i>	Vine

190	<i>Thunbergia erecta</i>	<i>Meyenia Erecta</i>	bush clockvine	<i>Acanthaceae</i>	Climber
191	<i>Tinospora cordifolia</i>	<i>Menispermum cordifolium</i>	Giloy	<i>Menispermaceae</i>	Climber
192	<i>Toona ciliata</i>	<i>Cedrela microspora</i>	Burma Cedar.	<i>Meliaceae</i>	Tree
193	<i>Vitis vinifera L.</i>	<i>Cissus vinifera</i>	common grape vine	<i>Vitaceae</i>	Climber
194	<i>Washingtonia filifera</i>	<i>Livistona filamentosa</i>	desert fan palm	<i>Arecaceae</i>	Tree
195	<i>Withania somnifera</i>	<i>Physalis flexuosa</i>	Indian ginseng	<i>Solanaceae</i>	Shrub
196	<i>Yucca gloriosa</i>	<i>Yucca acuminata</i>	Spanish Dagger	<i>Asparagaceae</i>	shrub
197	<i>Zamia furfuracea</i>	<i>Zamia vestita</i>	cardboard palm	<i>Zamiaceae</i>	Tree
198	<i>Ziziphus jujuba Mill</i>	<i>Ziphus sativus</i>	Indian plum	<i>Rhamnaceae</i>	Tree and shrub

## CHAPTER 7 – CARBON FOOTPRINTS

Carbon is the basis of life on mother Earth. It is incorporated into the plants through photosynthesis, consumed by animal species through the food, present in the form of carbon dioxide (CO<sub>2</sub>) the atmosphere, locked into the rocks as limestone and compressed into the different fossil fuels such as coal and oil. As CO<sub>2</sub> level in the atmosphere continue to increase, most climate designs or project that the oceans of the world and trees will keep soaking up more than half CO<sub>2</sub>. The plants on land and in the sea, taken up carbon by over many years increased the percentage discharged during decay, and this increased carbon became locked away as fossil fuels beneath the surface of the planet.

The starting of the 21st century, we brought growing concern about global warming, climate change, food security, poverty and population growth. In the 21st century more carbon has been released into the atmosphere than that has been absorbed. CO<sub>2</sub> is a principle component causing global warming. Atmospheric carbon dioxide levels have increased to 40 % from preindustrial levels to more than 390 parts per million CO<sub>2</sub>. On this background it is a need of time to cover the research areas interrelated with climate change.

### 7.1 Carbon footprints





In today's world one of the biggest issues faced by all of us is global warming. Global warming refers to an increase in average global temperature of mother Earth. The main cause of global warming is increase in the concentration of greenhouse gases (GHGs) in the atmosphere due to anthropogenic activities and their level is determined with the help of global warming potential (GWP) and expressed as Carbon Footprint (CF). Carbon Footprint is another phenomenon used for GHGs or carbon dioxide emission in terms of CO<sub>2</sub> equivalents. There are various definitions of carbon footprint are in literature. But the most recognized definition given by Wiedmann “the Carbon footprint is the measure of carbon dioxide emissions directly or indirectly caused by an activity or accumulated over the life stages of a product.” In other words, “A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product.”

As the Chaudhary Charan Singh University considered as institutional organization, the various energy resources like electricity, solar roof top systems are used. It is necessary to calculate the carbon footprint of the University to upgrading the Clean Developmental Mechanism (CDM) in various processes. All the data from the various sources were collected from all the sectors where energy resources are used. The collected data is calculated by using standard emission factors.

### **7.1.1 Electricity carbon footprint:**

In the university, electricity is used for various purposes like residential, office use and in the laboratories. The total electricity used in the University liberates mass kg of CO<sub>2</sub> per year. The laboratory equipments consume highest electricity which emits the large amount of carbon CO<sub>2</sub> per year.

The solar panels are installed on the roof of various buildings produces electricity from solar panels which further saves ample mass of CO<sub>2</sub> per year.

### **7.1.2 Paper footprint:**

The papers are used in the institution for various purposes like exam answer sheets, circulars, notices, office work etc. The papers are responsible for the emission of CO<sub>2</sub>. The University used total used 1,765.17 reams of papers which emits the 3.67 tons of CO<sub>2</sub>. In the University campus various departments follows paperless methods of communication to reduce the footprint by use of papers. The various sections on the campus save 13, 48,914 papers per years i.e. 2,697 reams. The paperless work reduces approximately 5.61 tons of CO<sub>2</sub> approximately. The total 2.80 tons of biomass is saved by paperless communication i.e. green computing.

### **Total footprint of the University:**

The total footprint is the addition of all the footprints and it is expressed as tons of CO<sub>2</sub> per year. The total footprint of Chaudhary Charan Singh University is approx. more than 10,000 tons of CO<sub>2</sub> per year approximately.

As the university is following the Clean Developmental Mechanism to reduce the emission of CO<sub>2</sub> and greenhouse emission by using solar panels for electricity generation and minimize the paper work at the university reduces of 18.10 tons of CO<sub>2</sub> per year approximately.

## **Conclusion:**

India's CO<sub>2</sub> emission is increased by an estimated 4.6 % in 2017, despite a turbulent year for its economy. The carbon footprint of nation is measured per person; India's emissions are still very low – at only 1.8 tons of CO<sub>2</sub> per capita which is much lower than the world average of 4.2 tons. But those emissions have been increasing steadily, with an average growth rate over the past decade of 6 %. The universities are the organizations which are having large areas which consume the high quantities of electricity and LPGs for many purposes. The Chaudhary Charan Singh University Campus emits 30,355 tons of CO<sub>2</sub> per year approximately. The present Clean Development Mechanism (CDM) practices to reduce the 18.10 tons CO<sub>2</sub> per year approximately.

## **Recommendations**

- Installation of solar panels or solar energy generation devices should be enhanced to reduce the electricity footprint of the campus. Terrace of each building can be utilized to produce electricity from tiltable solar modules.
- The food waste generated from university hostel mess, guest house, canteens and staff quarters should be converted into the biogas which can be further utilized for hostel kitchens.
- The solar battery operated vehicles should be used on the campus to overcome the vehicle footprint.
- The Green computing or E- work is helping the organization to reduce footprint very effectively.
- The solar energy based street lamps on campus will reduce carbon footprint.
- The awareness should be made among the faculty, students and other employees regarding Clean Development Mechanism (CDM) to reduce the consumption of electricity and natural resources.
- "Carbon Sequestration" survey should be conducted in the campus. Carbon

sequestration is a process of converting atmospheric carbon i.e. CO<sub>2</sub> in to other sinks of carbon such as vegetation, soil, ocean etc. in various forms to mitigate global warming audit is one of the important clauses of Kyoto Protocol.

## **About Carbon Sequestration**

While transforming ourselves from regional university to global university it is a responsibility of such universities to face the global future challenges and try to find out possible solutions for them. It is a social and environmental responsibility of Government Institutes, Universities, National and International Organizations to respond positively for various global issues at local level and should percolate the generated knowledge in to the society. Globalwarming and climate change are current environmental issues need to be addressed scientifically and efficiently. As Universities are provided with skilful human resource supported by analytical infrastructure, it is our duty to bring such ideas in practice.

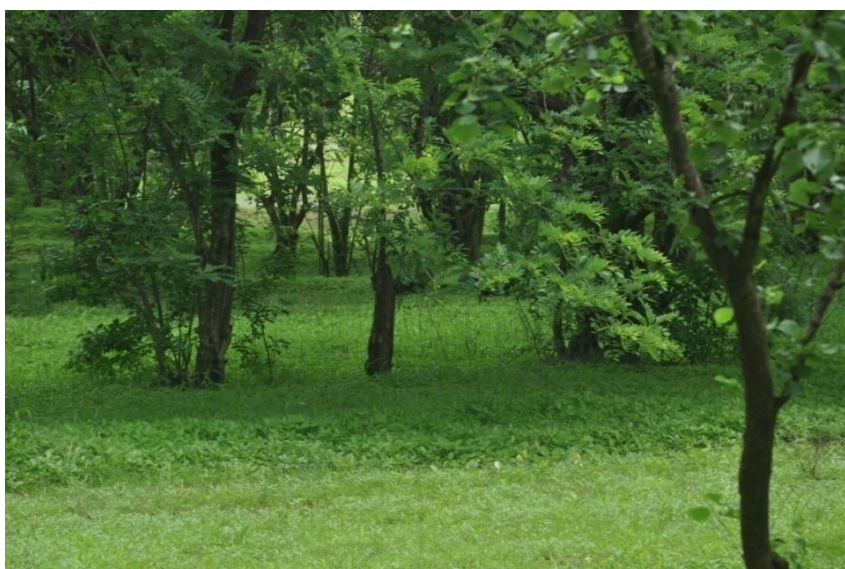
### **Objectives & Benefits:**

- To study woody green cover of University campus.
- To study species diversity of woody vegetation in the University campus.
- To understand biomass and carbon stock accumulated by woody vegetation in the University Campus
- To explore carbon sequestration potential of woody vegetation in the University campus.
- To explore potential of woody vegetation of the University campus as an oxygen source.
- To measure canopy cover of the trees on the University campus

## CHAPTER 8 – GREEN INITIATIVES

University is located at the area which is one of the important wilderness areas of Meerut city with its precious biodiversity. It covers an area of about 221 acres. The major portion is covered with vegetation. The university aims to protect and conserve its biodiversity, fresh and clean ambience through many initiatives.

The university has taken following green initiatives to protect and conserve the nature.



### 1. Plantation and Nurturing Programme

Many plantation drives are taken by the University on its campus. Every year on 5<sup>th</sup> June i.e. World Environment Day, the University takes Plantation activity. Under 33 Crore tree plantation scheme of Govt., University has taken many plantation drives. The garden department looks after tree plantation activities. The trees are watered by students of various Departments. They nurture these trees throughout the year. Students of various departments and students make the plantation and nurturing programmes successful.

## **2. Green computing practice:**

Being an academic institution, papers are used for various purposes like exam answer sheets, circulars, notices, office work , for document printing and Xeroxing. Since the trees are cut for paper manufacturing, the sequestration of carbon is reduced increasing carbon foot print. To cut down the carbon footprint, the university administration and various departments follows paperless methods of communication by using emails, online forms submission etc. The paperless work was helpful in reducing tons of CO<sub>2</sub>. The tons of biomass is saved by this green computing practices.

## **3. Solar Electricity Generation:**

The University has installed solar panels system for electricity generation which produces 1600 kilowatt of electricity and send to the grid of PVVNL (Pashchimaanchal Vidyut Vitran Nigam Limited) which is helpful for electricity bill reduction. Most of the buildings are constructed considering the need of Light and ventilation which reduces the use of electricity. The air conditioners are used only in essential conditions in the laboratories and offices to reduce electricity consumption.

## **4. Conferences and workshops on Environmental Sustainability:**

Chaudhary Charan Singh University organizes Conferences and Workshops based on the theme of environmental sustainability.

## CHAPTER 9 – SUMMARY & CONCLUSION

### Summary

Green Audit is one of the important tool to check the balance of natural resources and its judicial use. Green auditing is the process of identifying and determining whether institutional practices are eco-friendly and sustainable. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area.

The Department of Environmental Science, Chaudhary Charan Singh University, Meerut has conducted a “Green Audit” of Chaudhary Charan Singh University, Meerut in the academic year 2020-21. The main objective to carry out green audit is to check the green practices followed by university and to conduct a well defined audit report to understand whether the university is on the track of sustainable development. After completing the audit procedure of university for green practices, there are following conclusions, recommendations and Environmental Management Plan (EMP) which can be followed by university in future for keeping campus environment friendly.

### Conclusion:

From the green audit following are some of the conclusions which can be taken for improvement in the campus.

- University takes efforts to dispose majority waste by proper methods. The Green computing i.e. Online payment system, online circulars and examination procedures (SRPD) are helpful for reducing the use of papers and ultimately reducing carbon footprint.

- Reducing the use of one time use plastic bottles, cups, folders, pens, bouquets, decorative items will be useful to solve the problem of plastic pollution to some extent.
- Biodegradable waste is used efficiently for composting and vermicomposting. There is a scope to utilize the organic matter for biogas generation or manure production. Use of LED lamps and Tube Lights is less and is to be encouraged.
- Toilets and bathrooms are consuming more water in the departments. The replacement of old taps can be beneficial for solving this issue
- The use of electrical cars in the campus are good initiatives to save fuel.
- The overall ambient air quality on the campus is good while some air quality issues may arise due to developmental activities on the campus should be addressed.
- The sound levels on the campus is good except due to some transportation activities.
- Science departments are following the principles of Green Chemistry to reduce chemical wastes.

### **Key Recommendations & Environment Management Plan (EMP)**

Following are some of the key recommendation for improving campus environment and to be considered as **Environment Management Plan (EMP)**.

- An environmental policy document has to be prepared with all the recommendations and current practice carried by university.
- A frequent visit should be conducted to ensure that the generated waste is measured, monitored and recorded regularly and information should be made available to administration.
- The university should develop internal procedures to ensure its compliances with environmental legislation and responsibility should be fixed to carry out



it in practice.

- The solid waste should be reused or recycled at maximum possible places. The biodegradable waste is generated in more amounts in hostels which should be properly utilized for manure preparation or biogas generation.
- Reuse of glass bottles for storage of chemicals should be encouraged or the bottles should be sent to again suppliers for reuse.
- Electrification of street lights by solar power should be encouraged.
- Installation of sensor based electrification items like fans, lights, etc. can save electricity.
- Installation of solar panels and rain water harvesting system to every terrace of building will be useful in conserving the natural resources.
- Regular checkups and maintenance of pipes, overhead tanks and plumbing system should be done by engineering section to reduce overflow, leakages and corrosions.
- Science laboratories large amount of water goes waste during the process of making distilled water; the system should developed to reuse this water for other purposes. The solar distillation unit be installed at the earliest.
- No such processes or activities were observed at Chaudhary Charan Singh University which can deteriorate the environmental quality.
- The said University is in continuous efforts to spread the environmental awareness programmes among staff and students.
- It was also observed that the said University is keeping the environmental quality at priority in every developmental stage.

**WE ARE GLAD TO DECLARE CHAUDHARY CHARAN SINGH UNIVERSITY AS AN ENVIRONMENT FRIENDLY UNIVERSITY ALONG WITH MANY DEVELOPMENT PROCESSES IS FAIRLY PRACTICING ENVIORNMENTAL IMPORTANCE AT ANY STAGE OF ITS DEVELOPMENT.**

## CHAPTER 10 – ACKNOWLEDGEMENT

I would like to **express my special thanks of gratitude** to staff of Chaudhary Charan Singh University who gave me the golden opportunity to do this wonderful project **(GREEN AUDIT)**, which also helped me to be the part of ESG (Environment Sustainability Goals) of University.

I am really thankful to all.

**END OF THE REPORT**