



# Gangadhar Meher University



## Green Audit Report

2022-2023

On Dated: 09<sup>th</sup>, 10<sup>th</sup> & 11<sup>th</sup> October 2023

**AUDITED BY**

**Er. Ashutosh Kumar Srivastava (B.E., Civil Engineering, 1986) & Team**

**(Assessor IAS, IGBC AP, ASSOCHAM-GEM-CP, Facilitator CII-IGBC, Lead Auditor of ISO 9001, ISO 14001, ISO 22000, ISO 45001, ISO 50001, GRI certified Professional 2021 updated)**

# **G.C. CONSULTANCY SERVICES**



**(ISO 9001, 14001, 45001 Certified, MSME & NSIC Registered Company)**

**Flat No. 614, Vasant Enclave, Rajendra Nagar, Gorakhnath, Gorakhpur,  
U.P. 273015**

## INDEX

ACKNOWLEDGEMENT .....	IX
Disclaimer .....	X
Context and Concept .....	XI
CERTIFICATE .....	XII
Preface .....	XIII
History of Sambalpur, Odisha .....	XIV
Profile of Gangadhar Meher University, Sambalpur, Odisha .....	XV
Administrative Block of Gangadhar Meher University, Sambalpur .....	XV
ISO 9001:2015 Certificate of GMU .....	XVI
ISO 14001:2015 Certificate of GMU .....	XVII
ISO 50001:2018 Certificate of GMU .....	XVIII
Green Audit Certificate of GMU .....	XIX
About Gangadhar Meher University, Sambalpur, Odisha .....	XX
Site Plan of Gangadhar Meher University, Sambalpur, Odisha .....	XXI
Faculties .....	XXII
Course Provided by Gangadhar Meher University .....	XXIII
Vision & Mission .....	XXV
Vision: .....	XXV
Mission: .....	XXV
University Anthem .....	XXVI
University Logo .....	XXVII
Awareness for Environment: .....	XXVII
Library .....	XXVIII
Hostel .....	XXVIII
Sports and Games .....	XXX
Beyond Academics .....	XXXI
Banking Facilities .....	XXXI
National Cadet Corps (NCC) .....	XXXII
Workshop on 'Beti Bachao Beti Padhao' was Organised by G. M. University by in association with RAF, JAMSHEDPUR today (14/09/2023) in LG 1 at 3.30 pm .....	XXXIII
School of Psychology Observed 'International Day of The Girl Child 2023' today (11/10/2023) .....	XXXIV
One day Outreach Program on 'Gender Sensitization and Social Issues' is being Organized by School of Psychology in association with PATANG at Budharaja High School today (30/07/2023) .....	XXXV
Students Seminar was held in School of Psychology on 21/07/2023 and 22/07/2023 from 3 .30 pm to 5.30 pm on Gender Equality .....	XXXVI
An interaction Session with Dr. Reeta Mishra, the Founder and Managing Trustee: PATANG, on a collaborative programme (regarding an add-on Course Gender Champions) on 26/04/2023 .....	XXXVII

<b>THE UNIVERSITY HAS PROVIDED 2 DIFFERENT WINGS FOR NCC SUCH AS</b> .....	XXXVIII
<b>ARMY WING:</b> .....	XXXVIII
<b>NAVAL WING:</b> .....	XXXVIII
<b>Other Student Activities</b> .....	XXXVIII
<b>Clubs and Organizations:</b> .....	XXXVIII
<b>Cultural Events:</b> .....	XXXVIII
<b>Sports and Athletics:</b> .....	XXXVIII
<b>Seminars and Workshops:</b> .....	XXXVIII
<b>Community Service:</b> .....	XXXVIII
<b>Student Government:</b> .....	XXXVIII
<b>Academic Competitions:</b> .....	XXXIX
<b>Discipline &amp; use of Mobile phone</b> .....	XXXIX
<b>Introduction of Auditing Firm</b> .....	XXXIX
<b>G C Consultancy Director’s &amp; team Details</b> .....	XL
<b>List of Instruments</b> .....	XLI
<b>Environmental Audit</b> .....	1
<b>INTRODUCTION</b> .....	2
<b>Environment Audit</b> .....	2
<b>Goals of Environment audit</b> .....	3
<b>Objectives of Environment audit</b> .....	3
<b>About Criteria 7 of NAAC</b> .....	3
<b>Benefits of Environment Audit to an Educational Institute</b> .....	4
<b>About Criteria 7 of NAAC</b> .....	4
<b>Benefits of Environment Audit to an Educational Institute</b> .....	5
<b>1.0 WATER &amp; WASTEWATER AUDIT</b> .....	6
<b>1.1 Introduction</b> .....	6
<b>1.2 Water Audit Process</b> .....	7
<b>1.3 Importance of Water Audit</b> .....	7
<b>1.4 Water Audit</b> .....	8
<b>1.5 Water Quality</b> .....	8
<b>1.6 Drinking Water Quality</b> .....	9
<b>1.6.1 WHO Drinking Water Specifications Updated On 11 Oct 2019</b> .....	9
<b>1.6.2 Water quality in India Source UNICEF Repository</b> .....	12
<b>1.6.3 INDIAN STANDARDS FOR SAFE DRINKING WATER</b> .....	15
<b>1.6.4 Definition of drinking water quality</b> .....	15
<b>1.7 Water Quality Samples</b> .....	18
<b>1.8 Test for Bacteria presence in water</b> .....	19



1.9	Test for Copper, Sulphates and Fluorides .....	20
1.10	Ground water.....	23
1.10.1	Groundwater Quality .....	23
1.10.2	Quality of water for irrigation.....	24
1.11	Water Quantity .....	26
1.11.1	According to the report.....	26
1.11.2	Methodology for reduction in water consumption .....	26
1.11.3	Broadly speaking, you can reduce your direct water footprint by .....	27
1.11.4	Measure daily consumption data .....	27
1.11.5	Measure the pumping hours.....	27
1.11.6	University water resources.....	27
1.11.7	Water consumption in the University .....	28
1.12	Sustainable Water Practices .....	29
1.12.1	Watershed Management Practices .....	29
1.12.2	Wastewater Filtration Tank .....	30
1.13	Rainwater Harvesting Units.....	30
2.0	Air Quality Audit.....	32
2.2	Sulphur dioxide (SO <sub>2</sub> ): .....	35
2.3	Oxides of Nitrogen (NO <sub>x</sub> ): .....	35
2.4	Carbon monoxide (CO):.....	35
2.5	Carbon Dioxide (CO <sub>2</sub> ): .....	35
2.6	Formaldehyde (HCHO) As a Hazardous Air Pollutant:.....	35
2.7	Total Volatile Organic Compounds (TVOC) .....	36
2.8	Particulate Matter (PM): .....	36
2.8.1	Particulate Matter 10 (PM <sub>10</sub> ).....	37
2.8.2	Particulate Matter 2.5 (PM <sub>2.5</sub> ) .....	37
2.9	Ozone (O <sub>3</sub> ): .....	37
2.10	Lead (Pb):.....	37
2.11	Ambient Air Quality.....	38
2.12	AQI Chart .....	39
2.13	Air Quality Field Test .....	41
3.0	Waste Management .....	42
3.1	Objectives: .....	42
3.2	Solid Waste Management: .....	42
3.2.1	Campus solid waste management program .....	42
3.2.2	Producing less wastes.....	42
3.2.3	Here are the methods of solid waste disposal and management .....	42

3.2.4	The 7 R's of Recycling .....	43
3.3	Municipal Solid Waste .....	43
3.4	Plastic Waste .....	44
3.4.1	Centralized Online Portal .....	44
3.4.2	Environmental Compensation.....	44
3.4.3	Committee to Recommend Measures .....	44
3.5	Construction & Demolition waste.....	45
3.5.1	Construction and demolition waste management.....	45
3.6	SOLID WASTE AUDIT.....	46
3.6.1	Generation of solid waste in Gangadhar Meher University, Sambalpur .....	46
3.6.2	Status of solid waste generation in Gangadhar Meher University, Sambalpur .....	46
3.7	E-Waste .....	47
3.7.1	Importance of e-waste management.....	47
3.7.2	Five Reasons Why E-Waste Recycling is Important .....	47
3.7.3	It's critical to keep electronic waste out of landfills.....	47
3.7.4	Electronic products .....	47
3.7.5	Reclaiming valuable materials.....	47
3.7.6	Using recycled material .....	48
3.7.7	Discarded electronic devices .....	48
3.8	Single use Plastic restriction in campus Area .....	48
3.9	Hazardous Waste Management .....	48
3.9.1	The Importance of Chemical Lab Waste Disposal for Colleges and Universities .....	48
3.9.2	Need Proper Disposal Procedures for Chemistry Lab Waste at GMU .....	49
3.9.3	Waste Bins and Controlled Waste Disposal .....	49
3.9.4	Risks of Improperly Handled Lab Waste .....	50
3.9.5	Environmental Hazards from Improperly Handled Lab Waste .....	50
3.9.6	Workers Impact Proper Lab Waste Disposal.....	50
3.9.7	Risk of Serious Injuries from Mismanaged Lab Waste in Colleges/Universities .....	51
3.9.8	Responsibilities .....	51
3.9.9	Procedure .....	52
3.9.10	Objectives .....	52
3.9.11	Practice adopted in India .....	52
3.9.12	TREATMENT, STORAGE AND DISPOSAL FACILITY FOR HAZARDOUS AND OTHER .....	54
	WASTES.....	54
3.10	Acid from Labs .....	54
3.10.1	Disposal of Acid in a Lab.....	54
3.10.2	How to dispose of acid solutions.....	55

<b>3.11</b>	<b>Types of waste generated from a lab</b> .....	55
3.11.1	Handling and disposal of laboratory waste.....	55
3.11.2	Types of laboratory waste .....	55
3.11.3	Disposal of proper chemical hazardous waste in the laboratory Caps and closure .....	55
3.11.4	Responsibilities .....	55
<b>3.12</b>	<b>Bio-Medical Waste</b> .....	56
3.12.1	Types of Bio-medical waste .....	56
<b>Green Campus Audit</b> .....		57
<b>4.0</b>	<b>BIODIVERSITY AUDIT</b> .....	58
4.1	BIODIVERSITY.....	58
4.2	PLANTATIONS.....	59
4.3	LANDSCAPING AND GARDENING ACTIVITIES .....	59
4.3.1	MAINTENANCE OF GARDENS AND LANDSCAPE .....	59
4.4	MAINTENANCE OF PLANTATIONS .....	60
4.5	HOUSE PLANTS .....	60
4.6	Campus Involvement .....	61
4.7	Environmental Conservation Program.....	61
4.8	BIODIVERSITY OF FLORA FAUNA ASSOCIATED WITH IN University CAMPUS .....	61
4.8.1	INTRODUCTION.....	61
4.8.2	Need for biodiversity conservation.....	61
4.9	Fauna Survey .....	62
4.9.1	Pilot fauna survey .....	62
4.9.2	Questionnaire based fauna survey .....	62
4.10	RESULT.....	63
4.10.1	Fauna Survey Pilot fauna survey .....	63
4.11	Discussion.....	66
<b>Bio-Diversity Data Analysis:</b> .....		66
4.12	Oxygen emission and carbon storage capacity of tree .....	66
<b>Observation:</b> .....		68
<b>5.0</b>	<b>Fire Fighting</b> .....	71
5.1	Fire safety norms in India .....	71
5.2	Measures to assess fire safety .....	71
5.3	Provide adequate means of escape .....	71
5.4	Outline clear pathways to exit doors.....	71
5.5	Install smoke detection systems.....	71
5.5.1	Maintain smoke suppression systems.....	71
5.5.2	Conduct Regular Fire Drills .....	71

5.6	<i>Use flame-retardant materials in interiors</i> .....	72
5.7	<i>Make office accessible to firefighters</i> .....	72
5.8	<i>Keep the building plans handy</i> .....	72
5.9	<i>Ask the local fire brigade to assess safety</i> .....	72
5.10	<i>Comply with National Building Code</i> .....	72
6.0	<i>Sanitation &amp; Hygiene</i> .....	74
	Energy Audit .....	76
7.0	<b>ENERGY AUDIT</b> .....	77
7.1	<i>Resource Energy Audit</i> .....	77
7.2	<i>Energy Audit Objective</i> .....	77
	<i>Primary</i> .....	77
	<i>Secondary</i> .....	77
7.3	<i>Indirect Benefits of Energy Audit</i> .....	77
7.4	<i>Source of Energy</i> .....	77
7.5	<i>Indoor lighting fixtures</i> .....	78
7.6	<i>Outdoor lighting Fixtures</i> .....	83
7.7	<i>Ceiling Fan, Exhaust Fan &amp; Wall Fan</i> .....	85
7.8	<i>Air Conditioners</i> .....	91
7.9	<i>Pumping System</i> .....	92
7.10	<i>DG Set</i> .....	93
7.11	<i>Other Appliances</i> .....	93
7.12	<i>Details of Connected Load (kW) Till 31<sup>st</sup> March 2023</i> .....	94
7.13	<i>Payback Period</i> .....	94
7.14	<i>Lighting system</i> .....	95
7.15	<i>Energy Management Strategy</i> .....	95
	Recommendations.....	97
	References .....	99

## ACKNOWLEDGEMENT

M/s G C Consultancy Services, audit team grateful to **Prof. (Dr.) N. Nagaraju**, Hon'ble Vice Chancellor of Gangadhar Meher University, Sambalpur, Odisha for assigning this important work of Green audit. We appreciate the co-operation extended to our team for completion of study.

Our special thanks to:

1.	<i>Prof. (Dr.) N. Nagaraju</i>	<i>Hon'ble Vice Chancellor Gangadhar Meher University, Sambalpur, Odisha</i>
2.	<i>We are also thankful to <b>Prof. Gyana Ranjan Swain (Director IQAC), Prof. Dr. Alekh Sutar, Dr. Cinia Tigga, Dr. Kalyani Rath, Dr. Monty Kujur, Dr. Joshabanta Hansdah, Dr. Subash Jhankar, Dr. Atul Pradhan, Dr. Gopikanta Suna, Dr. Ajay Tripathy, Dr. Gyana Ranjan Bal, Dr. Chandan Sahu, Ms. Shivani Shrama &amp; Sri Prakash Mirdha</b> for sparing their precious time and guiding us on various aspects of university development &amp; achievements.</i>	
	<i>Thanks a lot, to you all, we learnt a lot from you. This will guide us also for our future works and guide us on various aspects of university development &amp; achievements.</i>	
3.	<i>Our special compliments to <b>Prof. Gyana Ranjan Swain (Coordinator IQAC)</b>, who was continuously with us during the audit and his efforts of coordination with other departments in collecting the data &amp; helping us compiling them, cannot be forgotten. Thanks to all staff of IQAC cell.</i>	
4.	<i>We are also thankful to the staff members for giving us support &amp; valuable input by involving themselves while collecting the data and conducting field tests and measurements.</i>	
	<i>We also express our gratitude to the canteen staff and manager for their warm welcome and for serving highly hygienic and hot food. The canteen was well-sanitized, and the food quality was commendable.</i>	

Date: 09<sup>th</sup>, 10<sup>th</sup> & 11<sup>th</sup> Oct 2023

Authorized Signature

Place: Gorakhpur

M/S G C Consultancy  
Services

## Disclaimer

M/s G C Consultancy Services, Green Audit Team has prepared this report for Gangadhar Meher University, Sambalpur based on input data submitted by their representatives of university complemented with the best judgment capacity of the expert team and samples collected by our team in presence of GMU team members.

While all sensible care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the conclusions are arrived following best estimates and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements, or forecasts in the report.

If GMU authorities wish to distribute copies of this report external to any organization, then all pages must be included.

M/s G C Consultancy Services, its staff and agents shall keep confidential all information relating to university and shall not disclose any such information to any third party, except that in the public domain or required by law or relevant accreditation bodies M/s G C Consultancy Services staff, agents and accreditation bodies have signed individual confidentiality undertakings and will only receive confidential information on a 'need to know' basis.

**Ashutosh Kumar Srivastava**

**(Assessor IAS, IGBC AP, ASSOCHAM-GEM-CP  
Facilitator CIIGBC, Lead Auditor ISO9001, ISO14001, ISO22000,  
ISO45001, ISO50001, ISO 17020, ILAC P15,  
GRI certified Professional 2021 updated)**

## Context and Concept

In India, the process for environmental audit was first mentioned under the Environment Protection Act, 1986 by the Ministry of Environment of forests on 13th march, 1992. As per this act, every person owning an industry or performing an operation or process needs legal consent and must submit an environmental reporter statement.

The National Assessment and Accreditation Council, New Delhi (NAAC) has made it mandatory from the academic year 2019–20 onwards that all Higher Educational Institutions should submit an annual Green, Environment and Energy Audit Report. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the sustainable environment.

In view of the NAAC Advisory issued on 26<sup>th</sup> May 2022, regarding environment auditing, the University management decided to conduct an external environment assessment study by a competent external professional auditor.

The term ‘Environmental audit’ means differently to different people. Terms like ‘assessment’, ‘survey’ and ‘review’ area, so used to describe similar activities. Furthermore, some organizations believe that an ‘environmental audit’ addresses only environmental matters, whereas others use the term to mean an audit of health, safety and environment- related matters. Al though there is no universal definition of Environment Audit, many leading companies/institutions follow the basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication of Environmental Auditing (1989).

### The ICC Defines Environmental Auditing as:

“A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects.”

This audit focuses on the environmental legal compliances and implementation of rules defined by MoEF&CC or CPCB, state pollution control board. The concepts, structure, objectives, methodology, tools of analysis are objectives of the audit are discussed below.



## CERTIFICATE

This is to certify that a detailed **“Green Audit”** for Gangadhar University has been conducted at its campus during the academic year 2022-2023 on 09<sup>th</sup>, 10<sup>th</sup> & 11<sup>th</sup> October 2023. The Green audit was conducted in accordance with the applicable standards prescribed by the Central Pollution Control Board (CPCB), New Delhi, and the Ministry of Environment, Forest, and Climate Change, (MoEF&CC), New Delhi. The audit involves Water, Air, Wastewater, Energy/ Renewable Energy, Hygiene, Sanitation, Green inventory, solid waste, plastic waste, and sewage waste etc., and given an 'Environmental Management Plan' (EMP), which the university may 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 Environment and it gives a true and fair view in conform, it with green audit in principles accepted in India.

Date: 09<sup>th</sup>, 10<sup>th</sup> & 11<sup>th</sup> October 2023

Authorized Signature

Place: Gorakhpur

M/s G C Consultancy Services

## Preface

Sambalpur, also known as Hirakhanda, is a city in the western part of the Indian state of Odisha. It is the headquarters of Sambalpur district and is one of the most important cities in the region. It is believed that the city was founded by the Sambal dynasty in the 7th century AD. The city was ruled by various dynasties over the centuries, including the Cholas, the Panduvamsis, the Somvanshis, and the Marathas. Sambalpur was finally annexed by the British in 1817.

Sambalpur is known for its handloom textiles, which are famous all over India and the world. Sambalpuri sarees are particularly popular for their unique designs and colors. The city is also known for its metalworking and stone carving industries.

Green auditing is the process of identifying and determining whether in situations practices are eco-friendly and sustainable. In objective to carryout agreed, audit is to check green practices followed by the university and to conduct a well-formulated audit report to understand where the university can optimize the uses of waste material as well as reduce its consumption of electricity and water. The initiative taken by GMU to conduct an 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 Forest & Climate Change, New Delhi, and Central Pollution Control Board, New Delhi. Questionnaires were prepared for solid waste, energy, water, hazardous waste. For audit purposes, analysis of suitable data is required, for the same study area is grouped into various Blocks and Departments. The audit was carried out for solid waste, electricity and energy, water and wastewater, hazardous waste, air quality, and green inventory including carbon footprints. It also indicates the green initiatives taken by universities to save environmental resources.

## History of Sambalpur, Odisha



Sambalpur, Odisha has a rich and varied history, dating back to ancient times. The region has been ruled by various dynasties over the centuries, including the Cholas, the Panduvamsis, the Somvanshis, and the Marathas. Sambalpur was finally annexed by the British in 1817.

Here is a brief overview of the history of Sambalpur:

**Early history:** The earliest evidence of human habitation in Sambalpur dates back to the Stone Age. The region was also part of the ancient kingdom of Kalinga, which was conquered by the Mauryan Empire in the 4th century BC.

**Medieval period:** In the medieval period, Sambalpur was ruled by various dynasties, including the Cholas, the Panduvamsis, the Somvanshis, and the Kalachuris. The city of Sambalpur was founded by the Chauhan dynasty in the 14th century.

**Maratha rule:** In the 18th century, Sambalpur was conquered by the Marathas. The Marathas ruled Sambalpur for a brief period, until they were defeated by the British in the Third Anglo-Maratha War in 1817.

**British rule:** After the Third Anglo-Maratha War, Sambalpur was annexed by the British. The British ruled Sambalpur as part of the Central Provinces.

**Independence and after:** Sambalpur became part of the newly formed state of Odisha in 1947. After independence, Sambalpur developed into a major industrial and educational center.

Sambalpur has played an important role in the Indian freedom struggle. Several freedom fighters from Sambalpur participated in the Indian National Movement. The Sambalpur Rebellion of 1849 was a major uprising against the British rule.

## Profile of Gangadhar Meher University, Sambalpur, Odisha



**Administrative Block of Gangadhar Meher University, Sambalpur**

Gangadhar Meher University (GMU) is a public university located in Sambalpur, Odisha, India. It was established in 2015 as a state university by the Government of Odisha. The university is named after Gangadhar Meher, a freedom fighter and social reformer from Odisha.

GMU is a multidisciplinary university that offers undergraduate and postgraduate programs in a wide range of subjects. The university also offers doctoral programs in several subjects.

GMU has a campus of over 34.491 acres, which is located in Sambalpur city. The campus has all the necessary facilities for students, including classrooms, laboratories, libraries, hostels, and sports facilities.





## Certificate of Registration

This is to certify that

### GANGADHAR MEHER UNIVERSITY

AMRUTA VIHAR, SAMBALPUR, ODISHA, PIN- 768004, INDIA

has been independently assessed by QRO  
and is compliant with the requirement of:

**ISO 9001:2015**

### Quality Management System

For the following scope of activities:

**Providing Educational Courses in UG Programme (Economics, Education, English, Geography, Hindi, History, Mathematics, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Statistics, Commerce, Botany, Chemistry, Computer Science, Mathematics, Physics, Statistics, Zoology, BBA, BSC IST) & PG Programme (Economics, Education, English, Geography, History, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Commerce, MBA, MFC, Botany, Chemistry, Computer Science, Mathematics, Physics, Zoology, MCA)**

Date of Certification: 5th December 2023

2<sup>nd</sup> Surveillance Audit Due: 4th December 2025

1<sup>st</sup> Surveillance Audit Due: 4th December 2024

Certificate Expiry: 4th December 2026

Issued Through



*Chaman ..*

Head of Certification

**Certificate Number: 305023120514Q**

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit.  
(In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at [www.qrocert.org](http://www.qrocert.org)

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : [www.qrocert.org](http://www.qrocert.org), E-mail : [info@qrocert.org](mailto:info@qrocert.org)

# ISO 14001:2015 Certificate of GMU



## Certificate of Registration

This is to certify that

### GANGADHAR MEHER UNIVERSITY

AMRUTA VIHAR, SAMBALPUR, ODISHA, PIN- 768004, INDIA

has been independently assessed by QRO  
and is compliant with the requirement of:

### ISO 14001:2015 Environmental Management System

For the following scope of activities:

Providing Educational Courses in UG Programme (Economics, Education, English, Geography, Hindi, History, Mathematics, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Statistics, Commerce, Botany, Chemistry, Computer Science, Mathematics, Physics, Statistics, Zoology, BBA, BSC IST) & PG Programme (Economics, Education, English, Geography, History, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Commerce, MBA, MFC, Botany, Chemistry, Computer Science, Mathematics, Physics, Zoology, MCA)

Date of Certification: 5th December 2023

2<sup>nd</sup> Surveillance Audit Due: 4th December 2025

1<sup>st</sup> Surveillance Audit Due: 4th December 2024

Certificate Expiry: 4th December 2026

Issued Through



*Chaman Ch...*

Head of Certification

Certificate Number: 305023120515E

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit.  
(In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at [www.qrocert.org](http://www.qrocert.org)

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : [www.qrocert.org](http://www.qrocert.org), E-mail : [info@qrocert.org](mailto:info@qrocert.org)

ISO 14001:2015 Certificate of GMU



# ISO 50001:2018 Certificate of GMU



## Certificate of Registration

This is to certify that

### GANGADHAR MEHER UNIVERSITY

AMRUTA VIHAR, SAMBALPUR, ODISHA, PIN- 768004, INDIA

has been independently assessed by QRO  
and is compliant with the requirement of:

**ISO 50001:2018**

### Energy Management Systems

For the following scope of activities:

Providing Educational Courses in UG Programme (Economics, Education, English, Geography, Hindi, History, Mathematics, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Statistics, Commerce, Botany, Chemistry, Computer Science, Mathematics, Physics, Statistics, Zoology, BBA, BSC IST) & PG Programme (Economics, Education, English, Geography, History, Oriya, Philosophy, Political Science, Psychology, Sanskrit, Commerce, MBA, MFC, Botany, Chemistry, Computer Science, Mathematics, Physics, Zoology, MCA)

Date of Certification: 5th December 2023

2<sup>nd</sup> Surveillance Audit Due: 4th December 2025

1<sup>st</sup> Surveillance Audit Due: 4th December 2024

Certificate Expiry: 4th December 2026

Issued Through



**Certificate Number: 305023120516EN**



*Chaman ..*

Head of Certification

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit.  
(In case surveillance audit is not allowed to be conducted; this certificate shall be suspended / withdrawn).

The Validity of this certificate can be verified at [www.grocert.org](http://www.grocert.org)

This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP

142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)

Website : [www.grocert.org](http://www.grocert.org), E-mail : [info@grocert.org](mailto:info@grocert.org)

ISO 50001:2018 Certificate of GMU



## Green Audit Certificate of GMU

Contact : +91 9868920846  
Email : bosaisafety@gmail.com



**BOSAI SAFETY PRIVATE LIMITED**  
**COMPLIANCE VERIFICATION**  
**Green Audit**

This is to certify that  
**GANGADHAR MEHER UNIVERSITY**  
ADDRESS- AMRUTA VIHAR, SAMBALPUR-768004

has been assessed and found to be in accordance with the requirements of a Green Audit.

**Certificate Number: BOSAI/GA/0002 (PROVISIONAL)**

**Date of issue: 18-11-2023,** **Originally Expiry Date: 17-11-2026**

Validity of this certificate is subject to annual surveillance audit to be done successfully on or before of 17-11-2024 & 17-11-2025 respectively. In case, if surveillance audit is not allowed to be conducted; this certificate shall be deemed to as suspended/withdrawn.



Issued Through



**Bosai Safety Private Limited**

Dinesh Kumar Singh  
Digitally signed by Dinesh Kumar Singh  
Date: 2023.11.18 13:55:18 +05'30'

**Bosai Safety Private Limited, Office : C/O SHILP INDYA, SCC BUILDERS, H-69, SECTOR-63, NOIDA-201301**  
**Registration : U74999UP2020PTCI31468, PAN : AAJCB1289L, TAN : MRTB04966B GST : 09AAJCB1289L1Z6**

Green Audit Certificate of GMU

## About Gangadhar Meher University, Sambalpur, Odisha

Gangadhar Meher University (GMU), Sambalpur, Odisha, is a state university in India. The university was established as a college in 1944 as Sambalpur College with 192 students. The name of the institution was changed to Gangadhar Meher College in 1949. It was upgraded to a university in 2015 and has been renamed as Gangadhar Meher University.

GMU has a well-equipped library and state-of-the-art infrastructure. It is also home to a number of student clubs and societies, which provide students with opportunities to hone their extracurricular skills and talents.

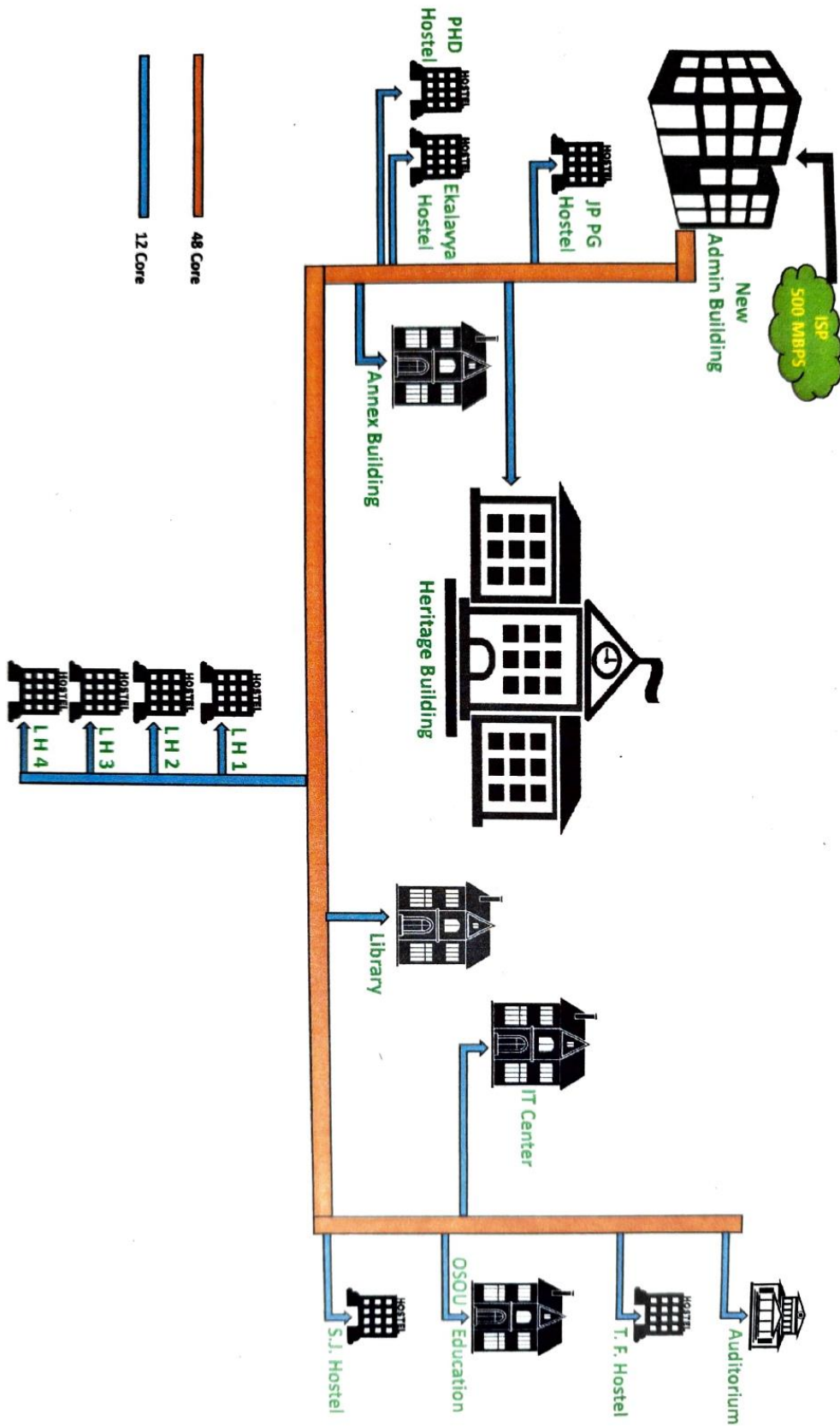
The university places a strong emphasis on research activities. It encourages faculty and students to engage in research projects and contributes to the overall academic development of the region.

Gangadhar Meher University hosts a variety of cultural and extracurricular activities. These include student clubs, cultural events, and sports activities, providing students with a well-rounded educational experience.

The university is committed to providing quality education and fostering an environment for intellectual growth. It has a strong teaching faculty that is dedicated to delivering a high standard of education.

Gangadhar Meher University plays a crucial role in higher education and academic research in Odisha, contributing to the overall educational and intellectual development of the state and the region.

# Site Plan of Gangadhar Meher University, Sambalpur, Odisha



GMU Site Plan

## Faculties

The sanctioned strength of University teachers including Professors, Associate Professors and Assistant Professors is 70.

Sr. No.	Name	Designation	Department
1	Dr.Susanta Kumar Das	Professor	Physics
2	Dr. Gyanaranjan Swain	Professor	political Science
3	Dr.Meera Swain	Asso.Prof	Anthropology
4	Dr. Bibhu kalyan Mohanty	Asso.Prof	Anthropology
5	Dr. Alekha Kumar Sutar	Asso.Prof	Chemistry
6	Dr.Monalisha Mohapatra	Asso.Prof	Chemistry
7	Dr. Madhumita Panda	Asso.Prof	Comp.Sci.
8	Dr.Partha Sarathi Mallik	Asso.Prof	Education
9	Dr.Anjali Tripathy	Asso.Prof	English
10	Dr.Arabinda Sharma	Asso.Prof	Geography
11	Dr.Bijaya Laxmi Panigrahi	Asso.prof	Mathematics
12	Dr. Himansu sekhar Samal	Asso.Prof	Philosophy
13	Dr.Namita Shadangi	Asso.Prof	Physics
14	Dr. Pramoda Kumar Samal	Asso.Prof	Physics
15	Dr.Minaketan Bag	Asst.Prof	Anthropology
16	Dr.Kalyani Rath	Asst.Prof	Anthropology
17	Dr. Santosh Kumar Sethi	Asst.Prof	Biotech
18	Dr. Swetaleena Tripathy	Asst.Prof	Biotech
19	Dr.Monty Kujur	Asst.Prof	Biotech
20	Dr. Raghunath Satpathy	Asst.Prof	Biotech
21	Dr.Suprava Nayak	Asst.Prof	Chemistry
22	Sri Sumanta Pradhan	Asst.Prof	Chemistry
23	Dr.Debasis Behera	Asst.Prof	Chemistry
24	Dr.Ajaya Kumar Tripathy	Asst.Prof	Com. Science
25	Dr.Usha Manasi Mohapatra	Asst.Prof	Com. Science
26	Dr.Suraj Badaik	Asst.Prof	Economics
27	Dr.Anuranjan Tete	Asst.Prof	Economics
28	Dr.D P Priyadarshi Joshi	Asst.Prof.	Economics
29	Dr.Sanjukta Bhuyan	Asst.Prof	Education
30	Gopikanta Suna	Asst.Prof	Education
31	Sadhujan Bankira	Asst.Prof	Education
32	Dr. Neena Dash	Asst.Prof	Education
33	Brahamananda Padra	Asst.Prof	English
34	Dr.P.Muralidhar Sharma	Asst.Prof	English
35	Sujit Kumar Jally	Asst prof	Geography
36	Dr.Rashmi	Asst.Prof	Geography
37	Dr.Pammi Nitin Sinha	Asst.Prof	Geography
38	Dr.Santosh Kumar Mallik	Asst.Prof	History
39	Dr.Atula Kumar Pradhan	Asst.Prof	History
40	Dr.Paramatap Pradhan	Asst.Prof	History
41	Dr.Susmita Rani Sasisni	Asst.Prof	History
42	Dr.Jayendra Kumar Singh	Asst.Prof	Lib. & Info. Sc

Sr. No.	Name	Designation	Department
43	Dr.Rosalien Rout	Asst.Prof	Lib. & Info. Sc
44	Cinia Tigga	Asst.Prof	Lib. & Info. Sc
45	Ashok Kumar Das	Asst.Prof	Lib. & Info. Sc
46	Dr.Yudhisthira Jamudulia	Asst.Prof	Mathematics
47	Dr. Ashrita Patra	Asst.Prof	Mathematics
48	Laxmi Majhi	Asst.Prof	Mathematics
49	Dr.Ranjan Sethi	Asst prof	Odia
50	Dr.Parikhita Bhoi	Asst prof	Odia
51	Dr.Laxmipriya Behera	Asst.Prof	Odia
52	Dr.Subhankari Pati	Asst.Prof	Philosophy
53	Jamric Ekka	Asst.Prof	Philosophy
54	Dr.Pranati Purohit	Asst.Prof	Physics
55	Dr.Gangadhar Behera	Asst.Prof	Physics
56	Dr.Ananta Prasad Chakraverty	Asst.Prof	Physics
57	Dr. jasabanta Sekhar Hansdah	Asst.Prof	Physics
58	Dr.Banita Mahanandia	Asst.Prof	political Science
59	Dr.Keshab Chandra Ratha	Asst.Prof	political Science
60	Miss Singh Subhalaxmi Baidhra	Asst.Prof	political Science
61	Dr.Rupashree Brahma Kumari	Asst.Prof	Psychology
62	Puspa Hembrum	Asst.Prof	Psychology
63	Dr.Rupashree Goswami	Asst.Prof	Psychology
64	Sanjukta Padhi	Asst.Prof	Psychology
65	Dr.Prasanta kumar Sethi	Asst prof	Sanskrit
66	Dr.Sala Besra	Asst.Prof	Sanskrit
67	Dr.Sushree Sasmita Pati	Asst.Prof	Sanskrit
68	Dr.Suneli Dei	Asst.Prof	Sanskrit
69	Dr.Rajendra Gartia	Asst.Prof	Statistics
70	Dr.Nirupama Sahoo	Asst.Prof	Statistics

### Course Provided by Gangadhar Meher University

Course offering in Undre Graduate Programme		
Sr. No.	Stream Name	Hons. Subject Name
1	Arts	Anthropology
2	Arts	Economics
3	Arts	Education
4	Arts	English
5	Arts	Geography
6	Arts	Hindi
7	Arts	History
8	Arts	Mathematics
9	Arts	Odia
10	Arts	Philosophy
11	Arts	Political Science

Course offering in Undre Graduate Programme		
Sr. No.	Stream Name	Hons. Subject Name
12	Arts	Psychology
13	Arts	Sanskrit
14	Arts	Sociology
15	Arts	Statistics
16	Biological Science	Anthropology
17	Biological Science	Botany
18	Biological Science	Zoology
19	Commerce	Commerce
20	Physical Science	Chemistry
21	Physical Science	Geography
22	Physical Science	Mathematics
23	Physical Science	Physics
24	Physical Science	Statistics
25	Self Financing	Computer Science
26	Self Financing	BBA
27	Self Financing	BSC IST
28	Self Financing	Integrated Bed

Course offering in Post Graduate Programme	
Sr. No.	Course Name
1	Anthropology
2	Biotechnology
3	Botany
4	Chemistry
5	Commerce
6	Economics
7	Education
8	English
9	Geography
10	Hindi
11	History
12	Library and Information Science
13	M.Sc. (Computer Science)
14	Mathematics
15	MBA (Financial Management)
16	Odia
17	Philosophy
18	Physics
19	Political Science
20	Psychology
21	Sanskrit
22	Sociology

Course offering in Post Graduate Programme	
Sr. No.	Course Name
23	Statistics
24	Zoology
25	MBA
26	MCA

Ph. D. Programme	
Sr. No.	Hons. Subject Name
1	Anthropology
2	Biotechnology
3	Chemistry
4	Commerce
5	Economics
6	Education
7	English
8	Geography
9	Hindi
10	History
11	Library and Information Science
12	M.Sc. (Computer Science)
13	Mathematics
14	Odia
15	Philosophy
16	Physics
17	Political Science
18	Psychology
19	Sanskrit
20	Sociology
21	Statistics
22	Zoology

### Vision & Mission

#### **Vision:**

- To make quality higher education accessible to the students without discrimination.
- To develop and nurture the intellectual capital.
- To promote self-learning and self-assessment through adopting technology-intensive education system.
- To expand the areas of higher education through inclusion of both basic and applied disciplines.
- To promote professional programs.

#### **Mission:**

- To adopt inclusive policy in enrolment.



- To offer incentives to girl students pursuing higher education/research.
- To ensure flexibility in syllabus by involving representatives of students and alumni in syllabus framing.
- To promote student centric learning by developing hi-tech classrooms with high speed Internet connections.
- To provide the students with the congenial research ecosystem with the target to solve local and global issues and problems.
- To evolve mechanisms to explore the diversity in talent and counsel career development in congruence with their talents.
- To train the graduating students in finishing schools to make them society-ready.
- To offer online and offline certificate courses for enrichment and refinement of their skills.
- To offer certificate courses in foreign languages and computer literacy for attaining global competency.

### University Anthem

ମଧୁମୟ !  
 ବିଶ୍ୱ ଦେଖା ମଧୁମୟ ରେ ଜୀବନ °  
 ବିଶ୍ୱ ଦେଖା ମଧୁମୟ  
 ମଧୁର ଝରଣ କରିବ ହରଣ  
 ତୋ ପାପ ମରଣଭୟ ରେ ଜୀବନ ° । ଘୋଷା ।  
 ଜନନୀର ସ୍ନେହ ଜାୟାର ପ୍ରଣୟ  
 ବୁଧ~ବନ୍ଧୁ ସଦାଳାପ,  
 ଜନକ ଆଦର ଏକ ଏକ ଝର  
 ତଡ଼ି ଦେଉଛନ୍ତି ତାପରେ ଜୀବନ °  
 ନବ ନବ କର୍ମ ନବ ନବ ମର୍ମ  
 ନବ ନବ ଜ୍ଞାନପଥ,  
 ନବୀନ ଆଲୋକେ ଦେଖାନ୍ତି ଏ ଲୋକେ  
 ମଧୁ ଝର ଶତ ଶତ ରେ ଜୀବନ °  
 ମଧୁମୟ ବନେ ମଧୁମୟ ସ୍ୱନେ  
 ଗାଇ ମଧୁମୟ ଗୀତି,  
 ବିହଙ୍ଗମଗଣ ପୂରାନ୍ତି ଶ୍ରବଣ  
 ମଧୁ ଭାଳି ନିତି ନିତି ରେ ଜୀବନ °  
 ଦିନେ ଦିନପତି ରାତ୍ରେ ରକ୍ଷତତି  
 ସହିତ କୁମୁଦବନ୍ଧୁ,  
 ବିଚରି ଗଗନେ ଅଖିଳ ଭୁବନେ  
 ବିଚରନ୍ତି ଜ୍ୟୋତି ମଧୁ ରେ ଜୀବନ °  
 ମହୀ ମହୀଧରେ ସରିତ ସାଗରେ  
 ସରେ ବନ ଉପବନେ,  
 ଦେଖ ପୁଲକ୍ୱଳ ପଲ୍ଲବ କଲ୍ଲୋଳ  
 ମଧୁ ମାଖୁଛନ୍ତି ଘେନ ରେ ଜୀବନ °  
 ବିଶ୍ୱନାଥଙ୍କର କରୁଣାକନ୍ଦର  
 ମଧୁ ଝର ଜହ୍ନଜଳ,  
 ଚାହିଁ ଝର ପ୍ରତି ଉଚ୍ଚେ କଲେ ଗତି  
 ପାଇବୁ କରୁଣାଚଳ ରେ ଜୀବନ °

ହେଲେହେଁ ତୁ ସାନ କରୁଣାନିଧାନ  
ରାଜ୍ୟରେ କରୁଛୁ ବାସ,  
ବଢ଼ାଇଲେ କର ତାଙ୍କ ଶ୍ରୀପୟର  
ଲାଭେ ନ ହେବୁ ନିରାଶ ରେ ଜୀବନ °  
ସର୍ପଦଣ୍ଡ ଜନ ମୁଖରେ ଲବଣ  
ଦେଲେ ବୋଲିଥାଏ ମାଟି,  
ଜାନଭୁଷ୍ଟେ ମଧୁ ନ ଲାଗିଲେ ସ୍ଵାଦୁ  
ଜାନଗଦ ପିଅ ବାଟି ରେ ଜୀବନ °

### University Logo



### **Description of LOGO:**

The University's crest contains the name of the University and the year of its inception. The rays of the morning Sun symbolize the cultural renaissance brought by the University. The *Konark* wheel stands for the art, sculpture and the glory of Odisha. The atomic fission symbolizes the dawn of the atomic era. The diamond represents strength and crystalline purity, brightness and glory of the erstwhile *Hirakhand* Empire of which Sambalpur was the capital. The book is the sign of study and research and the Hirakud dam not only symbolizes the harnessing of nature by men for the service of humanity but also gives the crest its local color. The motto is an extract from the *Kathopanishad*.

**यस्यद् वैदोभय सह ।**

**श्र बिधया मृत्यु तोर्त्वा विधयामृत मस्तूते । ।**

One who has both real and practical knowledge crosses death with the help of practical knowledge and attains immortality with real knowledge.

### **Awareness for Environment:**

Gangadhar Meher University exists and has a focus on environmental awareness; it may have its own programs or initiatives aimed at promoting environmental sustainability, conservation, or eco-consciousness.

To gather accurate information about the university's specific efforts or initiatives related to the environment, I recommend contacting the university directly or visiting their official website. They should be able to provide you with the most accurate and up-to-date information about their environmental awareness programs, if any.

Please note that my information may not be comprehensive or reflect recent developments, so it's always best to verify with official source.

## Library

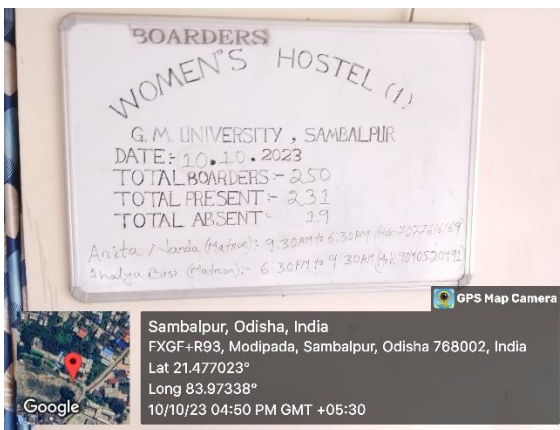
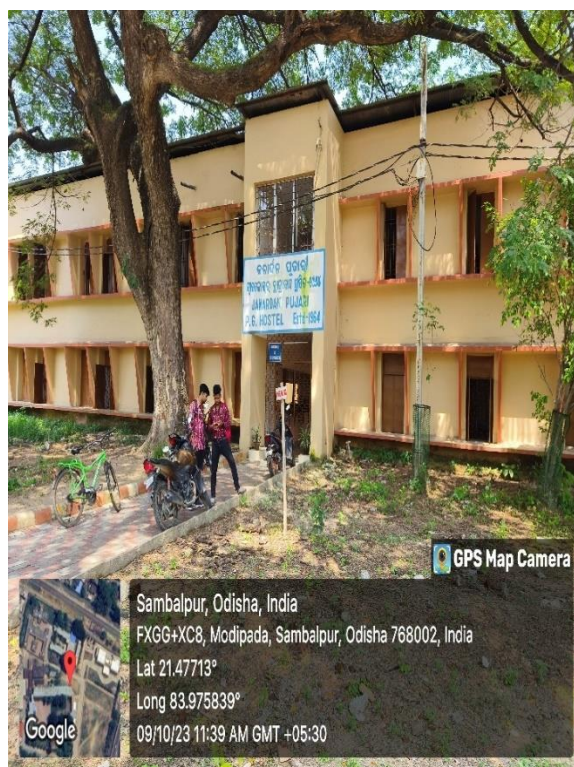
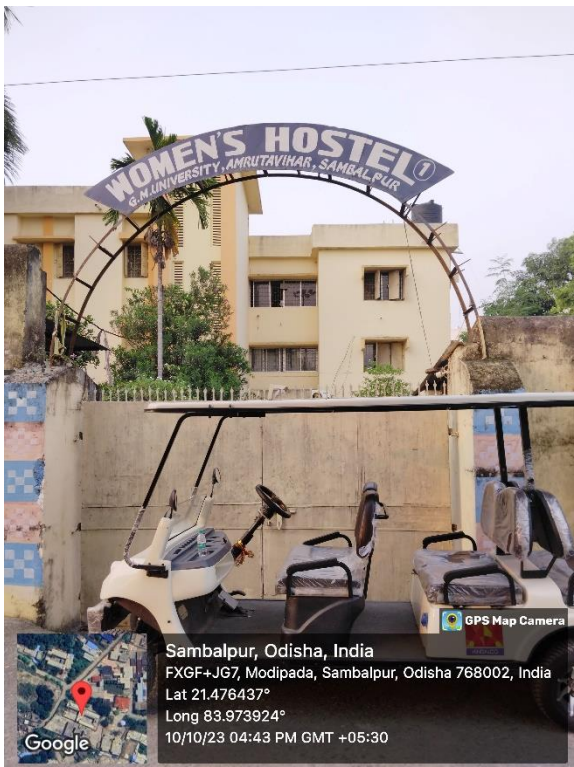


Library at G.M. University, Sambalpur

The Central Library came into existence in 1944. At present, it stands as a modern library with a lot of automation and one of the largest libraries in terms of the number of books and journals. Presently it contains 116671 Books, subscription to 63 Journals and 15 Magazines. The University library offers a congenial study environment for students, staff and visitors and provides a wealth of knowledge through its vast collection of books and online resources. It houses a rich resource of books, relating to different subjects. It also subscribes to a variety of periodicals, magazines and journals to keep the students abreast of the contemporary scenario in their areas of study.

## Hostel





### Hostels at G.M. University, Sambalpur

There is total nine (09) number of hostels present in Gangadhar Meher University, out of which four hostels for girl's student and five hostels for boy's student. The details of names of the hostels and boarder's strength is given below.

#### FOR WOMENS HOSTEL: -

SL NO	NAME OF THE HOSTEL	NO. OF BOARDERS STAYING IN HOSTELS
O1	WOMENS HOSTEL- I	250
O2	WOMENS HOSTEL- II	47
O3	WOMENS HOSTEL- III	74
O4	OLD EKALABYA HOSTEL	33
	<b>GRAND TOTAL-</b>	<b>404</b>

## FOR BOYS HOSTEL: -

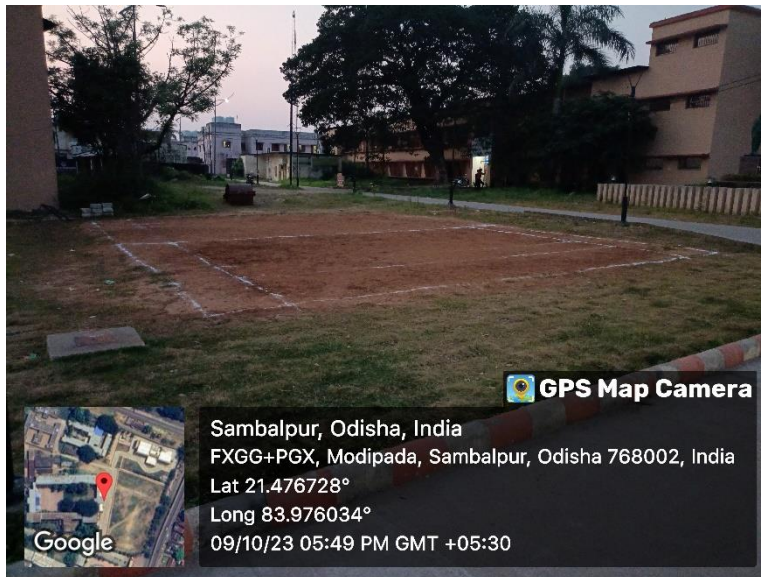
SL NO	NAME OF THE HOSTEL	NO. OF BOARDERS STAYING IN HOSTELS
01	JPPG HOSTEL	97
02	SILVER JUBILEE HOSTEL	136
03	TRUST FUND HOSTEL	119
04	NEW EKALABYA HOSTEL	115
05	MADHUMAYA HOSTEL	05
	<b>GRAND TOTAL</b>	<b>472</b>

## Sports and Games



Playground at G.M. University, Sambalpur





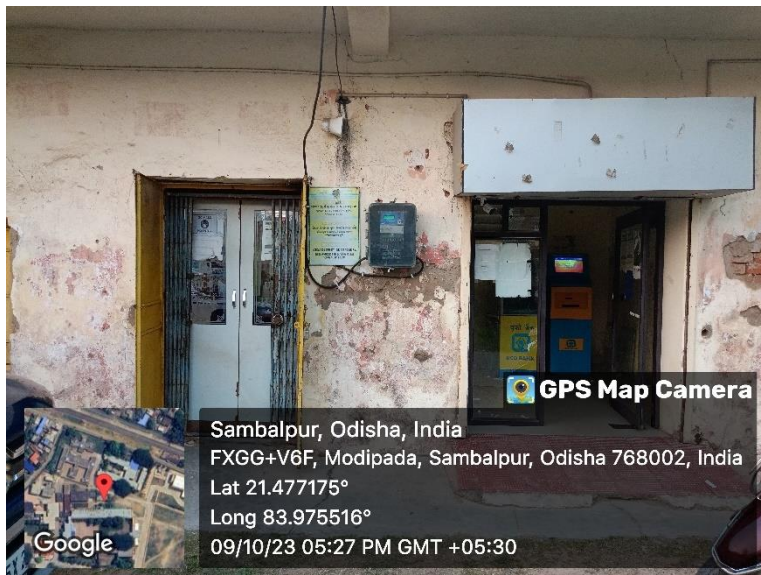
**Kabaddi Ground at G.M. University, Sambalpur**

Physical recreation through sporting activities has been a legacy of this institution since its inception. Games like cricket, hockey, football, and volley-ball have been introduced to active this objective. The students take part enthusiastically in these games which provide a healthy diversion from academic stress and pressure. The Annual Athletic Meet is being held regularly since 1954 in which students get an opportunity to display their athletic skills and potential. There are two playgrounds on the campus that are used for all sporting activities.

### **Beyond Academics**

GMU believes in the philosophy that apart from academics, the students must be provided with proper opportunities to explore their creativity. Accordingly cultural programmes and competitions such as song, dance, drama, debating etc. are organized to encourage, unearth and nurture the latent talent of the students. They form teams and share responsibility in organizing the events.

### **Banking Facilities**



**Banking & ATM facility at G.M. University, Sambalpur**

The University has a branch of the UCO Bank in the campus in which students and the staff conduct banking transactions as per their requirement. Application forms for important national level examinations are also sold by the bank which is highly beneficial and convenient for the students to access. An ATM of SBI has also been installed at the main gate of the University to facilitate the students and staff.

On the whole the GMU campus provides a healthy, congenial and trouble free environment that makes it a preferred destination for students in pursuit of higher education.

### **National Cadet Corps (NCC)**

Upholding the aims of the National Cadet Corps i.e., to develop character, commandership, discipline, leadership, secular outlook, and spirit of adventure and the ideals of selfless service among the youth of the country. Gangadhar Meher University devotedly trains the Cadets to imbibe and be a responsible citizen of the country. Gangadhar Meher University (GMU), Sambalpur has provision for NCC in Senior Division (SD) for Boys & Senior Wing (SW) for Girls. The enrolment in the NCC is based on physical fitness followed by medical examination. Each student enrolled to the NCC is required to attend Institutional Training for 3 years, encompassing Parades and theory classes are held during the morning session on Sundays. The classes/parades begin from the first week of August and continue till the end of December\*. NCC Cadets are provided with the full uniform and are given free refreshment at the end of each parade. NCC training programme includes Map Reading, Field Craft, Drill/ weapon (Rifle) Training and firing at the Firing Camp. The Youth Exchange Programme is a thrilling experience for NCC Cadets. Six countries are part of this programme. At the end of the training period, 'B' & 'C' Certificates Examination are held every year. Some good NCC Cadets are sent for advanced leadership course, mountaineer course, Republic Day camps etc. NCC program begins in August and ends with the certificate exams held in February every year. Our NCC cadets have won many accolades and laurels in shooting, firing, and drill and line competitions. NCC cadets also attend Republic Day camps. A number of allowances and incentives are admissible to Cdts in the NCC. These incentives can broadly be categorized under various heads such as, concessions in employment, Concessions in Academic Field, Cash Awards and Prizes/Medals/Trophies and Scholarships.



Workshop on 'Beti Bachao Beti Padhao' was Organised by G. M. University in association with RAF, JAMSHEDPUR today (14/09/2023) in LG 1 at 3.30 pm



Workshop on 'Beti Bachao Beti Padhao'

# School of Psychology Observed 'International Day of The Girl Child 2023' today (11/10/2023)



'International Day of The Girl Child 2023'



One day Outreach Program on 'Gender Sensitization and Social Issues' is being Organized by School of Psychology in association with PATANG at Budharaja High School today (30/07/2023)



'Gender Sensitization and Social Issues Program'

Students Seminar was held in School of Psychology on 21/07/2023 and 22/07/2023 from 3 .30 pm to 5.30 pm on Gender Equality



Seminar on Gender Equality

An interaction Session with Dr. Reeta Mishra, the Founder and Managing Trustee:  
PATANG, on a collaborative programme (regarding an add-on Course Gender  
Champions) on 26/04/2023



An interaction Session was held with Dr. Reeta Mishra, the Founder and Managing Trustee:  
PATANG, on a collaborative programme (regarding an add-on Course Gender Champions)



## THE UNIVERSITY HAS PROVIDED 2 DIFFERENT WINGS FOR NCC SUCH AS

### ARMY WING:

The activities of NCC at GMU are guided by certain core values that we endeavor to instill among the Cadets. The Company provides an environment conducive to motivate cadets to join the armed forces and holds a record of producing cadets, on a regular basis, who join the Indian Armed Forces.

### NAVAL WING:

The aim of the naval wing training is to give exposure to the cadets on various facets of navy and motivate cadets to join Indian navy as a platform.

## Other Student Activities

### Clubs and Organizations:

Students can join various clubs and organizations based on their interests, such as cultural clubs, sports clubs, academic clubs, social service organizations, and more. These groups often organize events, workshops, competitions, and meetings related to their respective focus areas.

### Cultural Events:

Universities often host cultural festivals, music concerts, dance performances, and drama productions. These events provide opportunities for students to showcase their talents and immerse themselves in diverse cultural experiences.

### Sports and Athletics:

Many universities have sports facilities and organize intramural or intercollegiate sports competitions. Students can participate in a range of sports, including football, basketball, cricket, badminton, and athletics.

### Seminars and Workshops:

Universities frequently organize seminars, workshops, and conferences on various topics, inviting renowned speakers, scholars, and industry experts. These events offer students the chance to learn from experts and engage in intellectual discussions.

### Community Service:

Universities often encourage students to engage in community service activities, such as volunteering at local organizations, conducting awareness campaigns, or participating in social initiatives.

### Student Government:

Universities typically have student governments or student unions that represent the student body and organize events, address student concerns, and advocate for student rights and welfare.

### Academic Competitions:

Students can participate in academic competitions, research symposiums, hackathons, and other events related to their fields of study. These activities foster academic growth and encourage innovation and collaboration.

### Discipline & use of Mobile phone

The use of mobile phones by the students is prohibited in the classrooms and on the campus. Nevertheless, they can be used in the garden. Dress-Code has been decided for the faculty members. The whole campus is monitored by CCTV cameras. The University takes strict measures to maintain safety and security for all.

### Introduction of Auditing Firm

M/s. G C Consultancy Services, Gorakhpur is ISO:9001, 14001 & 45001 certified, a fast-growing committed consultancy firm. It has its unique feature & unlike other organization we don't simply conduct audit and report preparation is done. But we consider all Government norms (Central & State), CPCB, SPCB, NGT and Supreme court guidelines at the time of Audit. The quality and adoption of CPCB, SPCB norms is our commitment. It is one of the fast-growing Organization in Energy audit, renewal energy, water conservation, waste management, air quality services providing company executed several projects covering all the diversified field Sectors & states of India. The Director Being Ex Central Government Officer & having experience of 34+ years and his associate team members are very well experienced in the field of Green, Quality Environment & Energy Audits. The associate team and experts are highly qualified and experienced in the field of diversified Green Audit and Services. The individual credential of each member in the field of Energy Audit is very rich due to their past association with the very reputed organization of Auditing sectors. The company has Head office at Gorakhpur, Uttar Pradesh.

Name of Firm	M/s G C Consultancy Services
Address	614, Vasant Enclave, Rajender Nagar, Gorakhnath, Gorakhpur. 273015
Contact details	7007794292, 9919935600 Email id: <a href="mailto:gccs4114@gmail.com">gccs4114@gmail.com</a>

## G C Consultancy Director's & team Details

Sr. No.	Name	Designation	Qualification and Technical Experience
1.	Er. Ashutosh Kumar Srivastava Director	Principal Auditor  34+ Years of Experience	<i>BE (Civil), Lead Auditor ISO 9001, 14001, 22001, 45001, 50001, 17020. GRI professional 2021 Updated. IGBC AP, ASSOCHAM GEM CP, Expert in water audit, air audit, wastemanagement.</i>
2.	Dr. Anita Srivastava	Head for documentation	<i>Ph. D (Botany), Rajasthan University, Jaipur. Rajasthan</i>
3.	Mr. Vikas Srivastava Deputy Director	Water Quality & Quantity, Ambient Air Quality Expert, and Head for preparation of report. 5+ Years' Experience	<i>B.Com. from DDUGU M.Com. from DDUGU UGC NET Qualified Lead auditor for ISO 14001:2015</i>
4.	Mr. Lokendra Singh Chauhan	Energy & Renewal Expert 15 Years' Experience	<i>AMIE (Electrical Engineering) from Institute of Engineers India, Kolkata, PG Diploma in Strategic HR Management, Retired as Scientist-D/ Joint Director from Bureau of BIS after 38+ years' experience of working in different activities of BIS.</i>
5.	Arun Singh	<i>Trainee Auditor</i>	<i>B.Sc. (Math)</i>





GCCS Team at Gangadhar Meher University, Sambalpur

M/s G C Consultancy Services Registered in Ministry of Micro, Small & Medium Enterprises (MSME) as Micro unit, registered in NSIC under Environment Consultancy services.

### *List of Instruments*

The following are the instruments used at the time of the Environment Audit.

Sr. No.	Instrument	Make and Sr. No.
1	Water testing kits at site	<i>Prerana Laboratories</i>
2	Air Quality test	<i>Prana Laboratories</i>
3	Temperaturegun 1 Set (infrared Thermometer)	<i>Cyclops L Portable pyrometers</i>
4	Lux Meter 1 Set (Digital Lux Meter)	<i>Fluke lux meter. Conforms to IEC 61010, CAT III 600V safety rated</i>
5	Flue gas Analyzer	<i>Testo 330i: The future of flue gas analysis.</i>

# Environmental Audit

## *INTRODUCTION*

### *Environment Audit an Effective Efforts towards Environment Sustainability & Energy Conservation*

Modernization and industrialization are the two important outputs of the twentieth century that have made human life more luxurious and comfortable. Simultaneously, they are responsible for various uses of natural resources, exploitation of forest and wildlife, producing passive solid waste, polluting the scarce and sacred water resources, and finally making our mother Earth ugly and in-hospitable. Today, people are getting more familiar with 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 a sustainable environment.

Considering the present environmental problems of pollution and excessive use of natural resources, Hon'ble Prime Minister Shri Narendra Modi ji has declared the Mission of Swachh Bharat Abhiyan. Also, University Grants Commission has mentioned the "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. Govt. of India has issued National Education Policy 2020 and has issued white paper on its policy. Generation coming should be well conversant with the effects and impacts on Environment and Modernization/Development. Coming generation must know how to make a balance in both.

Environment Audit is the most efficient ecological tool to solve such environmental problems. It is a process of regular identification, quantification, 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 impacts on the surroundings. An environment audit can be one of the initiatives for such institutes to account for their energy, water resource use as well as wastewater, solid waste, hazardous waste generation. The environment Audit process can play an important role in the promotion of environmental awareness and sensitization about resource use. It can create consciousness towards ecological balance, values, and ethics. Through the green audit, one can get direction about how to improve the condition of the environment without much affecting the impact on nature.

### *Environment Audit*

Environment auditing is the process of identifying and determining whether an institution's practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. However, over the period 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 the required resources? Whether we are handling waste carefully? In fact, as per modern thinking there is waste as such. The policy of Waste to Wealth has been the new concept introduced. Environment 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 the min to green and clean ones.

The environmental audit provides an approach for it. It also increases overall consciousness and awareness among the people working in institutions towards an environment.

### *Goals of Environment audit*

Gangadhar Meher University has conducted an Environment audit & other audits earlier with specific goals as:

- Assess facility of different types of waste management.
- All waste shall be first finding the scope of its use under *Waste to Wealth policy*.
- Increase environmental awareness throughout campus.
- Identification and documentation of green practices followed by university.
- Identify strengths and weaknesses in green practices.
- Conduct a survey to know the ground reality about green practices.
- Analyze and suggest solutions for problems identified from the survey.
- Identify and assess environmental risk.
- Short-term goal of environment audit program.
- The long-term goal of the environmental audit program is to collect base line data of environmental parameters and resolve environmental issues.
- To motivate staff and student for optimized sustainable use of available resources.

### *Objectives of Environment audit*

- To examine the current practices which can impact the environment such as water, air, optimum resource utilization, waste management, etc.
- To prepare an Environmental Statement Report on green practices followed by different departments, support services, and administration building.
- To set goals (Short/ Long), vision, and mission for Green practices on the campus.
- To identify and analyze significant environmental issues.
- To establish and implement Environmental Management Plan (EMP) in various departments and review them periodically.
- To assess for better performance in green practices and its valuation.

### *About Criteria 7 of NAAC*

Universities are playing a key role in the development of human resources worldwide. Government of India through NEP 2020 has framed the policy under which there shall be 4 verticals out of which NAC vertical will be governed for independently assessment of all HEIs.

Higher education institutes on campus run various activities with the aim to percolate the knowledge along with practical dimension among the society. Likewise, different technological solutions related to the environment are also provided by the higher education institutes. Different types of evolutionary methods are used to assess the problem concerning the environment. It includes Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Carbon Footprint Mapping, environment audit, etc.

National Assessment and Accreditation Council (NAAC) is a self-governing organization that rated the institutions according to the scores assigned at the time of accreditation of the institution. Environmental Audit has become a mandatory procedure for educational institutes under NEP 2020 and in Criterion VII of NAAC. The intention of the green audits is to upgrade the environmental condition inside and around the institution. It is performed by considering environmental parameters like optimum use of water and wastewater (approach of recycling and reusing of the same) and accounting, energy conservation, possibilities of new/renewable energy, waste management, air, noise monitoring, facilities for females and differentially abled persons etc. for making the institution eco-friendlier.

Students are the major strength of any academic institution. They are also the future of the nation. Hence educating the Practicing green action in any educational institution will inculcate the good habit of caring for natural resources in students. Many environmental activities like plantation and nurturing saplings and trees, Cleanliness drives, Bird watching camps, no vehicle day, Rainwater harvesting, etc. will make the students good citizens 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.

### ***Benefits of Environment Audit to an Educational Institute***

There are many advantages of Environment 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.
- To identify and analyze significant environmental issues.
- To establish and implement Environmental Management Plan (EMP) in various departments and review them periodically.
- To assess for better performance in green practices and its valuation.

### ***About Criteria 7 of NAAC***

Universities are playing a key role in the development of human resources worldwide. Government of India through NEP 2020 has framed the policy under which there shall be 4 verticals out of which NAC vertical will be governed for independently assessment of all HEIs.

Higher education institutes on campus run various activities with the aim to percolate the knowledge along with practical dimension among the society. Likewise, different technological solutions related to the environment are also provided by the higher education institutes. Different types of evolutionary methods are used to assess the problem concerning the environment. It includes Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Carbon Footprint Mapping, environment audit, etc.

National Assessment and Accreditation Council (NAAC) is a self-governing organization that rated the institutions according to the scores assigned at the time of accreditation of the institution. Environmental Audit has become a mandatory procedure for educational institutes under NEP 2020 and in Criterion VII of NAAC. The intention of the green audits is to upgrade the environmental condition inside and around the institution. It is performed by considering environmental parameters like optimum use of water and wastewater (approach of recycling and reusing of the same) and accounting, energy conservation, possibilities of new/renewable energy, waste management, air, noise monitoring, facilities for females and differentially abled persons etc. for making the institution eco-friendlier.

Students are the major strength of any academic institution. They are also the future of the nation. Hence educating the Practicing green action in any educational institution will inculcate the good habit of caring for natural resources in students. Many environmental activities like plantation and nurturing saplings and trees, Cleanliness drives, Bird watching camps, no vehicle day, Rainwater harvesting, etc. will make the students good citizens 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.

### ***Benefits of Environment Audit to an Educational Institute***

There are many advantages of Environment 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.
- Empower the organization to frame a better environmental performance.
- It portrays a good image of the 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 stakeholders.

- Recognize the cost-saving methods through waste minimizing and managing.
- Authenticate conform it to 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.
- Developing an environmental ethic and value systems in youngsters.
- Green auditing should become a valuable to link the management and monitoring of environmental and sustainable development programs of the University.
- Finally, it will help to build a positive impression through green initiatives for the upcoming NAAC visit.

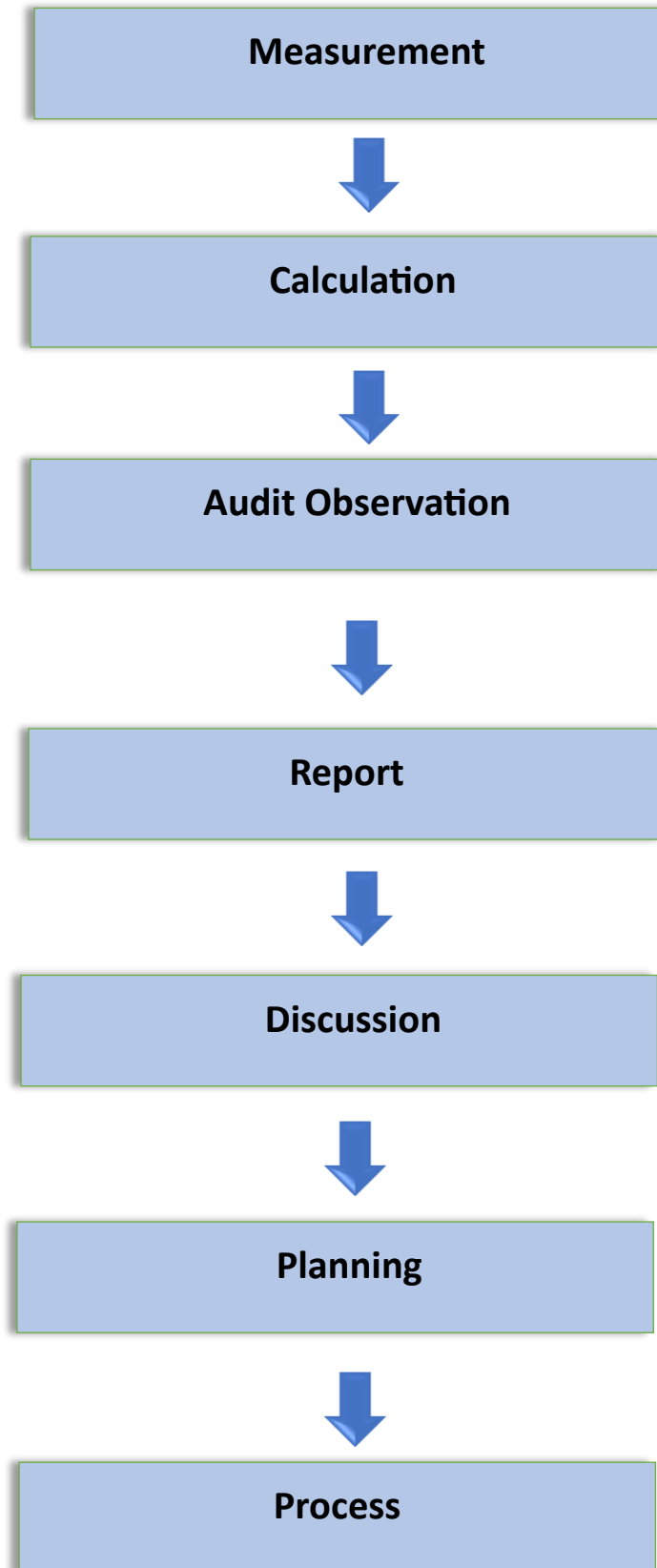
## **1.0 WATER & WASTEWATER AUDIT**

### **1.1 Introduction**

Water is a precious natural national resource available with affixed quantum. The availability of water is decreasing due to the increasing population of the nation as per capita availability of utilized water is going down. Due to the ever-rising standard of living of people, industrialization, urbanization, demand for 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 Honorable 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 suggesting conducting water audits 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 water. Water Audit is nothing but an effective measure for minimizing losses, optimizing various uses, and thus enabling considerable conservation of water in their irrigation sector, domestic, power, and industrial sectors. 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.

## 1.2

### *Water Audit Process*



## 1.3 Importance of Water Audit

- Systematic process.
- May some surprising results.



- Easier to work on solutions when the problems are identified.
- Attracting mechanisms can be put into place.

It is observed that several factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology 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 require 150 to 200 liters per person (capita) per day. As per the standards provided by WHO Regional Office for Southeast Asia Schools require 2 liters of water per student for drinking purposes; 10-15 liters per student for Water-flush toilets. Administration requires (Staff Accommodation not included) 50 liters per person per day.

## 1.4 Water Audit

The university is spread in a sprawling *lush green* campus of 34.491 acres dotted with buildings of Academic, Administrative and support services. 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 buildings / hostels, academic buildings, on-campus, and on-grounds. Wastewater is referred to as the water which is transported off the campus. The wastewater includes sewerage; residence water used in cooking, showering, clothes washing as well as wastewater from chemical and biological laboratories which ultimately go down in the sink or drainage system.

## 1.5 Water Quality

Primary Water Quality Criteria for Bathing Waters, in a water body or its part, water is subjected to several types of uses. Depending on the types of uses and activities, water quality criteria have been specified to determine its suitability for a particular purpose. Among the various types of uses there is one use that demands the highest level of water quality or purity and that is termed as "Designated Best Use" in that stretch of water body. Based on this, water quality requirements have been specified for different uses in terms of primary water quality criteria. The primary water quality criteria for bathing water are specified along with the rationale in table 1. PRIMARY WATER QUALITY CRITERIA FOR BATHING WATER (Water used for organized outdoor bathing) CRITERIA 1. Fecal Coliform MPN/100 ml; & Fecal Streptococci MPN/100 ml: 2. pH: 3. Dissolved Oxygen: 4. Biochemical Oxygen demand 3-day, 27°C: 500 (desirable) 2500 (Maximum Permissible) 100 (desirable) 500 (Maximum Permissible) Between 6.5 - 8.5 5 mg/1 or more 3 mg/1 or less RATIONALE to ensure low sewage contamination. The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal change, changes in flow conditions etc. The range provides protection to the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing. The minimum dissolved oxygen concentration of 5 mg/1 ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment. The Biochemical Oxygen Demand of 3 mg/1 or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevents production of obnoxious gases.

## 1.6 Drinking Water Quality

The major river of Sambalpur, Odisha is the Mahanadi River. It is the longest river in Odisha, flowing for 851 kilometers (529 mi) through the state. The river is an important source of water for irrigation, drinking, and industrial use. It is also a major transportation route and a source of hydroelectric power. The ground water of Sambalpur contains Designated Best Use Water Quality Criteria Designated-Best-Use Class of water Criteria Drinking Water Source without conventional treatment but after disinfection:

- A. Total Coliforms Organism MPN/100ml shall be 50 or less, pH between 6.5 and 8.5 Dissolved Oxygen 6 mg/l or more Biochemical Oxygen Demand 5 days 20C 2 mg/l or less Outdoor bathing (Organized).
- B. Total Coliforms Organism MPN/100ml shall be 500 or less, pH between 6.5 and 8.5 Dissolved Oxygen 5 mg/l or more, Biochemical Oxygen Demand 5 days 20C 3 mg/l or less Drinking water source after conventional treatment and disinfection.
- C. Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4 mg/l or more Biochemical Oxygen Demand 5 days 20° C, 3 mg/l or less Propagation of Wildlife and Fisheries.
- D. pH between 6.5 to 8.5 Dissolved Oxygen 4 mg/l or more Free Ammonia (as N) 1.2 mg/l or less Irrigation, Industrial Cooling, Controlled Waste disposal.
- E. pH between 6.0 to 8.5 Electrical Conductivity at 25 °C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2 mg/l.

### 1.6.1 WHO Drinking Water Specifications Updated On 11 Oct 2019

WHO produces international norms on water quality and human health in the form of guidelines that are used as the basis for regulation and standard setting, in developing and developed countries worldwide. The quality of drinking water is a powerful environmental determinant of health. Assurance of drinking water safety is a foundation for the prevention and control of waterborne diseases. The guidelines developed by WHO are prepared through a vast global consultative process involving WHO member states (India is the member state), national authorities and international agencies, in consultation with the WHO Expert Advisory Panel.

Parameters	Standard limits as per WHO Guidelines (mg/L)
Acrylamide	0.0005
Alachlor	0.02
Aldicarb	0.01
Aldrin and Dieldrin	0.00003
Ammonia	1.5
Antimony	0.02
Arsenic	0.01

Parameters	Standard limits as per WHO Guidelines (mg/L)
Atrazine	0.002
Barium	0.7
Benzene	0.01
Benzo (?) pyrene	0.0007
Boron	0.5
Bromate	0.01
Bromodichloromethane (BDCM)	0.06
Bromoform	0.1
Cadmium	0.003
Carbofuran	0.007
Carbon tetrachloride	0.004
Chlorate	0.7
Chlordane	0.0002
Chloramines	0.5 - 1.5
Chloride	200 – 300
Chlorine	5
Chlorite	0.7
Chloroform	0.3
Chlortoluron	0.03
Chlorpyrifos	0.03
Chromium	0.05
Color in drinking water	No visible color
Copper	2.0
Cyanazine	0.0006
Cyanide	0.07
1,2-Dichlorobenzene	1.0
1,4-Dichlorobenzene	0.3
1,2-Dichloroethane	0.03
Dichloromethane	0.02
2,4-Dichlorophenoxyacetic acid	0.03
DDT and metabolites	0.001

Parameters	Standard limits as per WHO Guidelines (mg/L)
Di(2-ethylhexyl) phthalate	0.008
1,2-Dichloroethylene	0.05
1,2-Dichloropropane	0.04
Dimethoate	0.006
1,4-Dioxane	0.05
Dissolved oxygen	No health-based guideline value is recommended
Eidetic acid (EDTA)	0.6
Endrin	0.0006
Epichlorohydrin	0.0004
Ethylbenzene	0.3
Fenoprop	0.009
Fluoride	1.5
Hexachlorobutadiene	0.0006
Iron	No health-based guideline value is proposed
Isoproterenol	0.009
Lead	0.01
Lindane	0.002
Manganese	0.4
Mercury	0.006
Methoxychlor	0.02
Metolachlor	0.01
Microcystin-LR	0.001
Melinite	0.006
Molybdenum	0.07
Mon chloroacetate	0.02
N-Nitroso dimethylamine	0.0001
Nickel	0.07
Nitrate	50
Nitrilotriacetic acid (NTA)	0.2
Nitrite	3

Parameters	Standard limits as per WHO Guidelines (mg/L)
Pendimethalin	0.02
Pentachlorophenol	0.009
Permethrin	0.3
pH	No health-based guideline value is proposed
Pyriproxyfen	0.3
Selenium	0.01
Simazine	0.002
Sulphate	No health-based guideline value has been derived
Styrene	0.02
Terbutylazine	0.007
Tetrachloroethylene	0.04
Toluene	0.7
Total dissolved solids (TDS)	No health-based guideline value is proposed
Trichloro acetate	0.2
Trichloroethylene	0.02
2,4,6, -Trichlorophenol	0.2
Trifluralin	0.02
Tritium	10000 Bq/L
Uranium	0.015
Vinyl chloride	0.0003
Xylenes-total	0.5
Zinc	No health-based guideline value is proposed

Water contains naturally occurring compounds such as lead and arsenic among others. How harmful are these and what is the level of contamination, we must know about.

### 1.6.2 Water quality in India Source UNICEF Repository

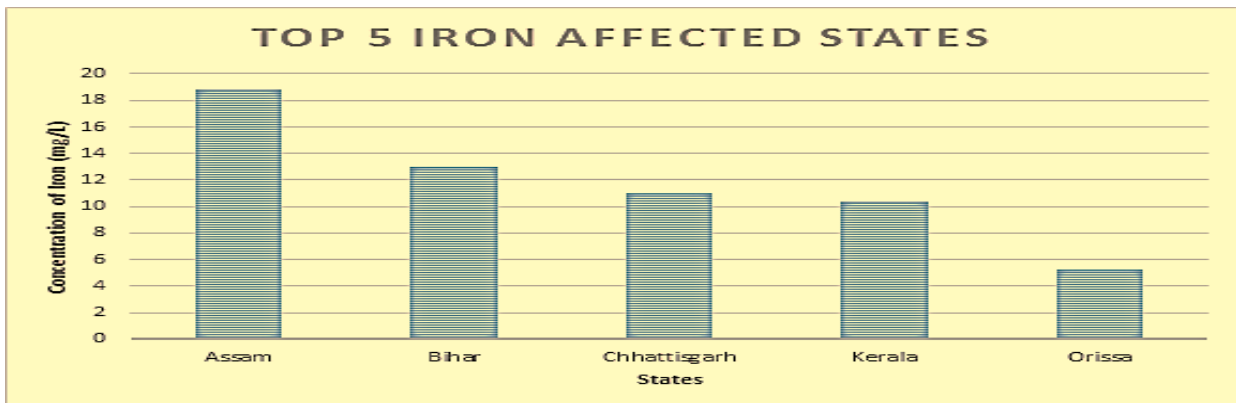
Both rural and urban India is faced with water problems. People do not have access to good quality, safe drinking water. The source for most drinking water is either rivers or underground aquifers (wells). Since water can dissolve just about anything that it meets long enough, often the groundwater we get isn't pure.

It could contain naturally occurring lead, arsenic, mercury, radium, chloride, iron and copper compounds dissolved in it. Most of these aren't harmful when consumed in small quantities. But



when the levels go higher than the prescribed amounts, it could be harmful and sometimes, even fatal. Let's analyze the effects of each of these compounds on our health and understand from the available data which states in India are susceptible to which types of contamination.

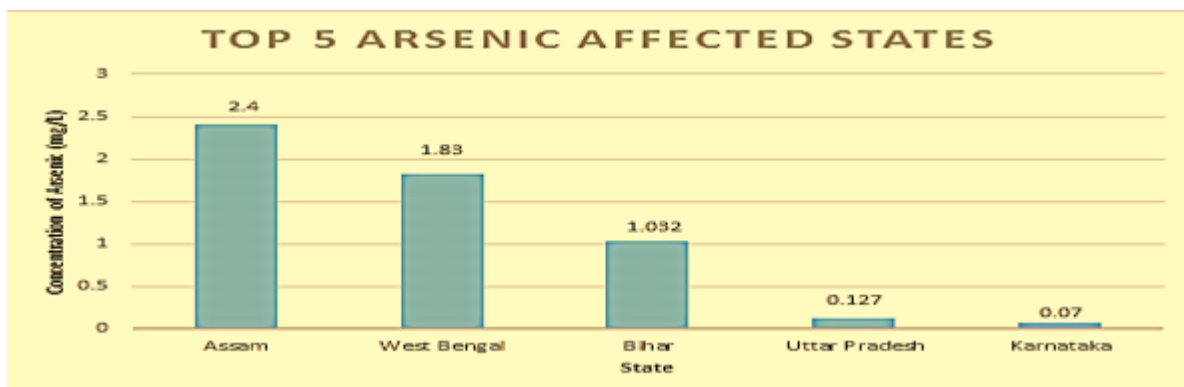
### Iron



Iron, which is seldom found in concentrations greater than 10 milligrams per liter (mg/L) or 10 parts per million can be a troublesome chemical in drinking water. Corrosion of pipes is a common reason why iron is found in drinking water. As little as 0.3 mg/L concentration of iron can make the water appear brown. A laboratory analysis of the water sample can tell you the extent of your problem.

The best way to treat this is to use aeration/ filtration or chlorination techniques. Chlorination is the process of adding the element chlorine to the water to make it fit for human consumption.

### Arsenic



Arsenic is a semi-metal found in foods and mostly in groundwater. Elevated levels of arsenic lead to metabolism failure in the body causing severe heart diseases, night blindness, cancer and even diabetes. A study conducted by USA today.com states that around 70 countries are affected by arsenic poisoning from groundwater. Assam and West Bengal have high concentrations up to 2.4 mg/L and 1.83 mg/L respectively.

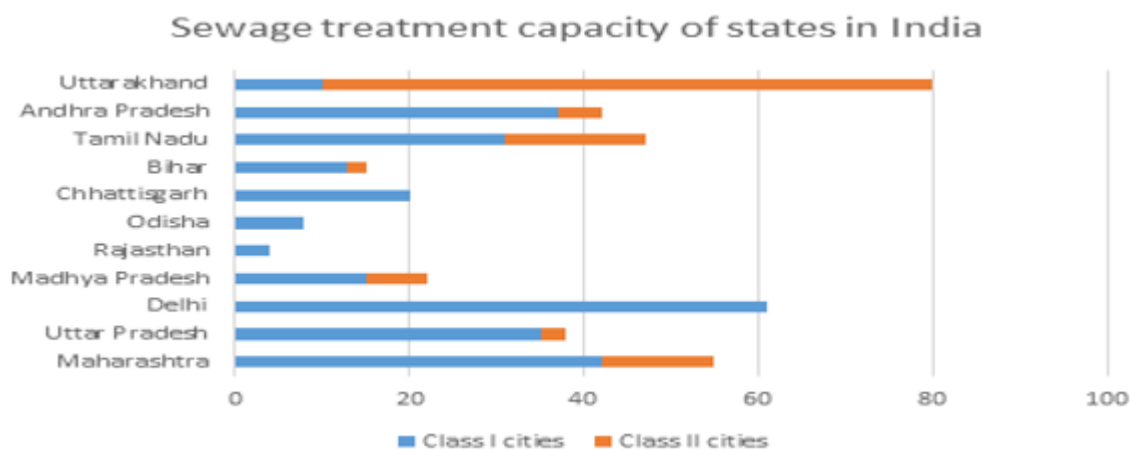
## Chlorine and Fluoride

Chlorine and fluoride are added to water to kill pathogens, which are disease producing agents. An excess amount of chlorine in the water causes a problem because it leaves behind a residue. This “residual amount”, when consumed, reacts inside the stomach, and damages some cells of the organs.

Fluoride is added in water just to prevent cavities, whether you have cavities or not! An excess amount of fluoride in water causes tooth discoloration forming yellow or brown pits and patches on teeth. Long term high exposure (more than 4 ppm) to fluoride may also result in bone spurs and birth defects. Rajasthan and Assam have the highest concentrations of these.

## Nitrate

Nitrate, a naturally occurring form of nitrogen, is found in the soil. It is required in large quantities to sustain high crop yields. A tasteless, colorless, and odorless compound, you cannot detect it unless your water is chemically analyzed. If you drink water from a private well, get a qualified laboratory to test it yearly. Times of India reported, “Dental and spine-related ailments are showing up in many cities and villages of Karnataka due to increasing levels of Nitrate concentration in drinking water.”



## Sewage treatment capacity of states in India

The major cause of increasing nitrate content is open sewage disposal and the use of nitrogen fertilizers. Since rural sanitation in the country is poor, the presence of nitrates in water is evident of such contamination. Proper sewage treatment including contaminants and recycling of wastewater to reuse it for various uses like gardening, toilet flushing, and car washing is necessary to keep these levels down. Currently Maharashtra and Uttar Pradesh have the highest sewage treatment capacity in India in Class I cities.

From the above analysis, we can see the extent of contamination that we are exposed to. Here are some safeguards that we can take to get clean drinking water.

- Water supply protection is most effective before contamination occurs. Surface water must never be allowed to flow down in the well. Rainwater and runaway water should be sloped out of a water body. A minimum of 300 feet distance must be maintained between sewage disposal and water supply areas.
- Also, it is important to locate and eliminate the source of the contamination. For example, lead

and iron contamination can be eliminated by replacing pipes, fittings, and fixtures.

- New sources for water supply should be developed in case the existing supply is extensively contaminated with nitrate, salt, pesticides, and other chemicals.
- Lastly, water must be treated to remove possible disinfectants and chemicals.

### 1.6.3 INDIAN STANDARDS FOR SAFE DRINKING WATER

- The Bureau of Indian Standards (BIS) has specified drinking water quality standards in India to provide safe drinking water to the people. It is necessary that drinking water sources should be tested regularly to know whether water is meeting the prescribed standards for drinking or not and, if not, then, the extent of contamination/ unacceptability and the follow-up required.
- Apart from BIS specification for drinking water, there is one more guideline for water quality, brought out by the Ministry of Water Resources, Government of India in 2005. This is known as Uniform Protocol for Water Quality Monitoring. A need has arisen to have a separate uniform protocol for Drinking Water Quality Monitoring in view of increasing risk of geogenic and anthropogenic contamination.
- Keeping in view requirement of preparing Uniform Drinking Water Quality Monitoring Protocol, the Ministry of Drinking Water and Sanitation (MDWS), Government of India constituted an Expert Group which prepared the Protocol. The Drinking Water Quality Monitoring protocol describes specific requirements for monitoring drinking water quality with a view to ensure provision of safe drinking water to the consumers.

### 1.6.4 Definition of drinking water quality

BIS has set specifications in IS-10500 and subsequently the revised edition of IS 10500: 2012 in Uniform Drinking Water Quality Monitoring protocol.

Some parameters apart from those mentioned in IS 10500: 2012 may also be measured if the States deem it necessary. This standard has two limits i.e., Acceptable limits and permissible limits in absence of alternate source. If any parameter exceeds the limit, that water is considered unfit for human consumption.

Broadly speaking water is defined as unfit for drinking as per Bureau of Indian Standards, IS-10500-2012, if it is bacteriologically contaminated (presence of indicator Uniform Drinking Water Quality Monitoring Protocol bacteria particularly E-coli, viruses etc.) or if chemical contamination exceeds maximum permissible limits (e.g. excess fluoride [ $>1.5\text{mg/l}$ ], Total Dissolved Solids (TDS) [ $>2,000\text{ mg/l}$ ], iron [ $>0.3\text{ mg/l}$ ], manganese [ $>0.3\text{ mg/l}$ ], arsenic [ $>0.05\text{ mg/l}$ ].

The latest drinking water specification and test protocol are:

Sr. No.	Test Parameter	IS: 10500-2012 Drinking Water Specification (Second Revision)		Method of Test (Indian Standard IS:3025 Methods of Sampling and Test for Water and Waste Water)
		Requirement (Acceptable limit)	Permissible limit In the Absence of alternate source	
1.	Odor	Agreeable	Agreeable	IS:3025 Part 5
2.	Taste	Agreeable	Agreeable	IS:3025 Part 8
3.	pH value	6.5 – 8.5	No relaxation	IS:3025 Part 11
4.	Turbidity, NTU, Max	1	5	IS:3025 Part 10
5.	Total dissolved solids (TDS), mg/l, Max	500	2000	IS:3025 Part 16
6.	Total alkalinity as CaCO <sub>3</sub> , mg/l, Max	200	600	IS:3025 Part 23
7.	Total hardness as CaCO <sub>3</sub> , mg/l, Max	200	600	IS:3025 Part 21
8.	Calcium as Ca, mg/l, max	75	200	IS:3025 Part 40
9.	Magnesium as Mg, mg/l, Max	30	100	IS:3025 Part 46
10.	Chloride as Cl, mg/l, Max	250	1000	IS:3025 Part 32
11.	Residual Free Chlorine, mg/l, Min*	0.2	1	IS:3025 Part 26
12.	Sulphate as SO <sub>4</sub> , mg/l, max	200	400	IS:3025 Part 24
13.	Nitrate Nitrogen as NO <sub>3</sub> , mg/l, Max	45	No relaxation	IS:3025 Part 34

Sr. No.	Test Parameter	IS: 10500-2012 Drinking Water Specification (Second Revision)		Method of Test (Indian Standard IS:3025 Methods of Sampling and Test for Water and Waste Water)
		Requirement (Acceptable limit)	Permissible limit In the Absence of alternate source	
14.	Fluoride as F, mg/l, Max	1.0	1.5	IS:3025 Part 60
15.	Total Iron as Fe, mg/l, Max	0.3	No relaxation	IS:3025 Part 53
16.	Coliform MPN/100 ml	Shall not be detectable in any 100 mlsample	Indian Standard IS:1622, Methods of Sampling and Microbiological Examination of water.	Indian Standard IS:1622, Methods of Sampling and Microbiological Examination of water.
17.	Fecal Coliform, Presence/Absence	Shall not be detectable in any 100 mlsample		
18.	E. coli, Presence/ Absence	Shall not be detectable in any 100 mlsample		

\*Applicable only when water is chlorinated

*As per Central Pollution Control Board of September 2013:*

**Table: General range of Important Chemical Constituents**

Sr. No.	Constituent	Range		ISI Standards Desirable	Permissible
		Min	Max		
1	pH	7.43	8.90	6.5–8.5	No range
2	E.C/μS/cm at 25°C	110	3263	750	3000
3	Total Hardness (mg/l)	45	660	300	600
4	Ca(mg/l)	8	166	75	200
5	Mg(mg/l)	1.0	113	30	100
6	Na(mg/l)	5.0	506	-	-
7	K (mg/l)	1.0	180	-	-
8	Co3(mg/l)	Nil	87	-	-
9	HCo3(mg/l)	24	634	-	-
10	Cl(mg/l)	7.0	695	250	1000



Sr. No.	Constituent	Range		ISI Standards Desirable	Permissible
		Min	Max		
11	So <sub>4</sub> (mg/l)	0.5	192	200	400
12	No <sub>3</sub> (mg/l)	0.4	249	45	100
13	F (mg/l)	0.04	1.6	1.0	1.5

## 1.7 Water Quality Samples

### Quality of water in terms of pH, TDS, EC. at Gangadhar Meher University, Sambalpur

Sr. No.	Place from where water sample collected	pH	Permissible Value	TDS	Permissible Value	Electrical Conductivity E.C./ $\mu$ S/cm at 25°C	Permissible Value
		1		2		3	
1	Admin building (ground Floor) RO	7.53	6.5 - 8.5	102	upto 500 ppm	204	200 to 800 $\mu$ S/cm
2	1st floor admin building (tap water)	7.77		77			
3	JP Boys hostel mess (RO)	7.48		34			
4	JP Boys hostel mess kitchen (tap water)	7.39		53			
5	Madhumaya boys' hostel (RO)	7.46		70			
6	New Ekalavya boys hostel mess (RO)	7.53		61			
7	New Ekalavya boys hostel mess kitchen (tap water)	7.55		64			
8	Academic Annex Building (RO)	7.64		93			
9	Canteen Area in academic building (RO)	7.48		52			
10	Lecture gallery-1 (RO)	7.4		55			
11	Library (RO)	7.51		48			
12	School of Education (RO)	7.28		66			
13	Ladies Hostel-1 (RO)	7.5		49			

Sr. No.	Place from where water sample collected	pH	Permissible Value	TDS	Permissible Value	Electrical Conductivity E.C./ $\mu$ S/cm at 25°C	Permissible Value
		1		2		3	
14	New women hostel (LH-2), RO	7.44		42		84	
15	Old Ekalavya ladies' hostel (RO)	7.46		42		84	
16	Ladies Hostel-3 (RO)	7.55		45		90	
17	Staff quarter (tap water)	7.56		51		102	
18	MBA Dept (RO)	7.46		56		112	
19	RO Water trust fund hostel	7.56		58		116	
20	Trust fund hostel (boys hostel tap water)	7.6		58		116	

\*TDS should be lie between 50 – 500 PPM and at some places TDS was found less than 50 PPM and it is caused deficiency of minerals in body.

### 1.8 Test for Bacteria presence in water

Sr. No	Sample collected from	Process adopted to test for bacteria	Result Presence of Bacteria	Chlorination in ppm IS:3025 Part 26	Result
		4		5	
1	1st floor admin building (tap water)	It was tested through site sample kit provided by Prerena Laboratories	Negative	0.3	Safe For drinking
2	Old Ekalavya ladies' hostel (raw water)		Negative	0.2	Safe For drinking
3	New Ladies Hostel-2 (raw water)		Negative	0.4	Safe For drinking

Sr. No	Sample collected from	Process adopted to test for bacteria	Result Presence of Bacteria	Chlorination in ppm IS:3025 Part 26	Result
		4		5	
4	Staff quarter (tap water)		Negative	0.2	Safe For drinking
5	Canteen Area in academic building (RO)		Negative	0.3	Safe For drinking
6	New Ekalavya boys hostel mess kitchen (tap water)		Negative	0.3	Safe For drinking

### 1.9 Test for Copper, Sulphates and Fluorides

Sr. No.	Sample	Hardness testing ppm	Copper ppm	Fluoride as F, Mg/L, Max	Permissible limit Mg/L	Presence of Sulphates Mg/L	Permissible Limit Mg/L
		6	7	8		9	
1	1st floor admin building (tap water)	100	Less than 0.2	0.65	1.0 mg/L IS 3025 Part 60	120	200 Acceptable limits IS:3025 Part 24
2	Old Ekalavya ladies' hostel (raw water)	100	Less than 0.2	0.63		135	
3	New Ladies Hostel-2 (raw water)	100	Less than 0.2	0.65		110	

Sr. No.	Sample	Hardness testing ppm	Copper ppm	Fluoride as F, Mg/L, Max	Permissible limit Mg/L	Presence of Sulphates Mg/L	Permissible Limit Mg/L
		6	7	8		9	
4	Staff quarter (tap water)	100	Less than 0.2	0.67		146	
5	Canteen Area in academic building (RO)	100	Less than 0.2	0.66		118	
6	New Ekalavya boys hostel mess kitchen (tap water)	100	Less than 0.2	0.65		152	

Total 9 parameters of water were tested in field test. All the results were within permissible limits of Indian Standards.

### Analysis:

1. Water samples were collected at 20 different locations.
2. Total 9 parameters were checked to analyze the quality of water.
3. No serious abnormality was detected in the water quality sample.
4. J.P. Boys Hostel Mess, Library, Ladies Hostel-I, New Women Hostel II, Old Eklavya Ladies Hostel & Indumati Hostel the TDS value was 34, 48, 49, 42, 42 & 45 respectively.

### Observation:

1. J.P. Boys Hostel Mess, Library, Ladies Hostel-I, New Women Hostel II, Old Eklavya Ladies Hostel & Indumati Hostel the TDS value is much below the normal value.
2. It is recommended that TDS to be increased otherwise the student will become mineral deficient.
3. Regular chlorination is required to be done to get the harmful bacteria killed.

## Water Quality Field Test:



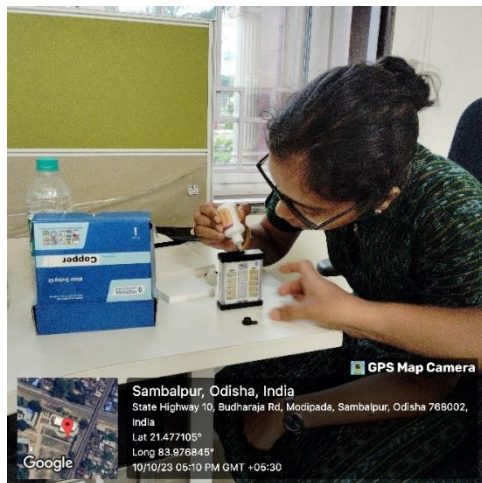
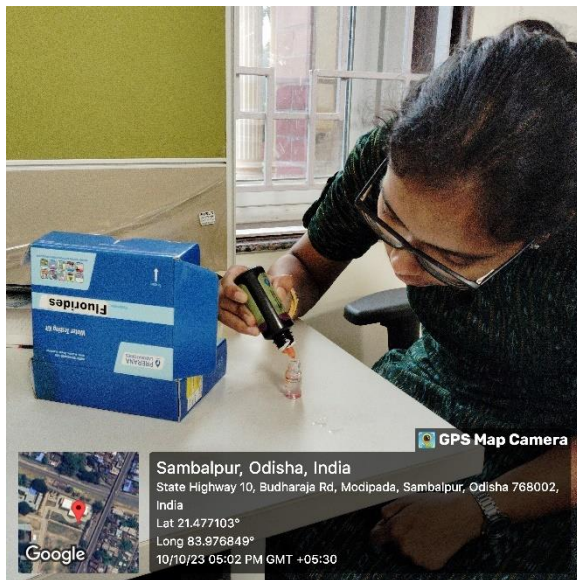
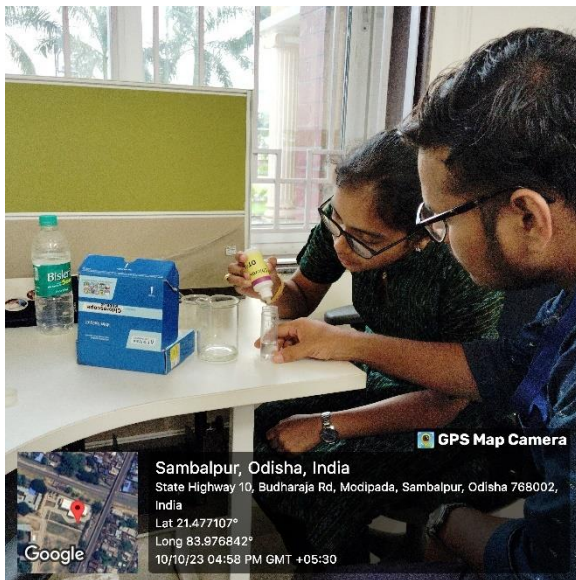
TDS test of water



Electrical Conductivity Test of water



pH test of water



Water Quality test



## 1.10 Ground water

Sambalpur district in Odisha has a good potential of ground water resources. The district is divided into four hydrogeological units:

- **Hard Rock Aquifers:** These aquifers are formed in granites, gneisses, and other hard rocks. They are generally deep and have low to moderate yields.
- **Fractured Hard Rock Aquifers:** These aquifers are formed in fractured hard rocks. They are generally shallow and have moderate to high yields.
- **Valley Fill Aquifers:** These aquifers are formed in the valleys of rivers and streams. They are generally shallow and have high yields.
- **Laterite Aquifers:** These aquifers are formed in laterite soils. They are generally shallow and have low to moderate yields.

The ground water quality in Sambalpur district is generally good. However, there are some isolated cases of high electrical conductivity and fluoride concentrations.

Ground water is used for drinking, irrigation, and industrial purposes in Sambalpur district. The major sources of ground water are dug wells and tube wells.

A study conducted by the Central Ground Water Board in 2016 found that the overall ground water quality in Sambalpur district is suitable for drinking, industrial, and irrigation purposes. All the chemical constituents, particularly electrical conductivity, fluorides, arsenic, and iron were within the permissible limits.

However, the study also found that there were some isolated instances of high electrical conductivity values in patches and fluoride values of 3.7 ppm at Daicha and 1.7 ppm at Jugipalli. The pH of ground water in Sambalpur district is in the range of 7 to 8.5, which shows that it is slightly alkaline.

### 1.10.1 Groundwater Quality

#### *A. Color*

Color is measured in Platinum Cobalt Scale. The color obtained in all the groundwater samples is 1 or less than 1.

#### *B. pH*

The pH value ranges between 6.5 and 8.5. The lowest value is **Academic Annex Building (RO)** (RO Water) i.e. 7.64 observed and whereas higher pH values were observed in samples in **School of Education** (RO Water) i.e. 7.28, all the groundwater samples showed good pH range or values. It is also observed that all the water samples lie in the range of 6.5 – 8.5 prescribed by Indian Standards for Drinking Water.

#### *C. Turbidity*

Turbidity is measured in the Nephelometric Turbidity Unit (NTU). The turbidity for nearly all the samples remained less than 1 NTU, the turbidity lies in the range 2 – 4.5 NTU.

### *D. Electrical Conductivity*

Electrical conductivity (EC) is a useful tool to evaluate the purity of water. Maximum EC is recorded in Admin Building Ground Floor, (204  $\mu$  mhos/cm) and the minimum EC at J.P. Boys Hostel Mess (68  $\mu$ mhos /cm).

### *E. Total Dissolved Solids*

The Total Dissolved Solids (TDS) of the water samples ranged from 34 ppm to 102 ppm. Maximum TDS is recorded in Admin Building Ground Floor (102 ppm) and the minimum EC at J.P. Boys Hostel Mess (34 ppm).

### *F. Quality of ground water for drinking*

The E.C. (specific conductivity) of ground water which is a degree of mineralization varies from 260 to 1120 micromhos / at 25°C and is well within permissible limits. In the city area Electrical conductivity varies between 325 to 1500 micro siemens / cm at 25°C. Carbonates are present in the form of bicarbonates and ranges between 146-390 mg/l.

## **1.10.2 Quality of water for irrigation**

High SAR is not good for irrigation as it leads to sodium hazard. Water samples in the district generally fall in C2 S1, C3 S1 and C4 S1 classes of US salinity diagrams. However, ground water in the district is generally safe for irrigation but a proper drainage system is required where EC is more than 1500  $\mu$ s/cm.

According to International Journal of preventive medicine research Potential Health Impacts of Hard Water PMID: PMC3775162 PMID: 24049611, Int J Prev. Med. 2013 Aug; 4(8): 866–875.

### *A. pH value:*

A pH of 7 is considered neutral. That “seven” number is considered neutral or balanced between acidic and alkaline. If water is below 7 on the pH scale, it's "acidic." If it's higher than 7, it's "alkaline." EPA guidelines state that the pH of tap water should be between 6.5 and 8.5.

Acidic water with a pH of less than 6.5 is more likely to be contaminated with pollutants, making it unsafe to drink. It can also corrode (dissolve) metal pipes.

Many municipal water suppliers voluntarily test the pH of their water to monitor for pollutants, which may be indicated by a changing pH. When pollutants are present, water companies treat their water to make it safe to drink again.

### *B. Alkaline water*

Alkaline water has become a popular drinking water choice over the past few years. Some people say that drinking slightly alkaline water — with a pH between 6.5 and 8.5 — can improve your health. They say it may make you age more slowly, maintain a healthy pH in your body, and block chronic disease like cancer.

### *C. Electrical Conductivity of Water*

Pure water is not a good conductor of electricity. Ordinary distilled water in equilibrium with carbon dioxide of the air has a conductivity of about  $10 \times 10^{-6} \text{ W}^{-1}\text{m}^{-1}$  (20 dS/m). Because the electrical current is transported by the ions in solution, the conductivity increases as the concentration of ions increases.

Electrical conductivity (EC) is a measurement of water's ability to conduct electricity. EC is related to water temperature and the total concentration, mobility, valence and relative concentration of ions. Higher EC means more electrolytes in the water.

The reason that the conductivity of water is important is because it can tell you how much dissolved substances, chemicals, and minerals are present in the water. Higher amounts of these impurities will lead to a higher conductivity.

Types of water	Conductivity Value
Pure distilled and Deionized water	0.05 $\mu\text{S}/\text{cm}$
Seawater	50 $\text{mS}/\text{cm}$
Drinking water	200 to 800 $\mu\text{S}/\text{cm}$ .
Rain or Snow water	2 to 100 $\mu\text{S}/\text{cm}$

$\mu\text{S}/\text{cm}$  means micro-Siemens per centimeter, a measure of electrical conductivity; it is equal to  $\mu\text{mhos}/\text{cm}$ ; BASIS FOR CHANGE: The Department proposes to add this definition, which is the measure of conductivity in the International System of units, and to substitute it for  $\mu\text{mhos}/\text{cm}$  throughout the Standards. 1 PPM is equal to 1.56 micro-S/cm.

### *D. Sulphates in drinking water*

People who are not used to drinking water with high sulfate can get diarrhea and dehydration from drinking the water. Infants are often more sensitive to sulfate than adults. To be safe, only use water with a sulfate level lower than 500 milligrams per liter (mg/L) to make infant formula. Older children and adults may get used to high sulfate levels after a few days.

### *E. Presence of Copper in water*

How to Protect Yourself and Your Family Drinking water with more than 1,300 micrograms of

copper per liter of water ( $\mu\text{g/L}$ ) can be a health risk for everyone. Infants and people with Wilson's disease may need water with an even lower level of copper to stay safe. Copper can get into your drinking water as it passes through your plumbing system. Over time, plumbing parts with copper in them usually build up a natural coating that prevents copper from being dissolved into the water. Plumbing systems with copper parts fewer than three years old usually have not had time to build up this protective coating.

## *F. Presence of Fluorides in drinking water*

Fluoride prevents tooth decay by making teeth stronger and more resistant to acid attacks. It also helps with slowing down or stopping the decay process. When fluoride levels in water are at optimal levels, it helps to protect teeth against cavities. Excess amounts of fluoride ions in drinking water can cause dental fluorosis, skeletal fluorosis, arthritis, bone damage, osteoporosis, muscular damage, fatigue, joint-related problems, and chronic issues.

### **1.11 Water Quantity**

#### **1.11.1 According to the report**

The water quantity of Sambalpur, Odisha is generally good, but it is important to manage it carefully to avoid overexploitation.

The district has a good potential of ground water resources, but the water level in some areas has declined in recent years due to overexploitation and climate change.

According to the Central Ground Water Board, the annual ground water recharge in Sambalpur district is estimated to be around 1900 million cubic meters (MCM). The annual ground water extraction is estimated to be around 1400 MCM. This indicates that the ground water resources of the district are sustainable.

However, it is important to note that the ground water recharge and extraction patterns vary from year to year depending on the rainfall. In years of low rainfall, the ground water recharge is less and the ground water level may decline.

#### **1.11.2 Methodology for reduction in water consumption**

Here are a few methods that can reduce the usage of water inside buildings:

- Rainwater Harvesting. Rainwater Harvesting is a method that can be quite easily implemented.
- Water Metering.
- Pressure reducing valves.
- Water-saving showerheads.
- Greywater Recycling system.
- Smart irrigation systems.
- Water-efficient toilets.
- Float valves on the tanks above the quarters/ homes and buildings.

### 1.11.3 Broadly speaking, you can reduce your direct water footprint by

- Turning off the tap while brushing your teeth.
- Using water-saving toilets.
- Installing a water-saving shower head.
- Taking shorter showers.
- Only wash clothes when necessary.
- Fixing household leaks.
- Using less water in the garden and when cleaning. Preferably use recycled water.
- Adopting drip irrigation methods.

### 1.11.4 Measure daily consumption data

As per Central Ground Water Authority As a general rule the following rates per capita per day may be considered for domestic and nondomestic needs: a) For communities with populations up to 20,000: b) For communities with : 100 to 135 lphd population 20,000 to 100,00 together with full flushing system c) For communities with population: 150 to 200 lphd above 100,000 together with full flushing system Note—The value of water supply given as 150 to 200 liter per head per day may be reduced to 135 liter per head per day for houses for Medium Income Group (MIG) and Low Income Groups (LIG) and Economically Weaker Section of Society (EWS), depending upon prevailing conditions and availability of water. Out of the 150 to 200 liters per head per day, 45 liters per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

### 1.11.5 Measure the pumping hours

The best way to control the water is to measure daily water demand which is being extracted from the source. For this we can use Water Meter and Energy meter. Water meter is for water consumption and the Energy meter is to check the energy consumed. Check it daily. Find out the leakages and ultimately check where water consumption is more. At each overhead tank we should provide a float valve so that unnecessary waste of water and energy shall be reduced. See the possibility if water consumption can be reduced. A periodical analysis will reduce the water and energy consumption to an optimum level.

- Recharging of ground water through RWH
- Observe the Ground water table before and after monsoon.
- Please observe the groundwater recharge position (Level whether increase or decrease). This will give an extra credit for achieving the ground water recharge to the University.
- Participation of student groups should be made to further increase their awareness towards water conservation.

### 1.11.6 University water resources

Daily requirement of water of the university is 4.5 lakhs liter i.e., fulfilled by Municipal Supply of Sambalpur, Odisha

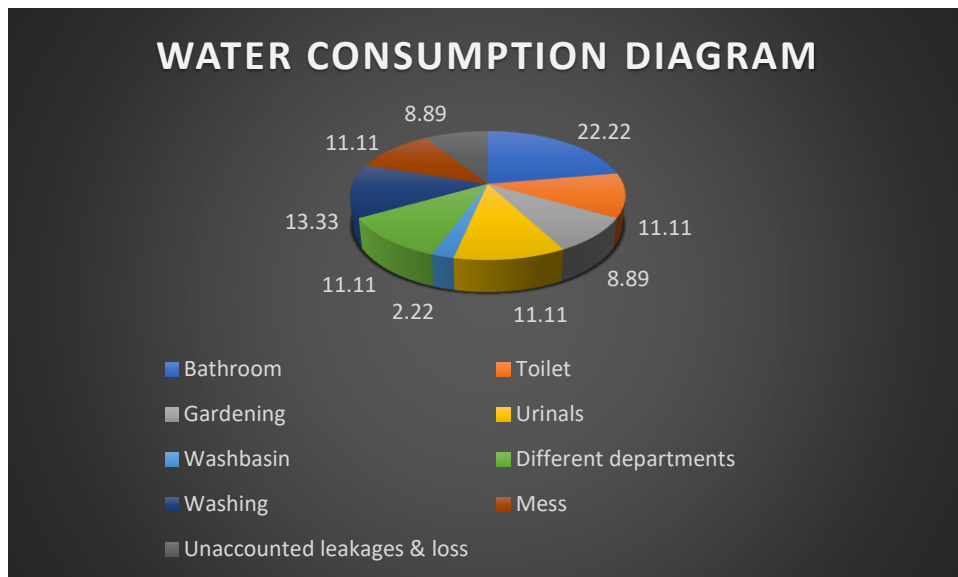


### 1.11.7 Water consumption in the University

From the data collected for the water audit of Gangadhar Meher University, the water distribution and water consumption pattern are noticed as follows for daily consumption of 4.5 lakhs liter of water.

#### *Yearly Average Water Consumption at Gangadhar Meher University*

Sr. No.	Sector	Total Daily Use (in liter)	Total Daily Use (in KL)	Total Monthly Use (in KL)	Total Yearly Use for 9 months (in KL)	Percentage
1	Bathroom	100000	100	3000	27000	22.22
2	Toilet	50000	50	1500	13500	11.11
3	Gardening	40000	40	1200	10800	8.89
4	Urinals	50000	50	1500	13500	11.11
5	Washbasin	10000	10	300	2700	2.22
6	Different departments	50000	50	1500	13500	11.11
7	Washing	60000	60	1800	16200	13.33
8	Mess	50000	50	1500	13500	11.11
9	Unaccounted leakages & loss	40000	40	1200	10800	8.89
<b>Total</b>		<b>450000</b>	<b>450</b>	<b>13500</b>	<b>121500</b>	<b>100.00</b>



### *Yearly Average Water Consumption at Gangadhar Meher University*

The Figure shows the total percentage of water consumed by all the sectors of GMU. The figure shows that Bathroom, Toilet, Gardening, Urinals, Washbasin & Different departments as the major sources of water utilization comprising 22.22%, 13.33%, 11.11%, 11.11%, 11.11% and 11.11% respectively. Further the loss is about 2.22% i.e., a huge in amount. So, university should install water meter for proper monitoring on water consumption.

#### **Analysis:**

1. There is no water meters installed in the university campus.
2. Water meter is recommended at the place of every water tank from where water is being distributed to all areas.

#### **Observation:**

1. Unless water is not metered, the exact consumption of water cannot be made.
2. Proper metering will be helpful in measurement, reduction of water consumption.
3. This will also reduce the consumption of energy which is being wasted in extra extraction of water.

## **1.12 Sustainable Water Practices**

### **1.12.1 Watershed Management Practices**

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

### 1.12.2 Wastewater Filtration Tank

The University has a huge campus with its administrative setup and there is a lot of wastewaters collected from different areas and other open areas which are disposed of in the tank. The university is required to construct a Mini Water Filtration Tank/ recycling on the campus. This filter house is used to filter the wastewater regularly. This water is utilized for further trees and plants in the University campus as self-filtered water throughout the year.

### 1.13 Rainwater Harvesting Units

The underground water table is decreasing day by day & minute by minute. There is no attempt to replenish the groundwater table with rainwater during the monsoon & other rainy days. Rainwater harvesting is the simple collection or storing of water through scientific techniques from the areas where the rain falls. It involves the utilization of rainwater for domestic or agricultural purposes. The method of rainwater harvesting has been in practice since ancient times. It is as far from the best possible way to conserve water and awaken society towards the importance of water. The method is simple and cost-effective too. It is especially beneficial in the areas, which face the capacity 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 Rainwater Harvesting proves to be the most effective way to conserve water. We can collect the rainwater into the tanks and prevent it from flowing into drains and being wasted. It is practiced on a large scale in metropolitan cities. Rainwater harvesting comprises the storage of water and water recharging through the technical process.

- Non-teaching staff or peons in the concerned section should take responsibility for monitoring the overflow of water tanks.
- A Large amount of water is wasted during the practical process in science laboratories. Designs of small water recycling systems help to reuse water.
- Producing distilled water in the laboratories required a large amount of water to the distillate. To reduce 1 liter of distilled water required more than 33 liters of water. To avoid more wastage, the University should design a common distillation plant for the Science Department.
- Reduce chemical waste formation in the Chemistry laboratory; adopt the principles of green chemistry to reduce chemical waste.
- Pipes, overhead tanks, and plumbing systems 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.
- As University is already having multiple units of Rainwater Harvesting Units. It will certainly add value to meet the mission of water conservation. And help in increasing the ground water table.

#### Analysis:

1. There is no RWH pit in the whole University campus, although there is about 70% of area

where rain water directly percolates in ground.

2. Approximately all the buildings are having rainwater pipes, good connecting drains. Only RWH pits are required

**Observation:**

1. Provide & construct 2-3 RWH pit and connect all RWH pipe through that, so that water coming from RWP should properly go into ground water.
2. All building roofs to be properly cleaned from dry leaves & other debris before monsoon rains.
3. All rainwater pipes should be properly repaired before monsoon.
4. All drains from RWP to RWH should be properly repaired & debris in the drain to be removed.

## 2.0

## Air Quality Audit

### 2.1

### National Ambient Air Quality Program (NAAQM)

Central Pollution Control Board, New Delhi initiated National Ambient Air Quality Monitoring program in the year 1984 to get a 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 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 Repairable Suspended Particulate Matter (RSPM/PM<sub>10</sub>) have been identified for regular monitoring at three locations. Monitoring of pollutants has been carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) as per CPCB monitoring protocol. GMU monitors air pollution regularly under the National Ambient Air Quality Monitoring Program, Central Pollution Control Board, New Delhi.

The objectives of air quality standards are:

- To indicate the levels of air quality necessary with an adequate margin of safety to protect the public.
- health, vegetation, and property.
- To assist in establishing priorities for abatement and control of pollutant level.
- To provide uniform yardstick for assessing air quality at national level.
- To indicate the need and extent of the monitoring programs.

City	Sambalpur
State	Odisha
Location	20° 40' N and 22° 11' N latitude, 82° 39' E and 85° 15' E longitude
Area	6,702 km <sup>2</sup>
Population	10,41,099 (According to census 2011)



<p>Climate</p>	<p>Sambalpur, Odisha has a tropical savanna climate (Köppen Aw), with hot, humid summers and mild, dry winters. The city experiences a monsoon season from June to September, during which time it receives a significant amount of rainfall.</p> <p>The average annual temperature in Sambalpur is 27.0 °C (80.5 °F). The hottest month is May, with an average temperature of 33.5 °C (92.3 °F). The coldest month is January, with an average temperature of 19.0 °C (66.2 °F).</p> <p>The average annual rainfall in Sambalpur is 1539.4 mm (60.6 in). The wettest month is August, with an average rainfall of 345.4 mm (13.6 in). The driest month is January, with an average rainfall of 4.0 mm (0.2 in).</p> <p>Here is a more detailed breakdown of the climate of Sambalpur, Odisha by season:</p> <p><b>Summer (March to May):</b> The summers in Sambalpur are hot and humid, with temperatures often exceeding 40 °C (104 °F). The humidity can be very oppressive, especially during the monsoon season.</p> <p><b>Monsoon (June to September):</b> Sambalpur experiences a heavy monsoon season from June to September. During this time, the city receives a significant amount of rainfall, which can lead to flooding.</p> <p><b>Winter (October to February):</b> The winters in Sambalpur are mild and dry, with temperatures ranging from 15 to 25 °C (59 to 77 °F). The humidity is also lower during the winter months.</p> <p>The best time to visit Sambalpur is during the winter months, when the weather is mild and pleasant. However, if you are interested in experiencing the monsoon season, then you should visit during the summer months.</p>
<p>Geography</p>	<p>Sambalpur is a city in the western part of Odisha, India. It is the headquarters of Sambalpur district. The city is located on the banks of the Mahanadi River, the longest river in Odisha.</p> <p>Sambalpur is surrounded by hills on three sides and the Mahanadi River on the fourth side. The city is located at an elevation of 150.75 meters above sea level.</p> <p>The climate of Sambalpur is tropical savanna, with hot and humid summers and mild and dry winters. The city experiences a monsoon season from June to September, during which time it receives a significant amount of rainfall.</p> <p>The average annual temperature in Sambalpur is 27.0 °C (80.5 °F). The hottest month is May, with an average temperature of 33.5 °C (92.3 °F). The coldest month is January, with an average temperature of 19.0 °C (66.2 °F).</p> <p>The average annual rainfall in Sambalpur is 1539.4 mm (60.6 in). The</p>

	<p>wettest month is August, with an average rainfall of 345.4 mm (13.6 in). The driest month is January, with an average rainfall of 4.0 mm (0.2 in).</p> <p>The soil in Sambalpur is mostly alluvial and sandy loam. The vegetation is mostly tropical deciduous forest. The major crops grown in the district are rice, wheat, sugarcane, and oilseeds.</p> <p>Sambalpur is a major industrial center in Odisha. The city has a number of industries, including textile mills, sugar mills, and rice mills. Sambalpur is also a major center for education and research. The city has several universities and colleges.</p> <p>Sambalpur is a popular tourist destination. The city is home to a number of historical and religious sites, including the Hirakud Dam, the Samaleswari Temple, and the Budharaja Temple. Sambalpur is also known for its handicrafts, including the Sambalpuri sari.</p>
Industries	<p>The major industries in Sambalpur, Odisha are:</p> <p><b>Aluminum:</b> Sambalpur is a major producer of aluminum in India. The city is home to the largest aluminum smelter in Asia, operated by Hindalco Industries Limited.</p> <p><b>Steel:</b> Sambalpur is also a major producer of steel. The city is home to several steel plants, including the Bhushan Steel Plant and the Jindal Steel Plant.</p> <p><b>Power:</b> Sambalpur is a major producer of power. The city is home to several power plants, including the Hirakud Dam Power Station and the Talcher Thermal Power Station.</p> <p><b>Textiles:</b> Sambalpur is known for its handloom textiles, particularly the Sambalpuri sari. The city has a number of textile mills and weaving units.</p> <p><b>Food processing:</b> Sambalpur is a major center for food processing. The city has a number of rice mills, sugar mills, and oil mills.</p> <p><b>Other industries:</b> Other industries in Sambalpur include cement, paper, and chemicals.</p> <p>In addition to these major industries, Sambalpur also has a number of small and medium-scale enterprises (SMEs). SMEs play an important role in the economy of Sambalpur, providing employment and generating income.</p>
Air Quality Stations	1 (PHED Office, Modipara)
Air Quality Trend	According to the Central Pollution Control Board (CPCB), the average annual PM2.5 concentration in Sambalpur has decreased by 13% between 2016 and 2022. This is a significant improvement, but the PM2.5 concentration is still above the WHO's safe limit of 10 µg/m <sup>3</sup> .

## 2.2 Sulphur dioxide (SO<sub>2</sub>):

SO<sub>2</sub> is the chemical compound produced by volcanoes and in various industrial processes and is also a precursor to particulates in the atmosphere.

## 2.3 Oxides of Nitrogen (NO<sub>x</sub>):

Oxides of nitrogen are a generic term for a group of highly reactive gases that contain nitrogen and oxygen in varying amounts. NO<sub>x</sub> is emitted as nitrogen oxide (NO) which is rapidly oxidized to more toxic nitrogen dioxide (NO<sub>2</sub>). Nitrogen dioxide (NO<sub>2</sub>) is a reddish-brown toxic gas with a characteristic sharp, biting odor and is a prominent air pollutant.

## 2.4 Carbon monoxide (CO):

CO poisoning occurs when carbon monoxide builds up in your bloodstream. When too much carbon monoxide is in the air, your body replaces the oxygen in your red blood cells with carbon monoxide. This can lead to serious tissue damage, or even death. Carbon monoxide is a colorless, odorless, tasteless gas produced by burning gasoline, wood, propane, charcoal, or other fuel. Improperly ventilated appliances and engines, particularly in a tightly sealed or enclosed space, may allow carbon monoxide to accumulate to dangerous levels.

## 2.5 Carbon Dioxide (CO<sub>2</sub>):

Carbon dioxide (CO<sub>2</sub>) is an important heat-trapping gas, or greenhouse gas, that comes from the extraction and burning of fossil fuels (such as coal, oil, and natural gas), from wildfires, and from natural processes like volcanic eruptions.

Since the beginning of industrial times (in the 18th century), human activities have raised atmospheric CO<sub>2</sub> by 50% – meaning the amount of CO<sub>2</sub> is now 150% of its value in 1750. This is greater than what naturally happened at the end of the last ice age 20,000 years ago.

The animated map shows how global carbon dioxide has changed over time. Note how the map changes colors as the amount of CO<sub>2</sub> rises from 365 parts per million (ppm) in 2002 to over 400 ppm currently. (“Parts per million” refers to the number of carbon dioxide molecules per million molecules of dry air.) These measurements are from the mid-troposphere, the layer of Earth's atmosphere that is 8 to 12 kilometers (about 5 to 7 miles) above the ground.

## 2.6 Formaldehyde (HCHO) As a Hazardous Air Pollutant:

Formaldehyde (HCHO) is the most important carcinogen in outdoor air among the 187 hazardous air pollutants (HAPs) identified by the U.S. Environmental Protection Agency (EPA), not including ozone and particulate matter. However, surface observations of HCHO are sparse and the EPA monitoring network could be prone to positive interferences. Here we use 2005–2016 summertime HCHO column data from the OMI satellite instrument, validated with high-quality aircraft data and oversampled on a 5 × 5 km<sup>2</sup> grid, to map surface air HCHO concentrations across the contiguous U.S. OMI-derived summertime HCHO values are converted to annual averages using the GEOS-Chem chemical transport model. Results are in good agreement with high-quality summertime observations from urban sites (–2% bias,  $r = 0.95$ ) but a factor of 1.9 lower than annual means from the EPA network. We thus estimate that up to 6600–12 500 people in the U.S. will develop cancer over their lifetimes by exposure to outdoor HCHO. The main HCHO source in the U.S. is atmospheric oxidation of biogenic isoprene, but the corresponding HCHO yield decreases as the concentration of nitrogen oxides (NO<sub>x</sub> ≡ NO + NO<sub>2</sub>) decreases. A GEOS-Chem sensitivity simulation indicates that HCHO levels would decrease by 20–30% in the absence of U.S. anthropogenic NO<sub>x</sub> emissions. Thus, NO<sub>x</sub> emission controls to improve ozone air quality have a

significant benefit in reducing HCHO-related cancer risks.

## 2.7 Total Volatile Organic Compounds (TVOC)

**Definition of TVOC** There are different classifications of Total Volatile Organic Compounds (TVOC). Most used is the World Health Organization (WHO) definition<sup>1</sup>, which differentiates the volatility (or boiling point) of organic compounds to define Very Volatile Organic Compounds (VVOCs), Volatile Organic Compounds (VOC) and Semi-Volatile Organic Compounds (SVOCs). This usually involves the molecular length of the carbon structure, i.e., the number of carbon atoms in the chemical formula. The summation of all VOCs is called the Total Volatile Organic Compounds (TVOC). The volume of gas per classification and the sum of all gases (TVOC) are important reflections of the relevant organic compounds found in indoor air. Classifications of Volatile Organic Compounds

Class Name	Typical Boiling Point [°C]
VVOC Very Volatile Organic Compound	< Typical
VOC Volatile Organic Compound	0 to (50 — 100)
SVOC Semi Volatile Organic Compound	(240 — 260)
TVOC Total Volatile Organic Compounds	(380 — 400)

Sum of all TVOC as an Indicator for Indoor Air Quality compounds. The TVOC is considered an important indicator for indoor hygiene and indoor air quality (IAQ). In addition to serious health concerns, there is the psychological aspect: homes, offices, and other environments that smell clean typically seem more welcoming than areas with foul odors caused by organic compounds.

**Common Volatile Organic Compounds in Indoor Spaces and their Sources** Volatile organic compounds are pervasive both outdoors and indoors. Depending on the interior decoration and usage, a room might be polluted with different organic compounds at the same time. Many volatile organic compounds have a chemical similar structure, which makes it difficult or sometimes impossible to distinguish between these in a VOC gas mixture. More information on detection of the TVOC can be found in Renesas' Application Note – TVOC Sensing.

Contribute to Poor Air Quality	Chemical	Examples	Source
Alkanes	n Butane, n Pentane, n Hexane, n n-Octane, Cyclohexane	Heptane, Aerosol spray products for some paints, cosmetics, automotive exhaust products, leather treatments, paint thinner, oil based paints, spot removers, aerosol/liquid insect pest products, mineral spirits, furniture polishes	Alkenes Isobutylene, Ethylene Solvents, fruit ripening, pest control, rubber production
Aromatics	BTEX (Benzene, Toluene, Ethylbenzene, Xylene), Dichlorobenzene, Naphthalene, Styrene	Tobacco smoke, moth balls, moth flakes, deodorizers, air fresheners, automotive exhaust products, paint thinner, oil based paints, aerosol/liquid insect pest products, mineral spirits, furniture polishes, rigid foam products, contact cement, model cement, tar board, plasticizer.	

## 2.8 Particulate Matter (PM):

PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

Particle pollution includes:

- a) **PM<sub>10</sub>**: inhalable particles, with diameters that are generally 10 micrometers and smaller; and

- b) **PM<sub>2.5</sub>**: fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.
- c) How small is 2.5 micrometers? Think about a single hair from our head. The average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle.

### 2.8.1 Particulate Matter 10 (PM<sub>10</sub>)

Using a nationwide network of monitoring sites, EPA has developed ambient air quality trends for particle pollution, also called Particulate Matter (PM). PM<sub>10</sub> describes inhalable particles, with diameters that are generally 10 micrometers and smaller. Under the Clean Air Act, EPA sets and reviews national air quality standards for PM. Air quality monitors measure concentrations of PM throughout the country. EPA, state, tribal and local agencies use that data to ensure that PM in the air is at levels that protect public health and the environment. Nationally, average PM<sub>10</sub> concentrations have decreased over the years.

### 2.8.2 Particulate Matter 2.5 (PM<sub>2.5</sub>)

Fine particulate matter (PM<sub>2.5</sub>) is an air pollutant that is a concern for people's health when levels in air are high. PM<sub>2.5</sub> are tiny particles in the air that reduce visibility and cause the air to appear hazy when levels are elevated. Outdoor PM<sub>2.5</sub> levels are most likely to be elevated on days with little or no wind or air mixing. The New York State Departments of Health (DOH) and Environmental Conservation (DEC) alert the public by issuing a PM<sub>2.5</sub> Health Advisory when PM<sub>2.5</sub> concentrations in outdoor air are expected to be unhealthy for sensitive groups.

The term fine particles, or particulate matter 2.5 (PM<sub>2.5</sub>), refers to tiny particles or droplets in the air that are two- and one-half microns or less in width. Like inches, meters and miles, a micron is a unit of measurement for distance. There are about 25,000 microns in an inch. The widths of the larger particles in the PM<sub>2.5</sub> size range would be about thirty times smaller than that of a human hair. The smaller particles are so small that several thousands of them could fit on the period at the end of this sentence.

Particles in the PM<sub>2.5</sub> size range can travel deeply into the respiratory tract, reaching the lungs. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose, and shortness of breath. Exposure to fine particles can also affect lung function and worsen medical conditions such as asthma and heart disease. Scientific studies have linked increases in daily PM<sub>2.5</sub> exposures with increased respiratory and cardiovascular hospital admissions, emergency department visits and deaths. Studies also suggest that long term exposure to fine particulate matter may be associated with increased rates of chronic bronchitis, reduced lung function and increased mortality from lung cancer and heart disease. People with breathing and heart problems, children and the elderly may be particularly sensitive to PM<sub>2.5</sub>.

### 2.9 Ozone (O<sub>3</sub>):

Ozone is a pale blue gas, soluble in water and nonpolar solvents with a specific sharp odor somewhat resembling chlorine bleach. Ozone is a secondary pollutant formed in the atmosphere by the reaction between oxides of nitrogen and volatile organic compounds (VOCs) in the presence of sunlight. Peak O<sub>3</sub> levels occur typically during the warmer times of the year.

### 2.10 Lead (Pb):

Lead is a bright silvery soft, dense, ductile, highly malleable, bluish-white metal that has poor electrical conductivity and is highly resistant to corrosion.



## 2.11

## Ambient Air Quality

In the Gangadhar Meher University Campus Area  
Presence of Pollution in Air Quality Testing at GMU, Sambalpur on  
09<sup>th</sup>, 10<sup>th</sup> & 11<sup>th</sup> 2023

Sr. No.	LOCATION	CARBON MONOXIDE (CO)	CARBON DIOXIDE (CO <sub>2</sub> )	FORMALDEHYDE (HCHO)	TOTAL VOLATILE ORGANIC COMPOUNDS (TVOC)
1	Admin Building	18	532	0.027	0.3
2	New Ekalavya Hostel	11	521	0.02	0.2
3	Academic Annex building	12	523	0.021	0.2
4	Canteen Area	12	523	0.021	0.2
5	Lecture Gallery - 2	17	533	0.027	0.3
6	Library	10	521	0.02	0.2
7	Admin Reception	12	523	0.021	0.2
8	Playground	9	519	0.018	0.2
9	School of Education	8	514	0.017	0.2
10	Ladies Hostel (LH-1)	9	519	0.018	0.2
11	Old Ekalavya Ladies Hostel	15	530	0.025	0.3
12	Indumati Ladies Hostel (LH-3)	13	526	0.023	0.2
13	Residential Area (outdoor)	11	521	0.02	0.2

Sr. No.	LOCATION	CARBON MONOXIDE (CO)	CARBON DIOXIDE (CO <sub>2</sub> )	FORMALDEHYDE (HCHO)	TOTAL VOLATILE ORGANIC COMPOUNDS (TVOC)
14	Residential Area (indoor)	8	517	0.017	0.2
15	Trust fund Boys Hostel	18	537	0.028	0.3

## 2.12 AQI Chart

Sr. NO.	LOCATION	AQI	PM 1.0	PM 2.5	PM 10	PC > 0.3	PC > 1.0	PC > 5.0	PC > 0.5	PC > 2.5	PC > 10
1	Admin Building	96	36	53	66	7488	368	12	1694	34	4
2	New Ekalavya Hostel	48	33	48	58	11480	545	14	2869	47	5
3	Academic Annex building	58	38	58	68	10296	519	12	2560	43	3
4	Canteen Area	52	34	52	66	9023	421	11	2151	37	3
5	Lecture Gallery - 2	45	30	45	58	7531	372	13	1798	35	5
6	Library	63	43	63	74	11570	549	14	2893	49	5
7	Admin Reception	56	37	56	67	10286	493	90	2553	39	3
8	Playground	48	36	53	64	9716	457	6	2343	32	2
9	School of Education	56	38	56	68	10572	496	9	2519	29	3
10	Ladies Hostel (LH-!)	62	41	62	71	11228	522	9	2740	35	3
11	Old Ekalavya Ladies Hostel	58	38	58	70	10504	499	11	2500	32	3

Sr. NO.	LOCATION	AQI	PM 1.0	PM 2.5	PM 10	PC > 0.3	PC > 1.0	PC > 5.0	PC > 0.5	PC > 2.5	PC > 10
12	Indumati Ladies Hostel (LH -3)	58	38	58	69	10687	489	7	2498	37	3
13	Residential Area (outdoor)	56	38	56	67	10352	490	9	2672	42	2
14	Residential Area (indoor)	60	40	60	71	10720	537	11	2642	36	4
15	Trust fund Boys Hostel	66	43	66	77	11502	590	12	2874	44	4

### Analysis:

1. Except Lecture Gallery II & New Ekalavya Hostel, AQI of the whole University campus area is more than 50.
2. Particulate Matters (PM) are also within the limits. PM<sub>10</sub> (PM<sub>2.5</sub>), are well within limits.
3. Different gases (CO, CO<sub>2</sub>, HCHO, TVOC) are well within limits.

### Observation:

1. Admin. building need to be checked for **AQI as 96** is quite higher than other places.
2. The campus should be highlighted as **smoke free, Pollution free, No single use plastic, Garbage free, zero waste area** as all these parameters are being complied with in the Campus. Highlights should be through Banners, Posters & such other awareness's.

New Ekalavya Hostel & Lecture Gallery – 2 have shown AQI less than 50 & it comes under excellent AQI. Except for these two areas AQI has been found to be more than 50. In these buildings, need to installation of more Exhaust fan. Near the university campus few meters away national highway air quality is worse than the university's campus area. Overall university maintain good air quality.

**NOTE:** Total 14 parameters of Ambient Air Quality was checked at 15 locations in whole campus area and at the outside the campus area for comparatively study. Except for New Ekalavya Hostel & Lecture Gallery – 2 area rest of all AQI was high.

The Central Pollution Control Board, New Delhi has set guidelines to monitor and analyze the air pollution quality parameters. The trees covered on the campus are the leading sources to absorb CO<sub>2</sub> and release enough fresh O<sub>2</sub> across the University Campus. The result shows that GMU Campus's air quality status is good as compared to other locations. It is identified that the university campus is a green campus. University campus observed minimum air pollution as compared to other Ambient Air Pollution Centers located in different parts of the city. More than 50% of the area of the University is full of lush greenery which has contributed much for its achievement over such an excellent AQI.

## 2.13

## Air Quality Field Test



Air Quality Test of G.M. University, Sambalpur

## 3.0 Waste Management

### 3.1 Objectives:

The overall objectives of the waste management assessment are summarized below:

- (i) To assess the activities involved for the proposed and determine the type, nature, and estimated volumes of waste to be generated.
- (ii) To identify any potential environmental impacts from the generation of waste at the site.
- (iii) To recommend appropriate waste handling and disposal measures / routings in accordance with the current legislative and administrative requirements; and
- (iv) To categorize waste material where practicable (inert material / waste fractions) for disposal considerations i.e., public filling areas / landfill.

### 3.2 Solid Waste Management:

To reduce waste at university, students and staff are educated on proper waste management practices through lectures, advertisement on notice boards, displaying slogan boards in the campus. Waste is collected daily from various sources and is separated into dry and wet waste.

#### 3.2.1 Campus solid waste management program

The main objectives of SWM are the maintenance of clean and hygienic conditions and reduction in the quantity of solid waste (SW), which is disposed of in the sanitary landfill facility (SLF) of the area after recovery of material and energy from it. Student participation in waste management will play a very important role as they will also spread awareness programs along with their duty towards cleanliness.

#### 3.2.2 Producing less wastes

- Students can utilize their belongings like paper, pencils, and pens to the maximum and produce less amounts of wastes.
- Keeping classrooms and households clean: The students can keep their classrooms and houses clean by not littering things here and there.

#### 3.2.3 Here are the methods of solid waste disposal and management

- Solid Waste Open Burning.
- Sea dumping process.
- Solid wastes sanitary landfills.
- Incineration method.
- Composting process.
- Disposal by Ploughing into the fields.
- Disposal by hog feeding.
- Salvaging procedure.
- Benefits of waste management
- Reducing waste will not only protect the environment but will also save on costs or reduce expenses for disposal. In the same way, recycling and/or reusing the waste that is produced benefits the environment by lessening the need to extract resources and lowers the potential for contamination.



## The 7 principles of waste management-



### 3.2.4 The 7 R's of Recycling

- Recycle.
- Refuse.
- Reduce.
- Reuse.
- Repair.
- Re-gift.
- Recover.

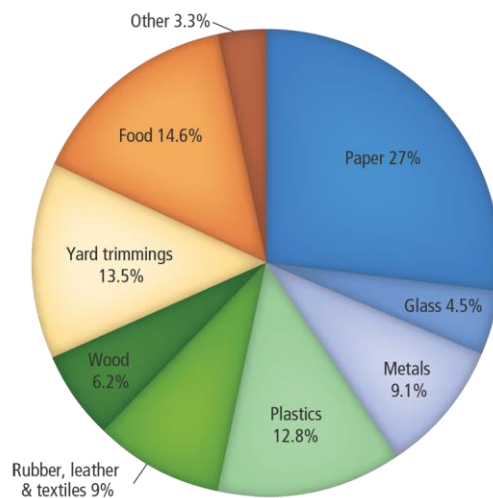
### 3.3 Municipal Solid Waste

Top 3 items in municipal solid waste

In 2018, about 146.1 million tons of MSW were land filled. Food was the largest component at about 24 percent. Plastics accounted for over 18 percent, paper and paperboard made up about 12 percent, and rubber, leather and textiles comprised over 11 percent. Other materials accounted for less than 10 percent each.

Solid Waste Management may be defined as the discipline associated with the control of generation, collection, storage, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other ...

The major sources of municipal solid waste



Municipal Solid Waste (MSW)—more commonly known as trash or garbage—consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses.

### 3.4 Plastic Waste

India has banned manufacture, import, stocking, distribution, sale and use of identified single use plastic items, which have low utility and high littering potential, all across the country from July 1, 2022.

Recently, the Ministry of Environment, Forest, and Climate Change announced the Plastic Waste Management (Amendment) Rules, 2022, which notified the instructions on Extended Producer Responsibility (EPR) for plastic packaging.

#### 3.4.1 Centralized Online Portal

- A. The government has also called for establishing a centralized online portal by Central Pollution Control Board (CPCB) for the registration as well as filing of annual returns by producers, importers and brand-owners, plastic waste processors of plastic packaging waste by 31st March 2022.
- B. It would act as the single point data repository with respect to orders and guidelines related to implementation of EPR for plastic packaging under Plastic Waste Management Rule, 2016.

#### 3.4.2 Environmental Compensation

Environmental compensation will be levied based upon polluter pays principle, with respect to non-fulfillment of EPR targets by producers, importers, and brand owners, for the purpose of protecting and improving the quality of the environment and preventing, controlling, and abating environment pollution. The Polluter Pays Principle imposes liability on a person who pollutes the environment to compensate for the damage caused and return the environment to its original state regardless of the intent.

#### 3.4.3 Committee to Recommend Measures

A committee constituted by the CPCB under the chairmanship of CPCB chairman will recommend measures to the environment ministry for effective implementation of EPR, including amendments to Extended Producer Responsibility (EPR) guidelines.

## 3.5 Construction & Demolition waste

The Bureau of Indian Standards has allowed the use of concrete made from recycled material and processed C&D waste. The Construction and Demolition Waste Rules and Regulations, 2016 have mandated reuse of recycled material. Even the Swachh Bharat Mission has recognized the need for C&D waste management.

### 3.5.1 Construction and demolition waste management

Construction and demolition waste is generated whenever any construction/demolition activity takes place, such as, building roads, bridges, flyover, subway, remodeling etc. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc.

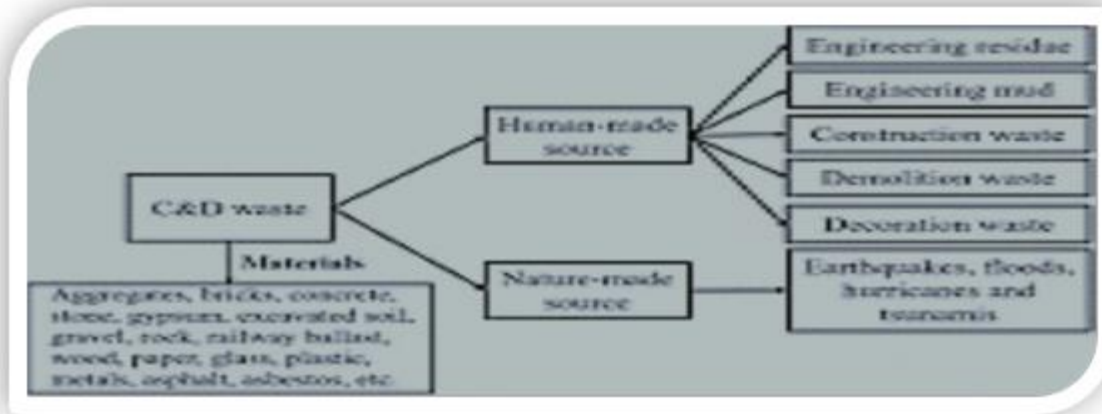
C&D waste includes bricks, tiles, stone, soil, rubble, plaster, drywall or gypsum board, wood, plumbing fixtures, non-hazardous insulating material, plastics, wallpaper, glass, metal (e.g., steel, aluminum), asphalt, etc.

At GMU, construction and demolition waste were found at many places. So, C&D waste can be used in landfill & developing sitting area and architecture landscaping.



Construction & Demolition Wastes are using to develop sitting area under the tree

Recycling construction and demolition waste is profitable and environmental way to produce aggregates and reuse valuable materials that would otherwise be disposed. Processing the waste



near the worksites also reduces the need for truck transportation resulting in lower logistics costs. the impact of construction and demolition waste on the environment.

The environmental impacts caused by C&D waste mainly include land space consumption, landfill depletion, energy and non-energy resource consumption, resource depletion, air pollution, noise pollution, water pollution, etc. (Akanbi et al., 2018).

### 3.6 SOLID WASTE AUDIT

Solid waste is the unwanted or useless solid material generated from human activities in a residential, industrial, or commercial area. Solid waste management reduces or eliminates the adverse impact on the environment and human health. A number of processes are involved in efficiently managing waste for an organization. It is necessary to manage the solid waste properly to reduce the load on the 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 solid waste properly to reduce the load on the 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 GMU campus. This report will help further solid waste management and to go for green campus development.

#### 3.6.1 Generation of solid waste in Gangadhar Meher University, Sambalpur

GMU campus solid waste data is collected from all the building areas and the same is directly handed over to the Municipalities' Bin for further segregation and recycling purposes. There are different types of waste that are recorded such as paper waste, plastic waste, construction waste, glass waste, etc. However biodegradable waste is recycled through the vermicomposting process. The daily rate of waste generation has-been increasing in recent time reaching up to an estimated amount of about 3600 Kg per month (tpd) during peak academic sessions and the minimum amount generated during the lean period is about 1900 Kg per month (tpd).

The wastes generated in the campus include (i) kitchen wastes, (ii) wastes from construction sites, (iii) liquid waste (residential and eateries), (iv) sewage and sludge, (v) biomedical waste, (vi) laboratory chemical wastes, (vi) Plastic wastes, (vii) cans and bottles; (viii) damaged or spoiled laboratory glassware, (ix)Unused tools and machinery including battery, (xi) papers including packaging materials (xii) electronics waste (xiii) garden leaves and (xiv) sweeping litters, etc.

Proper segregation of waste can fetch more revenue to the University.

#### 3.6.2 Status of solid waste generation in Gangadhar Meher University, Sambalpur

The University is committed to ensuring that all forms of wastes generated are handled based on the RRRR (Reduce, Reuse, Recycle, Recover) principles following appropriate source segregation



protocols including safe disposal of bio, medical and hazardous wastes. There are studies from time to time to estimate the amount and nature of waste, particularly solid waste which indicates the increasing trend of the volume. A preliminary survey reveals the domination of biodegradable components (volume basis) over the non-biodegradable counterparts on the campus. The students' hostels share the highest amount of solid waste mostly dominated by food/kitchen wastes (substantial amount of papers, plastics, metals are also seen with waste also generated in hostels) followed by residential areas, eateries including shopping complex and offices including academic buildings, construction sites (occasionally), open areas including gardens and roads.

Gangadhar Meher University, Sambalpur is generating lots of kitchen waster i.e., can be used in vermicomposting.

## **3.7 E-Waste**

### **3.7.1 Importance of e-waste management**

It's critical to keep electronic waste out of landfills. The EPA has stated that e-waste is dangerous when improperly disposed of. Electronic devices are composed of toxic substances and heavy metals. Materials such as chromium, cadmium, mercury, and lead can leach into the soil contaminating the air and waterways. New Gazette Notification w.e.f. from 1st April 2023.

### **3.7.2 Five Reasons Why E-Waste Recycling is Important**

Everyone has one. That box, drawer or shopping bag in a closet filled with old cell phones, obsolete chargers, broken tablets, and defunct MP3 players. It's our personal pile of electronic waste. According to government agencies, these piles are getting bigger, forcing us to consider why e-waste recycling is important.

Recycling electronic waste (e-waste, sometimes called e-scrap has become an increasingly important environmental issue as the useful life of electronic devices becomes shorter and shorter and the list of electronic gadgets we use becomes longer and longer. E-waste recycling benefits are numerous and the need to address these items in the solid waste stream is becoming more urgent. There are many factors to consider when evaluating electronics recycling, but here are the most significant reasons why e-waste recycling is important.

### **3.7.3 It's critical to keep electronic waste out of landfills**

The EPA has stated that e-waste is dangerous when improperly disposed of. Electronic devices are composed of toxic substances and heavy metals. Materials such as chromium, cadmium, mercury, and lead can leach into the soil contaminating the air and waterways. EPA estimates there are about 60 million tons of e-waste per year globally. Recycling this material will save landfill space. For these reasons, there are numerous state laws that now ban e-waste in landfills.

### **3.7.4 Electronic products**

These are valuable materials such as precious metals like gold, silver, and platinum along with copper, aluminum, plastic, and glass. Through the recycling process, these materials can be reclaimed. Most electronic devices are nearly 100 percent recyclable. It would be poor stewardship to landfill these materials.

### **3.7.5 Reclaiming valuable materials**

Reclaiming valuable materials from the recycling process means there will be decreased demand for new raw materials. This will help conserve important natural resources. According to the EPA, one metric ton of circuit boards contains 800 times the amount of gold mined from one metric ton of ore.

### 3.7.6 Using recycled material

Using recycled material will also help reduce greenhouse gas emissions produced when manufacturing or processing new products known as “virgin material.” The more recycled material is available, the lower the demand for virgin material.

### 3.7.7 Discarded electronic devices

Discarded electronic devices can also be kept out of the landfill if they are refurbished, reused, and donated to a worthy cause. A quick Google search will provide a list of organizations in most areas that rebuild old electronics and provide them to those who otherwise would go without. “Reuse” is an important component of keeping material out of the waste stream.

GMU is planning to segregate its E - Waste for further disposal to recyclers. For this they have already initiated the process. Also, in future they have agreed to file E-Waste return also.



E-Waste at G.M. University ready to dispose off

## 3.8 Single use Plastic restriction in campus Area

From 1<sup>st</sup> July 2022, single use plastic is banned all over India. It is expected from the University that posters and handbills to be pasted around the campus and those who find throwing of single use plastic in campus area to be fined. Student groups are encouraged to take active participation and watch and educate all that not to throw such plastic in the campus area. This can be achieved through awareness and participation only. It is recommended to put slogans for NO PLASTIC ZONE or such different types of slogans. A competition among the students shall be conducted to give different suggestions for Slogans. The best selected Slogans to be suitably rewarded or certificate to be issued to that student. Plastics are a good source of fuel also.

## 3.9 Hazardous Waste Management

### 3.9.1 The Importance of Chemical Lab Waste Disposal for Colleges and Universities

To protect the safety and health of your university and its surrounding environment and community, it is required to implement proper chemical waste management. State and federal regulations require that all generators of chemical waste follow the correct disposal procedures and waste management in their facilities. Millions of dollars in fines have been levied against universities that do not comply with the EPA's environmental waste management procedures in the United States.

The United States Environmental Protection Agency (EPA) defines chemical waste. Examples of some chemical waste material include:



- By-products created from educational and research experiments.
- Surplus and unused reagent grade chemicals.
- Any items that have been contaminated by chemicals.
- Batteries.
- Used oils.
- Items containing mercury.
- Pesticides.
- Chemically contaminated sharps.
- Contaminated needles, razor blades, pipette tips, pipettes, syringes.
- Fluorescent light bulbs.
- Preserved specimens.

And much more- check with your local hazardous waste disposal service for a more complete list.

### 3.9.2 Need Proper Disposal Procedures for Chemistry Lab Waste at GMU

It is the responsibility of all research and teaching staff to make sure the proper disposal of waste materials is followed according to EPA guidelines in the United States. Irresponsible or improper disposal of your chemical waste to the local refuse collection, into the atmosphere, or down the drains is forbidden by law.

The new legislation, along with increasingly strict environmental controls, makes it essential that appropriate disposal procedures are followed to avoid stiff fines being imposed on your University. These are some of the disposal methods your university should be following:

There are some materials on the EPA's 'red list' that should never be washed down your drains:

- Organo-halogen, organonitrogen pesticides, triazine herbicides, or any biocides
- Cyanides
- Compounds with the following elements- barium, beryllium, boron, chromium, cobalt, copper, lead, mercury, nickel, silver, tin, titanium, zinc
- Hydrocarbons or mineral oils
- Nitrites or fluorides
- Poisonous compounds, metal phosphides or phosphorus elements

This is a partial list of chemicals- to check with the local hazardous waste disposal service for a complete list to ensure you do not pour any dangerous chemicals down the drain.

### 3.9.3 Waste Bins and Controlled Waste Disposal

In United States, not abiding by the regulations and laws will lead to university failing an inspection when the EPA, OSHA, or RCRA perform a routine examination of campus facilities. If an inspection fails, not only will it be costly, but these inspections are disruptive and can leave the University with a negative reputation.

Any waste suitable for local garbage services, other than glass and paper is considered controlled waste. This waste includes your dirty paper, rubber, plastic, and wood and should be placed in waste bins. Waste bins should be available in all labs and collected daily through your regular cleaning services.

Each of the labs must have a container for specific wastes that are not allowed to go with normal waste bins. In one of these special containers, should have it labeled to hold all broken lab glassware, sharp objects such as glass or metals, fine powders (which should first be placed into a glass container), dirty sample tubes, and any other contaminated chemicals that are not needles or syringes.

The lab-controlled waste containers are required to be emptied on a regular basis and should never be allowed to overflow. It should never be allowed to place any glass, fine powder, or sharp metal into a standard lab waste bin. Before placing bottles into the waste container, remove their tops, and make sure there is no detectable smell of chemicals coming from the bottles.



Dustbin installed at various places

### 3.9.4 Risks of Improperly Handled Lab Waste

Exposure to toxic chemicals, reactions, explosions, fires, or spills are all possible risks when the chemical waste is not disposed of and handled properly. These possible situations pose threats to staff and students as well as other people in the area.

People's lives can be at risk, or the possibility of serious injuries is present from not complying with state and federal laws when it comes to managing your universities' hazardous waste. University administration should check with local hazardous waste disposal service, which is authorized to move and touch lab waste in a manner that minimizes potential risks to your staff and students.

### 3.9.5 Environmental Hazards from Improperly Handled Lab Waste

Students and staff members are not the only ones subject to risks from mishandled lab waste. The environment can also suffer serious consequences. Leachate, contamination, and pollution are all negative effects from hazardous waste, and will seriously leave a mark on the environment if the University does not handle them properly. When waste from the labs is eventually removed from the facility, it not only affects individuals such as staff and students, but it can also ultimately affect society. *Lab waste is disposed of through three routes: into the atmosphere through gaseous effluent from incineration or evaporation, into our oceans, rivers, or other waterways through sewer systems and wastewater treatment facilities, and finally into landfills.*

In labs, the workers who are generating lab waste have an obligation to consider the fate of their used materials that they've created from their work. The lab workers need to be aware of the significant impact their disposal materials will have on people outside the lab, and how they will affect the environment around university and the surrounding community.

### 3.9.6 Workers Impact Proper Lab Waste Disposal

Materials become a waste by regulatory definition or a generator's decision, and the first responsibility for it being properly disposed of is in the hands of the lab worker. These workers are in the best place to know the characteristics of the materials they have synthesized or used. It is the lab worker's responsibility to assess the risks associated with the waste and evaluate it. It is

the lab worker's choice on which strategy to handle; they must minimize or dispose of lab waste. Lab workers have numerous sources available to them to help with making the decision on how to dispose of their lab waste. It can also have them check with the local hazardous waste disposal service for guidance on how to properly dispose of dangerous lab wastes.

### 3.9.7 Risk of Serious Injuries from Mismanaged Lab Waste in Colleges/Universities

In United States the EPA has discovered forgotten chemicals in university stockrooms through routine inspections of their laboratories. They have created a pattern of hazardous waste management programs in these research labs with their waste being left, sometimes for decades, in damaged containers. Some of these containers are even labeled as 'unknown' and some chemicals have been kept in temperatures that could cause them to explode.

Laboratories in universities and medical research centers use a large variety of chemicals that perform an extensive range of work. If labs in university are not managed properly, they will endanger both the workers in the lab and the community surrounding your university. The most serious problems these mishandled lab wastes can inflict include death.

To improve chemical lab waste management, the EPA (Environmental Protection Agency) created outlines on how to properly dispose of these hazardous materials through the RCRA (Resource Conservation and Recovery Act.) They have also created workshops, encouraged self-auditing of university labs, provided compliance assistance, and in some cases, taken enforcement actions. In one case involving the University of California, the EPA located numerous violations of hazardous waste requirements, many of which the University disclosed on their own accord. The violations were stated to include more than 4,000 containers of hazardous lab waste. Some of these wastes included reactive cyanide, corrosive acid, ignitable paint, and photochemical waste.

It was reported that the University had to spend almost two million dollars and over 23,000 staff hours to complete environmental audits in forty-seven of their university facilities, their agricultural research stations, campuses, medical and vet schools, and other various facilities. The EPA did reduce the penalties for many of the violations when the university agreed to Incentives for Self-Policing.

It can now be seen the importance of proper chemical lab waste disposal at your university. Proper handling will save the facility millions of dollars trying to correct mismanagement if it is discovered by the EPA. When you routinely follow proper management, you will have no concerns when it's time for an audit of university.

It will not only save individuals and University unnecessary expenses; one will protect the soil, air, wildlife health, and water in the environment and that of the surrounding community. Regulations to dispose of lab waste properly exist to help one know how to handle your hazardous chemicals. If anyone is unsure which procedures apply to the materials in the University lab, contact the local hazardous waste disposal service, and they will help. This service can come into the lab and show how to label, store and dispose of all lab waste safely and properly.

The management of hazardous waste is a process which includes the collection, recycling, treatment, transportation, disposal, and monitoring of wastes disposal sites. In the current scenario of developing countries, hazardous wastes are often disposed directly into the environment posing health and environmental risk.

### 3.9.8 Responsibilities

- a) Hazardous-waste characteristics.
- b) Transport of hazardous waste. Transport vehicles. The manifest system.
- c) Treatment, storage, and disposal. Treatment. Surface storage and land disposal.
- d) Secure landfills.

e) Remedial action.

### 3.9.9 Procedure

Hazardous waste can be treated by chemical, thermal, biological, and physical methods. Chemical methods include ion exchange, precipitation, oxidation and reduction, and neutralization. Among thermal methods is high-temperature incineration, which not only can detoxify certain organic wastes but also can destroy them.

### 3.9.10 Objectives

Hazardous Waste Management Rules are notified to ensure safe handling, generation, processing, treatment, package, storage, transportation, use, reprocessing, collection, conversion, and offering for sale, destruction, and disposal of Hazardous Waste.

### 3.9.11 Practice adopted in India

Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016 with amendments:

Responsibilities of the occupier for management of hazardous and other wastes. -

- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely: - (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery, utilization including co-processing; (f) safe disposal.
- (2) The occupier shall be responsible for safe and environmentally sound management of hazardous and other wastes.
- (3) The hazardous and other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility.
- (4) The hazardous and other wastes shall be transported from an occupier's establishment to an authorized actual user or to an authorized disposal facility in accordance with the provisions of these rules.
- (5) The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall give to the operator of that facility, such specific information as may be needed for safe storage and disposal.
- (6) The occupier shall take all the steps while managing hazardous and other wastes to
  - (a) contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and
  - (b) provide persons working in the site with appropriate training, equipment, and the information necessary to ensure their safety.

Grant of authorization for managing hazardous and other wastes. -

- (1) Every occupier of the facility who is engaged in handling, generation, collection, storage, packaging, transportation, use, treatment, processing, recycling, recovery, pre-processing, co-processing, utilization, offering for sale, transfer or disposal of the hazardous and other wastes shall be required to make an application in Form 1 to the State Pollution Control Board and obtain an authorization from the State Pollution Control Board within a period of sixty days from the date of publication of these rules. Such application for authorization shall be accompanied with a copy each of the following documents, namely: -
  - (a) consent to establish granted by the State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974 (25 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (21 of 1981);
  - (b) Consent to operate granted by the State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974 (25 of 1974) and/or Air (Prevention and Control of Pollution) Act, 1981, (21 of 1981).

(c) in case of renewal of authorization, a self-certified compliance report in respect of effluent, emission standards and the conditions specified in the authorization for hazardous and other wastes: Provided that an application for renewal of authorization may be made three months before the expiry of such authorization: Provided further that-

(i) any person authorized under the provisions of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, prior to the date of commencement 6 (ii) of these rules, shall not be required to make an application for authorization till the period of expiry of such authorization; any person engaged in recycling or reprocessing of the hazardous waste specified in Schedule IV and having registration under the provisions of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, shall not be required to make an application for authorization till the period of expiry of such registration.

On receipt of an application complete in all respects for the authorization, the State Pollution Control Board may, after such inquiry as it considers necessary, and on being satisfied that the applicant possesses appropriate facilities for collection, storage, packaging, transportation, treatment, processing, use, destruction, recycling, recovery, pre-processing, co-processing, utilization, offering for sale, transfer or disposal of the hazardous and other waste, as the case may be, and after ensuring technical capabilities and equipment complying with the standard operating procedure or other guidelines specified by the Central Pollution Control Board from time to time and through site inspection, grant within a period of one hundred and twenty days, an authorization in Form 2 to the applicant, which shall be valid for a period of five years subject to such conditions as may be laid down therein. For commonly recyclable hazardous waste as given in Schedule IV, the guidelines already prepared by the Central Pollution Control Board shall be followed: Provided that in the case of an application for renewal of authorization, the State Pollution Control Board may, before granting such authorization, satisfy itself that there has been no violation of the conditions specified in the authorization earlier granted by it and same shall be recorded in the inspection report.

(2) The authorization granted by the State Pollution Control Board under sub-rule (2) shall be accompanied by a copy of the field inspection report signed by that Board indicating the adequacy of facilities for collection, storage, packaging, transportation, treatment, processing, use, destruction, recycling, recovery, pre-processing, co-processing, utilization, offering for sale, transfer or disposal of the hazardous and other wastes and compliance to the guidelines or standard operating procedures specified by the Central Pollution Control Board from time to time.

(3) The State Pollution Control Board may, for the reasons to be recorded in writing and after giving reasonable opportunity of being heard to the applicant, refuse to grant any authorization under these rules.

(4) Every occupier authorized under these rules, shall maintain a record of hazardous and other wastes managed by him in Form 3 and prepare and submit to the State Pollution Control Board, an annual return containing the details specified in Form 4 on or before the 30th day of June following the financial year to which that return relates.

(5) The State Pollution Control Board shall maintain a register containing particulars of the conditions imposed under these rules for management of hazardous and other wastes and it shall be open for inspection during office hours to any interested or affected person.

(6) The authorized actual user of hazardous and other wastes shall maintain records of hazardous and other wastes purchased in a passbook issued by the State Pollution Control Board along with the authorization.

(7) Handing over of the hazardous and other wastes to the authorized actual user shall be



only after making the entry into the passbook of the actual user.

Storage of hazardous and other wastes. - (1) The occupiers of facilities may store the hazardous and other wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling, recovery, pre-processing, co-processing and utilization of such wastes and make these records available for inspection: Provided that the State Pollution Control Board may extend the said period of ninety days in following cases, namely: - (i) (ii) (iii) (iv) (v)

(8) small generators (up to ten tons per annum) up to one hundred and eighty days of their annual capacity; actual users and disposal facility operators up to one hundred and eighty days of their annual capacity, occupiers who do not have access to any treatment, storage, disposal facility in the concerned State; or the waste which needs to be specifically stored for development of a process for its recycling, recovery, pre-processing, co-processing or utilization; in any other case, on justifiable grounds up to one hundred and eighty days.

### **3.9.12 TREATMENT, STORAGE AND DISPOSAL FACILITY FOR HAZARDOUS AND OTHER WASTES**

Treatment, storage, and disposal facility for hazardous and other wastes. -

(1) The State Government, occupier, operator of a facility or any association of occupiers shall individually or jointly or severally be responsible for identification of sites for establishing the facility for treatment, storage, and disposal of the hazardous and other waste in the State.

(2) The operator of common facility or occupier of a captive facility shall design and set up the treatment, storage, and disposal facility as per technical guidelines issued by the Central Pollution Control Board in this regard from time to time and shall obtain approval from the State Pollution Control Board for design and layout in this regard.

(3) The State Pollution Control Board shall monitor the setting up and operation of the common or captive treatment, storage, and disposal facility, regularly.

(4) The operator of a common facility or occupier of a captive facility shall be responsible for safe and environmentally sound operation of the facility and its closure and post closure phase, as per guidelines or standard operating procedures issued by the Central Pollution Control Board from time to time.

(5) The operator of a common facility or occupier of a captive facility shall maintain records of hazardous and other wastes handled by him in Form 3.

(6) The operator of a common facility or occupier of a captive facility shall file an annual return in Form 4 to the State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates.

## **3.10 Acid from Labs**

### **3.10.1 Disposal of Acid in a Lab**

Some of these methods are:

- (a) Recycling/reuse of chemicals.
- (b) Incineration and disposal in landfills of incineration ash.
- (c) Disposal in landfills of stabilized chemical waste, or non-hazardous waste; and
- (d) Disposal in sewers of neutralized, non-toxic chemicals.



### **3.10.2**      *How to dispose of acid solutions*

Carefully pour one-quarter to one-half-cup of the hydrochloric acid into 2 to 5 gallons of water. It's very important to always add the chemical to the water and not the water to the chemical. Pour the diluted solution down the sink, flushing with large amounts of water. Work slowly to avoid splashes.

### **3.11**        *Types of waste generated from a lab*

This waste can be broken down into a few categories: Hazardous; Clinical; Biological; Electrical; Laboratory. Reducing laboratory waste will have several benefits, saving money and reducing disposal costs while also encouraging safety in the lab.

#### **3.11.1**      *Handling and disposal of laboratory waste*

Waste disposal - disposal of laboratory wastes (guidance)

1. Disposal Procedures.
2. Wash Down Drains with Excess Water.
3. Incineration.
4. Laboratory Waste Bins and Controlled Waste.
5. Waste for Special Disposal.
6. Glass Recycling.
7. Bottles for Bulk Solvents.
8. Biohazard/Sharps Disposal - Syringes and Needles.

#### **3.11.2**      *Types of laboratory waste*

1. Clinical laboratories generate three primary types of waste: chemical waste, infectious (biohazard) waste, and pathological (large tissue) waste. This section contains information on correct disposal as well as environmental best practice for managing laboratory wastes.
2. Dispose of sulfuric acid in a lab  
Sulfuric acid may also be diluted and then neutralized. One method of neutralization is to add the acid slowly to a solution of soda ash and slaked lime, and to then flush with a large volume of water. Once sulfuric acid is diluted and neutralized it can be discharged to a sewer.
3. Neutralizing HCl in disposal
4. Decontamination/Waste Disposal Procedure Spills may be neutralized with sodium bicarbonate or baking soda. Do not dispose of HCl by pouring down drains followed by copious amounts of water without neutralization.

#### **3.11.3**      *Disposal of proper chemical hazardous waste in the laboratory Caps and closure*

1. Use waste containers with leak-proof, screw-on caps so contents can't leak if a container tips over.
2. If necessary, transfer waste material to a container that can be securely closed.
3. Keep waste containers closed except when adding waste.
4. Wipe down containers prior to your scheduled collection date.

#### **3.11.4**      *Responsibilities*

1. Hazardous-waste characteristics.
2. Transport of hazardous waste. Transport vehicles. The manifest system.
3. Treatment, storage, and disposal. Treatment. Surface storage and land disposal.

4. Secure landfills.
5. Remedial action.

### 3.12 *Bio-Medical Waste*

There are generally 4 different kinds of medical waste: infectious, hazardous, radioactive, and general 1000 kg/month – .

#### 3.12.1 *Types of Bio-medical waste*

1. Human anatomical waste like tissues, organs, and body parts.
  2. Animal wastes generated during research from veterinary hospitals.
  3. Microbiology and biotechnology wastes.
  4. Waste sharps like hypodermic needles, syringes, scalpels, and broken glass.
  5. Discarded medicines and cytotoxic drugs.
  6. What is the rule of bio-medical waste?
  7. Amendments in Bio-Medical Waste Management Rules, 2016 Rules. The amended rules stipulate those generators of bio-medical waste such as hospitals, nursing homes, clinics, and dispensaries etc. will not use chlorinated plastic bags and gloves beyond March 27, 2019, in medical applications to save the environment.
  8. Who is responsible for biomedical waste management?
  9. The responsibility of each state to check for compliance will be done by setting up district-level committee under the chairpersonship of District Collector or District Magistrate or Additional District Magistrate. In addition, every 6 months, this committee shall submit its report to the State Pollution Control Board.
  10. Biomedical waste management is important.
  11. Biomedical waste management is of great significance because biomedical waste can adversely affect health inviting serious implications to the people who get in touch with it.
- Segregation, storage and safe disposal of the waste is the key to the effective management of biomedical waste in a workplace.

#### **Analysis:**

1. The university campus area is very neat & tidy at its overall look.
2. Municipal Solid waste is being collected daily & sent to municipality on regular basis.
3. Waste bins at different locations were observed for Collection of waste.
4. No littering was observed in the whole campus area.

#### **Observation:**

1. The university has already declared the campus as **Single Use Plastic Free Zone area**.
2. This year the University has planned to summarize **all E – Waste** of the campus & send it to be authorized recycler for its disposal.
3. Need to set up a sewage treatment plant.

# Green Campus Audit

## 4.0 *BIODIVERSITY AUDIT*

The Biodiversity Audit Approach is an innovative, landscape-scale and evidence-based approach to delivery of biodiversity. It provides a working example of the implementation of an integrated approach to biodiversity delivery in a region. A key element has been the development of an evidence-based approach to understanding the requirements of priority species and providing guidelines for their conservation. Ecological requirements of priority species for conservation have been collated, and synthesized, integrating across numerous individual priority species to produce management guidance for multi-species assemblages. The approach: Collates and examines available evidence to understand what species are present. Objectively defines the suite of conservation priority species. Assess the recent or status of priority species. A key objective of the approach is to provide land managers and conservation advisers with guidance on how to enhance and sustain the important biodiversity. Effective management is best achieved by providing prescriptions based on sound evidence. The novel approach taken is to identify multi-species assemblages and associated flagship invertebrate and plant species, requiring similar ecological processes and conditions ('guilds'). This has the aim of integrating prescriptions for multiple species into habitat-based approaches, but through an evidence-based approach rooted in an understanding of the requirements of individual species.

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 programs.

## 4.1 *BIODIVERSITY*

To keep the greenery on 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 the University campus is as follows-

- Plantation of diversified species, Uses of medicinal plants, Identification of plants species.
- Awareness of carbon consumption and carbon footprint program.

To create a green cover, Eco-friendly atmosphere, and pure oxygen at the university campus, a plantation program is organized every year with active participation from the University community and visitors. A committee has been formed as the Campus Horticulture Committee to keep the greeneries in the university campus. All gardens are regularly maintained and looked after by the Horticulture Section under the guidance of committee members. Various departmental activities are being carried out every year such as: -

- Plantations and other Landscaping Activities
- Maintenance of Gardens and Landscape
- Maintenance of Plantations

The horticultural activities for landscaping and beautification of GMU are headed by a full-

fledged Director who has his own team. There were transformation and redeemed of certain natural vegetation patches for requisite infrastructure development to facilitate the emerging needs for the growth of the university. However, spaces for academic, administrative and recreational areas are delineated in harmony with the landscape to ensure an eco-friendly campus. Horticulture and gardening unit is posted in the University is looking after althea plantation and other landscaping activities within the University campus. Horticulture and gardening unit has under him a team of dedicated staff who are only dedicated to horticulture and Gardening work & develops strategies for smooth execution of plantation, maintenance and overall protection of the landscape. Therefore, the greenery of a large area in the campus is well maintained besides keeping remnants of the natural vegetation patches undisturbed. There are block plantations, plantations along the roads side, garden space of departmental building premises, and along the residential compounds, while several tree species regenerated naturally and there are plants that cover the whole natural and scrapes. Several trees and plants are carefully selected for the plantation to provide shelter for birds and to provide a shaded walkway. Massive plantations and different landscaping beautification activities have already been carried out in different parts of the University campus.

## **4.2** *PLANTATIONS*

GMU is in the continuous process of planting trees of importance, medicinal values & fruit bearing. University on various national and international events/occasions with active participation from university communities and guests. This program helps in encouraging an eco-friendly environment that 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 the Horticulture department, Botany department with the help of NSS students to identify with scientific names and give information about medicinal uses of the plants.

## **4.3** *LANDSCAPING AND GARDENING ACTIVITIES*

In addition, to carry out different plantation programs, efforts were also made by the Horticulture Section, GMU for beautification of different parts of the university campus by the development of flower gardens and other landscaping activities such as the development of lawns, hedges, ornamental and avenue plantations, etc. Several green areas have also been developed within the University campus. Moreover, plantation of different types of medicinal plants on the existing area of different locations of the University campus has also been done for further beautification of the landscape.

### **4.3.1** *MAINTENANCE OF GARDENS AND LANDSCAPE*

In addition to new plantation drives and landscaping/beautification activities, all essential maintenance work (like lawn, hedge, existing plants /shrubs, growing of seasonal flowers) for previously developed flower and other gardens, as well as other locations of the University campus, is done regularly under the supervision of Horticulture Section. The university has a separate Horticulture department.





**Greenery Maintain by G.M. University**

**4.4 MAINTENANCE OF PLANTATIONS**

Apart from the maintenance of gardens, all previously planted trees (like roadside and other plantations) in different locations of the university campus are regularly nurtured by cleaning, fertilization, watering, etc.

**4.5 HOUSE PLANTS**

House plants do not just look good – they can make us feel good, too. Studies have shown that house plants-



- Boost our mood, productivity, concentration, and creativity.
- Reduce our stress, fatigue, sore throats, and colds.
- Help clean indoor air by absorbing toxins, increasing humidity & producing oxygen.
- Add life to sterile space, give privacy and reduce noise levels.

Considering the different benefits of houseplants, currently, various types of House plant pots are replaced in the interior space of different administrative offices and Academic buildings, Guest House, Library, Auditorium and other amenity centers for beautification, greenery, and purifying the air. Essential maintenance works of these houseplants are carried out regularly under the supervision of the Horticulture department, GMU, Sambalpur.

#### 4.6 *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. GMU has an environment that invites opportunities to better its community through campus organizations. The green initiative started on the campus many years ago. The University students are actively participating and solely concerned with the 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 on campus regularly.

#### 4.7 *Environmental Conservation Program*

University is very active in the practical education of the students regarding environmental conservation. The University has arranged visits to their faculties to the Wildlife Institute of India (WII), Botanical Garden, Sanctuaries, Zoological Park sacred groves in order to educate their students. The University also took their students to different National Parks to educate the students of Conservation of Wildlife.

### 4.8 *BIODIVERSITY OF FLORA FAUNA ASSOCIATED WITH IN University CAMPUS*

#### 4.8.1 *INTRODUCTION*

Biodiversity is one measure of the health of biological systems. Life on earth today consists of many millions of distinct biological species. Biodiversity is not consistent across the earth. It is consistently rich in the tropics, and it is less rich in Polar Regions where conditions support much less biomass. A complex relationship exists among the different diversity levels. Identifying one level of diversity in a group of organisms does not necessarily indicate its relationship with other types of diversities. Rapid environmental changes typically cause extinctions. Most species that have existed on earth are now extinct. The period since the emergence of humans has displayed an ongoing reduction in biodiversity. Named the Holocene extinction, the reduction is caused primarily by human impacts, particularly the destruction of plant and animal habitats.

#### 4.8.2 *Need for biodiversity conservation*

Conservation is the protection, preservation, management, or restoration of wildlife and natural resources such as forests and water. Through the conservation of biodiversity, the survival of many species and habitats which are threatened due to human activities can be ensured. Other reasons

for conserving biodiversity include securing valuable Natural Resources for future generations and protecting the wellbeing of ecosystem functions. Plant genetic resources are the product of natural evolution and human intervention. In-situ biodiversity conservation includes the conservation of habitats, species, and ecosystems where they naturally occur. The conservation of elements of biodiversity out of the context of their natural habitats is referred to as ex-situ biodiversity conservation.

#### 4.9 *Fauna Survey*

The term fauna represents all the animal species found in a particular region at a particular time. These are the naturally occurring animal species of the area. It can be measured by taking a number of quadrats and recording presence/absence in each, or in each of the subdivisions of the quadrat. Fauna use many different parts of the environment. Some are ground-dwellers, others arboreal and some live underground or in rock crevices.

##### 4.9.1 *Pilot fauna survey*

Animal species present around each of the building locations were assessed. Places such as in and around the university vicinity, in the soil and on the vegetation around the university were checked and noted.

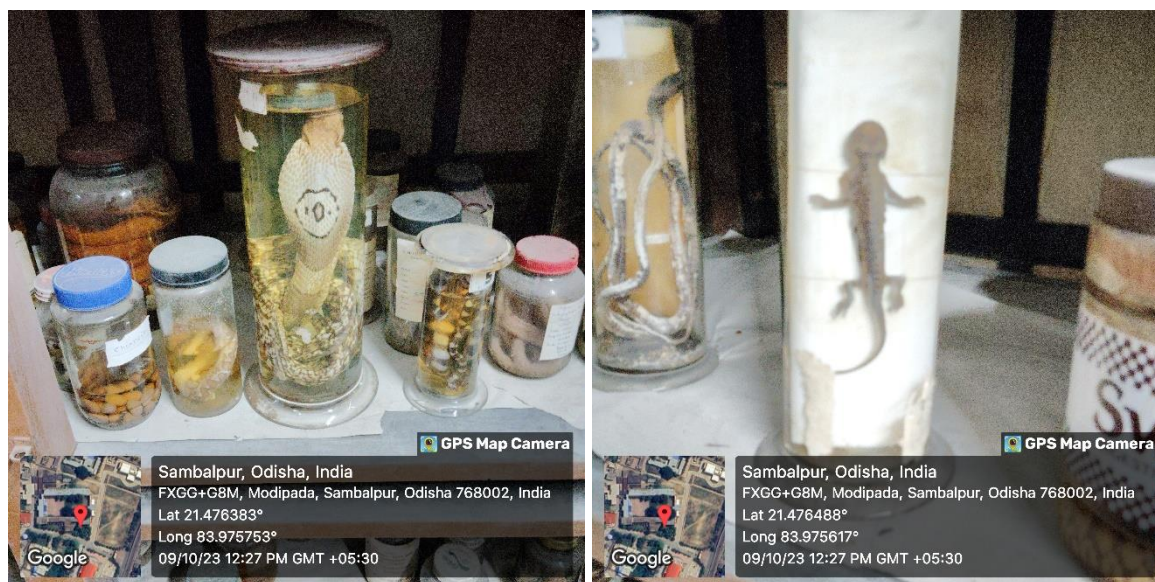
##### 4.9.2 *Questionnaire based fauna survey*

An assessment of animal species commonly cited around the study university area by pupils and workers of the university was also conducted through a structured interview schedule (questionnaire). The respondents were allowed to express the names of the animal species in their local language (Hindi or English).

<b>Fauna Details</b>				
<b>S. No</b>	<b>Scientific name</b>	<b>Common name</b>	<b>Family</b>	<b>Phylum</b>
1	Bufo melanostriatus	Toad	Bufoinae	Vertebrata/ Chordata
2	Rana tigrina	Frog	Ranidae	Vertebrata/ Chordata
3	Bos indicus	Cow	Bovidae	Vertebrata/ Chordata
4	Calotes versicolor	Garden Lizard	Agamidae	Vertebrata/ Chordata
5	Hemidactylus flariride	Wall Lizard	Lacertida	Vertebrata/ Chordata
6	Natrix piscator	Water Snake	colubridae	Vertebrata/ Chordata
7	Ptyas mucosa	Rat snake	colubridae	Vertebrata/ Chordata
8	Funambulus glandulus	Squarrel	Scioridae	Vertebrata/ Chordata
9	Columba livia	Pigeon	Columbidae	Vertebrata/ Chordata
10	Corus splendens	crow	corvidae	Vertebrata/ Chordata
11	Passer domestictus	Sparrow	Passeridae	Vertebrata/ Chordata

## Fauna Details

S. No	Scientific name	Common name	Family	Phylum
12	Bubo bubo	Owl	Strigidae	Vertebrata/ Chordata
13	Psittacula euparia	parrot	psittacidae	Vertebrata/ Chordata
14	Pheretima posthuma	Earthworm	Megascolecidae	Annelida
15	Hirudu medicinalis	Cattle leech	Hirudinidae	Annelida
16	Pila globosa	Apple snail	Ampullaridae	Mollusca
17	Helix pomatia	Garden snail	Helicidae	Mollusca
18	Carcinus maenas	Rock crab	portunidae	Arthropoda
19	Scolopendra india	Centepede	scolopendra	Arthropoda
20	Julus indicus	millipede	Julidae	Arthropoda
21	Periplanate americana	Cockroach	Blattidae	Arthropoda
22	Montis religiosa	Praying montic	Mantidae	Arthropoda
23	Anax indicus	Dragon fly	Anisoptera	Arthropoda
24	Apis indica	Honey bee	Apidae	Arthropoda
25	Melolontra indica	Indian chafer	Endopterygota	Arthropoda



### 4.10 RESULT

#### 4.10.1 Fauna Survey Pilot fauna survey

A total of twenty-five animal species were cited in the university area sampled. Fauna species observed in the study area were good representatives of the animals & birds kingdom as they are from various insect group, other invertebrates, reptiles, amphibians, birds and the mammals. Fauna species were noted to be common to each of the study areas. Among the fauna species common to the University study area, termites, ants, earthworms, lizards, spiders and springtails were observed to be more in abundance. Due to a big water body in the new campus most of the birds, animal and fauna are attracted towards it for quenching their thirst. It's great to know that university has worked extra ordinarily and scientific methods has been adopted.

Last five years data of number of plantation and survival rate

Year	No. of Plantation	No. of trees Survived	Percentage of survival	Beyond Boundary plantation
2019	280	41	14.64	500
2020	0	0	0.00	0
2021	310	48	15.48	200
2022	325	52	16.00	600
2023	400	73	18.25	600
<b>Total</b>	<b>1315</b>	<b>214</b>		<b>1900</b>

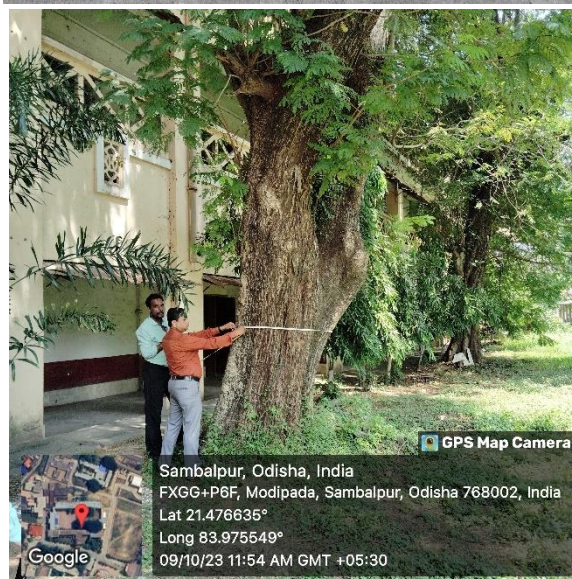
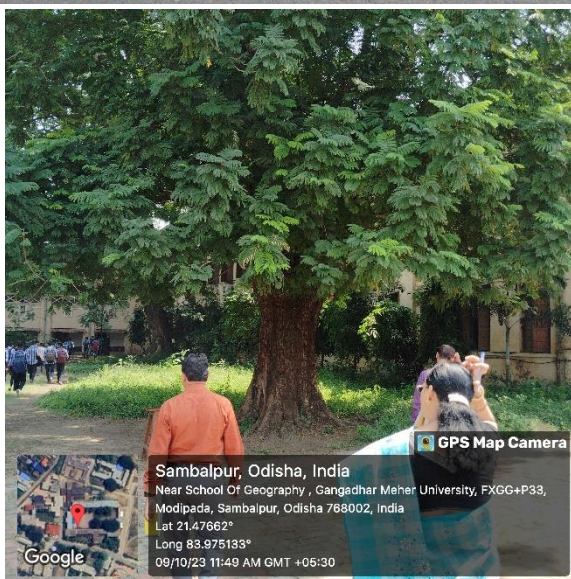
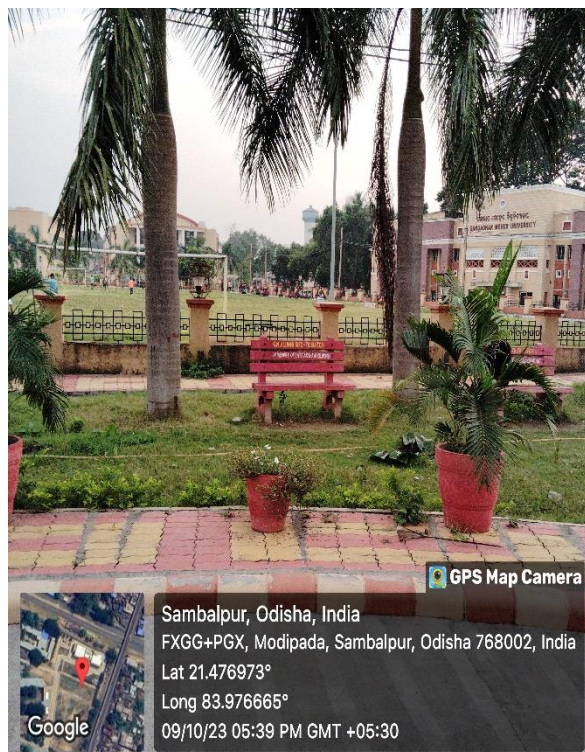
## Flora Details

S. No	Species Name	Common Name	Family	Habit	No. of plants
1	Mangifera indica	Aamba	Anacardiaceae	Terrestrial	10
2	Ananas cosmosus	sapuri	Bromeliaceae	Terrestrial	2
3	Musa domestica	Banana	Musaceae	Terrestrial	2
4	Rosa indica	Rose	Rosaceae	Terrestrial	10
5	Hibiscus rosa cinensis	Mandara	Malvaceae	Terrestrial	10
6	Ocimum sanctrum	Tulsi	Lamiaceae	Terrestrial	20
7	Psidium guajava	Guava	Myrtaceae	Terrestrial	5
8	Clitoria terratea	Aparajita	Fabaceae	Terrestrial	20
9	Bougain villea glabra	Kagazi	Nyctaginaceae	Terrestrial	10
10	Azadiracta indica	neem	Meliaceae	Terrestrial	15
11	Coccus nucifera	Coconut	Aricaceae	Terrestrial	5
12	Cidrus deodera	deodar	Pinaceae	Terrestrial	20
13	Cymbopogon sitratas	Lemon Grass	Poaceae	Terrestrial	2
14	Cycas revoluta	Sago Palm	Cycad	Terrestrial	5
15	Ficus religosa	Pepal	Moraceae	Terrestrial	5
16	Nelumbo nucifera	Lotus	Nelumbonaceae	Terrestrial	5
17	Eicchoria cracipes	Waterhycinth	Contediraceae	Terrestrial	6
18	Nymphaea pubescens	Water lily	Nymphaceae	Terrestrial	3
19	Artocarpus heterophyllus	Jackfruit	Moraceae	Terrestrial	5
20	Saraca asoca	Ashoka	Caesalpineaceae	Terrestrial	3
21	Tectona grandis	saguan	Lamiaceae	Terrestrial	10
22	Pinus rimburghii	pine	Pinaceae	Terrestrial	1
23	Jasminum santae	Mogra	Oleaceae	Terrestrial	10
24	Canna indica	Canna	Connaceae	Terrestrial	2
25	Moringa delifera	Munga	Moringaceae	Terrestrial	2
26	Eucalyptus teriticorris	Gum Tree	Myrtaceae	Terrestrial	4
27	Tinospora cordiflaric	giloy	Menispermaceae	Terrestrial	20
28	Aegle marmalos	Bela	Rutaceae	Terrestrial	2
<b>Total Number of Plants</b>					<b>214</b>

The highest diversity of plants was observed on the university campus with 28 plant species. The



number of *Ocimum sanctum* (20), *Clitoria terratea* (20), *Cidrus deodera* (20) & *Tinospora cordiflari* (20) were found to be the highest planted trees. *Azadiracta indica*, *Mangifera indica*, *Rosa indica*, *Hibiscus rosa cinensis*, *Bougainvillea glabra*, *Tectona grandis*, *Jasminum santae* etc. are commonly found plants.



### Giant and old trees at G.M. University, Sambalpur

As per the report received from the university, in 2022 the total trees planted is 325 and survival plants is 52 and survival rate is 16.00% whereas in 2021 total 310 trees were planted and survival plants is 48 and survival rate is 15.48%. In the year 2019 the survival rate was very low (14.64%). However, in this current year the survival rate has reached 18.25%. This progress is really commendable for the university within the last five years but survival rate of plants are still very low and university need to take care of plants after plantation. Although there is still lot of scope to increase the survival rate.



#### 4.11 *Discussion*

The major component of an ecosystem is plants. They are major modifiers of climate and providers of community structures, and they are pathway through which energy enters the ecosystem. The plant forms a complex interaction between the biotic and abiotic entities of the environment by making use of the biotic entities as food to produce food in form of biomass for the animal communities. High diversity of animal species within the university vicinity as recorded in this study could therefore be connected to the observed high diversity of plant species.

This study has shown that the university environments have rich and abundant flora and fauna populations which could be regarded as a biotic community consisting of the populations of different organisms interacting together. It also revealed that the activities in the study area may not be completely detrimental to the existence of the organisms.

Although, it is not a common practice to base ecological research on questionnaire surveys, this study has revealed that the opinion of people who have been used to a particular area over a long period of time on the fauna species usually encountered in such areas should not be discarded. However, there is the need for a field survey to back up verbal responses.

##### *Bio-Diversity Data Analysis:*

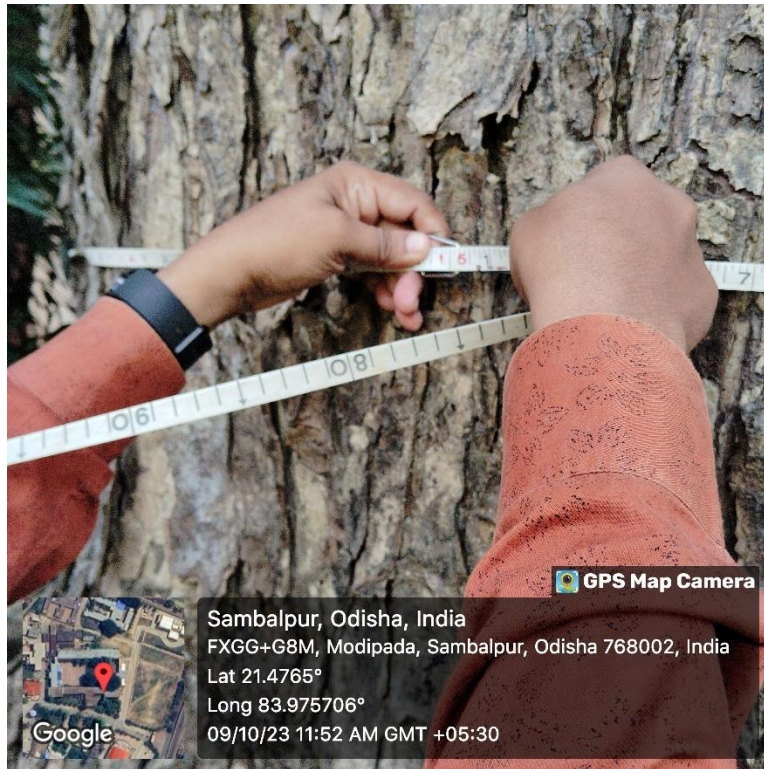
1. In **Flora** total **214** numbers of trees were identified & Geo-tagged by university.
2. It has been estimated that earlier the survival rate of plants was very low but later University has taken steps to increase the rate.
3. Precautions must be taken not only in planting trees but their survival also.
4. Some of the faculty, including students should be given the responsibility for survival of trees.
5. Regular watering & taking care of plants are important aspects for survival rate.
6. Average survival rate of plants in the last 5 years is **12.88 %**.
7. Although the survival rate from **14.64 %** has reached **18.25 %**. But still lots of effort should be made in this area.
8. Growing trees with medicinal values & that too with fruit bearing trees will not only make the University campus as pioneer University but will provide herbal & ayurvedic medicines & fruits to the nearby community as well as their students & staffs.
9. It was also informed that due to the soil conditions the plants are not growing. Hence it is suggested to get the soil sample tested & plant only such trees which are adaptable to such soil conditions.
10. Regular plucking of plants, which grow on buildings to be done.
11. In the field of **Fauna**, the animals & birds were found to be **less**. By providing small water bodies the fauna can be attracted for drinking water.
12. It is recommended that some small water bodies be developed in the campus areas.

#### 4.12 *Oxygen emission and carbon storage capacity of tree*

Sr. No.	Girth of Trees from 4.5' above Ground Level	No. of Trees	Age of trees (In years)	Oxygen (in Ton)	Stores Carbon (in Ton)
1	7 3/4" - 19 1/2"	40	3	13	5
2	19 1/2" - 35 1/3"	98	4	216	81
3	19 1/2" - 35 1/3"	30	6	99	37
4	35 1/3" - 59"	35	8	539	202
5	59" - 74 2/3"	1	20	39	15
6	59" - 74 2/3"	1	16	31	12
7	74 2/3" - 98 1/3"	1	38	303	114
8	Above 98 1/3"	1	56	921	345
9	Above 98 1/3"	1	56	908	340
10	Above 98 1/3"	1	72	1167	438
11	Above 98 1/3"	1	46	759	284
12	Above 98 1/3"	1	46	746	280
13	Above 98 1/3"	1	73	1193	447
14	Above 98 1/3"	1	52	856	321
15	Above 98 1/3"	1	53	869	326
<b>Total</b>		<b>214</b>		<b>8659</b>	<b>3247</b>

REF: <https://8billiontrees.com/> (<https://8billiontrees.com/carbon-offsets-credits/carbon-offset-tree-planting-calculator-find-how-many-trees-to-plant/>).

Also 1 carbon credit = 1 MT of CO<sub>2</sub> capture. (1 tree absorbs 21.77 Kgs of CO<sub>2</sub> annually)



**14 feet & 10 inches Girth Tree at G.M. University, Sambalpur**

### *Observation:*

With counted number of trees GMU campus has 214 in the whole campus area. These are the number of matured trees. There are countless number of trees in the whole campus area. Considering Carbon Credit in accordance to 8billiontrees.com the University has **3247 Carbon Credit**. Trees release **8659 Tons of Oxygen in a year**. It is really a great achievement that the University is maintaining the trees which are up to 74 years old & the girth of the trees are beyond the limits given by 8billiontrees.com (8 trees are having girth more than 98 1/3”).

### **Methodology Of Calculation of Carbon Footprint, Carbon Credit, from trees:**

The approximate amount of carbon taken up by the trees will be calculated automatically by a formula that uses the diameter (in forestry, this is called “diameter at breast height”, or DBH.) Measure the circumference of each living tree in your yard at a height of 4.5 feet (4 feet, 6 inches) above the ground level.

Trees are nature’s best carbon capture technology and have been working to clean the air since the first leafy frond appeared on Earth, and research shows that they are one of the best tools the planet has (at the moment) to help mitigate climate change.

But all trees aren’t the same...certain species can store more carbon than others.

As natural carbon sinks (or carbon reservoirs), trees capture carbon dioxide (CO<sub>2</sub>) from the atmosphere as they grow, but the amount of CO<sub>2</sub> captured by a tree depends on its size, it’s age, and other factors, like the tree’s species and where it is growing.

The calculator above estimates the average lifetime carbon benefits of any tree, based on its size. And, it shows equivalents, so you can see just how beneficial a tree is to the planet.

It uses the most up-to-date information from academic research and USDA Forest Service 11 databases but doesn't differentiate by species.

Forests are also critical to ecosystems, providing habitat for animals and plants, many of which are vital to survival. Forests also provide a range of environmental services most people take for granted. For example, they absorb storm water and reduce flooding, protect water quality by filtering out pollutants and sediment from waterways, and provide shade to cool the cities.

### Calculation of Carbon, a Tree Absorb: DIY Steps

The calculator above will help you determine how many trees one need to plant to offset the carbon footprint. Others can also allow to compare the different types of trees and calculate how much carbon dioxide one's favorite tree can capture in a year.

If one is planting trees to offset his carbon footprint, it helps to know which species absorb the most carbon. Some tree benefits calculators determine which tree species one can grow to contribute the most carbon capture.

Follow these steps:

- **Step 1:** Determine if one is using the calculator for a single tree or a group of trees to determine how much carbon a tree captures.
- **Step 2:** Enter the trunk circumference (single tree) or the number of trees, and the approximate age of the tree(s).
- **Step 3:** View calculation results immediately, including how much oxygen the trees produce, and how much carbon emissions they store.

### Price of Carbon Offsets:

The cost of a carbon offset varies widely each year, as the market fluctuates. Likewise, the type of program impacts the cost of the offset and so does the 'amount' of carbon emissions one want to erase. Carbon prices averaged (EUR) 11.40 a ton in 2008, but 90 percent of providers now set their own prices.

### Examples of Carbon Offsets

Although there are countless small ways one can personally reduce emissions, the scope of this audit will discuss scalable carbon offsets. The best carbon offset programs are not only for individuals, they're perfect for business carbon offsetting, too!

Note: the first step before you buy carbon offsets is using a carbon footprint calculator to find your precise emissions.

### Carbon Offset Tree Planting Projects

While one tree a day falls short of what's needed, the catchy motto **"Planting a tree a day helps keep emissions at bay"** certainly encourages action that can do a whole lot of good. Every little bit counts. Even one tree. In fact, maybe it's time to return to ancient wisdom: An ancient proverb says, **"the best time to plant a tree is twenty years ago. The second-best time is now."**

Why should anyone figure out their carbon footprint (also known as your ecological footprint)? The reason is simple... it's having a huge impact on the climate.

## Discussion

The major component of an ecosystem is plants. They are major modifiers of climate and providers of community structures, and they are pathway through which energy enters the ecosystem. The plant forms a complex interaction between the biotic and abiotic entities of the environment by making use of the biotic entities as food to produce food in form of biomass for the animal communities. High diversity of animal species within the university vicinities as recorded in this study could therefore be connected to the observed high diversity of plant species.

This study has shown that the university environments have rich and abundant flora and fauna populations which could be regarded as a biotic community consisting of the populations of different organisms interacting together. It also revealed that the activities on the study area may not be completely detrimental to the existence of the organisms. Thus, if well maintained, university activities are not entirely unfriendly to the biotic community.

Although, it is not a common practice to base ecological research on questionnaire survey, this study has revealed that the opinion of people who have been used to a particular area over a long period of time on the fauna species usually encountered in such areas should not be discarded. However, there is the need for a field survey to back up verbal responses.



## 5.0 *Fire Fighting*

Every educational institution must have a minimum of two staircases, two fire extinguishers on each floor and manually operated fire alarm call points on each floor. Every classroom that can seat more than 45 students must have two exits and fire drills should be conducted once in six months.

### 5.1 *Fire safety norms in India*

The height shall be a fire tower and in such a case width of the same shall not be less than the width of the main staircase. No combustible material shall be allowed in the fire tower. a) The use of spiral staircase shall be limited to low occupant load and to a building height 9 m.

### 5.2 *Measures to assess fire safety*

Fire safety is a fundamental consideration in building design and management, but unfortunately, firewalls that are often overlooked are today more likely to be associated with IT security than with physical safety.

Assess fire safety measures in your built environment with the help of this checklist.

### 5.3 *Provide adequate means of escape*

The first rule of fire management requires sufficient escape routes out of the building, in accordance with its scale and occupancy. The number, size and location of exits are specified in the National Building Code (NBC) 2005, a detailed set of guidelines for constructing, maintaining and operating buildings of all types. Office occupiers must additionally ensure that staircases, stairwells and corridors are well-maintained, ventilated and free of obstacles to be effective in an emergency.

### 5.4 *Outline clear pathways to exit doors*

Getting to exits is as important as providing enough exits. NBC guidelines specify the maximum distance a person must travel to access a fire exit, and the importance of photo-luminescent signage to enable evacuation at night. Refuge areas such as terraces are critical for high-rises where people can safely congregate, when asked to leave the building in phases.

### 5.5 *Install smoke detection systems*

The first few minutes of a fire are crucial in containing it. Automatic fire alarm systems such as smoke and heat detectors are mandatory elements in international building codes, and particularly useful in spotting fires during times when occupancy in the building is low.

#### 5.5.1 *Maintain smoke suppression systems*

Fire extinguishers are only useful if they work, so check them regularly. High-rise buildings, which are harder to access and evacuate, should consider installing automatic sprinkler systems. The National Fire Protection Association (NFPA), a US-based non-profit body, estimates that automatic suppression systems lower the cost of damage by 60%.

#### 5.5.2 *Conduct Regular Fire Drills*

Preventing panic in an emergency is as important as staying away from flames and fumes. Regular fire drills familiarize people with emergency evacuation methods at little cost. Nominate a fire

safety officer in every building to ensure that this becomes standard operating procedure.

## 5.6 *Use flame-retardant materials in interiors*

Materials used in the interior can save or endanger lives. The combination of wood, paper and textiles makes workstations highly combustible. Fabrics can be made flame-retardant, however, so that they self-extinguish when lit. An increasing number of companies, especially multinationals, request such fabrics despite their price premium, according to data from Indian office furniture manufacturer BP Ergo. Stringent fire regulations abroad make it necessary for US furniture makers such as Herman Miller to provide only fire-tested fabrics. Doors are also assigned a fire-resistance rating, measuring how long they can remain resistant to excessive temperatures and flames without collapsing.

## 5.7 *Make office accessible to firefighters*

Grilled windows are a widespread urban phenomenon. Occupants of offices in residential buildings with few exits should be wary of locking themselves into confined spaces.

## 5.8 *Keep the building plans handy*

It is imperative to make multiple copies of your building plan available to guide rescue agencies, especially during an emergency.

## 5.9 *Ask the local fire brigade to assess safety*

Fire departments, for a nominal fee, will independently assess your building's level of fire safety. Storage of hazardous or inflammable materials, old and unstable structures, inadequate escape routes or electricity overloads are potential death traps that are best assessed by professionals.

## 5.10 *Comply with National Building Code*

"Green buildings" are in vogue, but safe structures are sadly not. The code endeavors to avoid requirements that might involve unreasonable hardships or unnecessary inconvenience or interference with normal use and occupancy of buildings, insist upon compliance with minimum standards for fire safety necessary in public interest.

At Gangadhar Meher University Campus different locations fire safety devices were checked and it was found that proper refilling date, next filling date were mentioned on the device. Staff nearby were asked about the operation, and it was found they were acquainted with the operation of the firefighting devices. It is recommended to hold a fire safety drill once a year so that proper awareness should be there among the staff and the students.





Fire Safety arrangement at Gangadhar Meher University, Sambalpur

**Observation:** Gangadhar Meher University is fully equipped with all Fire safety measures. Nearly all buildings are having fire hydrants, alarms & smoke detectors. One separate ground water tank is built just for fire safety & filled with water. All firefighting have been tested UpToDate & refilled with CO<sub>2</sub>. Some students were asked about using of the device in case of emergency. They were found updated with the functioning of the devices.

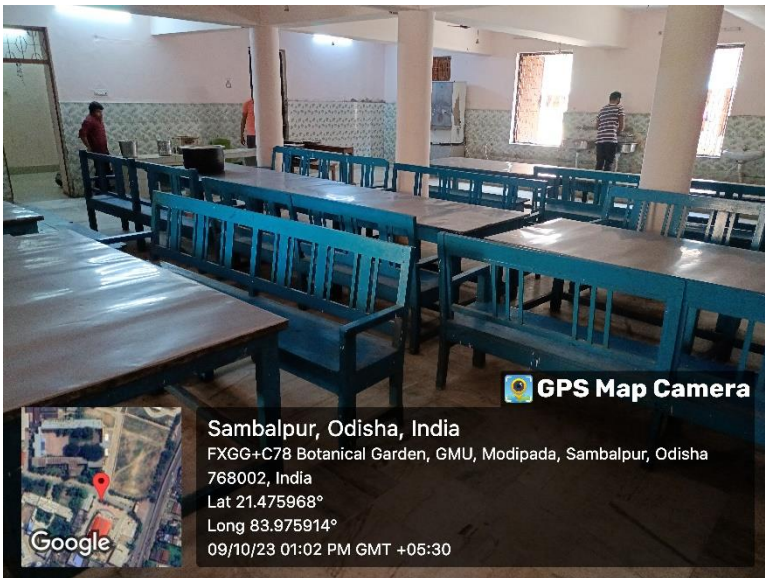
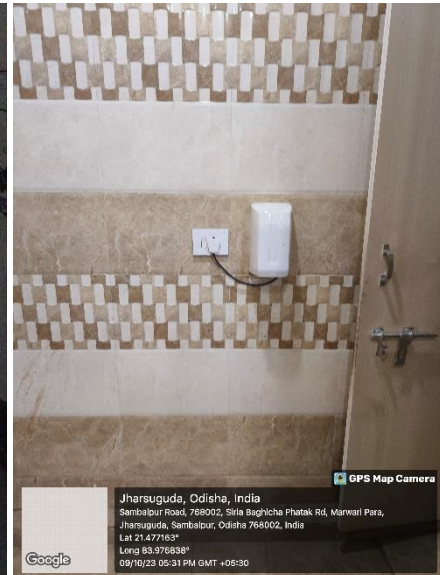
### Fire Fighting analysis:

1. University campus is fully equipped with firefighting.
2. There should be proper display boards & indicator boards.
3. Also, there should be brief methodology in pictorial form for the use of the devices near it.
4. One mock drill by NCC or some others shall be done, once a year just for demo purposes.
5. The equipments (like Smoke alarm, etc.) should be tested by agencies at periodic intervals.



## 6.0 Sanitation & Hygiene

University administrations are very conscious about Hygiene & Sanitation. Wherever the toilets were inspected, they were found neat and clean. Even the cafeteria was well sanitized with food stuff secured from dust & pollution. Two napkin incinerators were also provided in the campus area for females. These types of facilities are very rarely found in university campus. Such provision shows care of the university towards females. Our Loving Prime Minister also during address on 15th August 2022 speech appealed for respect toward women. This is in line of our loving PM.



### Sanitation & Hygiene Maintained by G.M. University

#### Observation:

1. In general, the sanitation & hygiene was good at the whole University campus.
2. Lots of empty packets were lying in the canteen & mess area.

#### Sanitation & Hygiene analysis:

1. Some improvements are required in the mess (where all hostel inmates take food) & canteen

area.

2. Contractors should be advised to keep the area clean & hygienic.
3. A committee should monitor the cleanliness & hygiene of mess & canteen.
4. Also, toilets should be monitored by that committee. Although most toilets were very hygienic but at 1 – 2 places it was not found upto the mark.
5. Mess & canteen staff should wear Head & Hand gears while preparing food



# Energy Audit

## 7.0 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 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 attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility. The present policy of Government of India is to achieve Net Zero. All out efforts have been planned. GMU is committed to achieve the goal of becoming net zero policy.

### 7.1 Resource Energy Audit

Energy resources utilized by all the departments, support services, and the administrative buildings of GMU, include Electricity and Diesel Generators installed on the campus.

### 7.2 Energy Audit Objective

The main energy audit objective is to reduce power consumption and save revenue for university. The objective of audit is to maximize saving energy and use best technology to save energy.

#### Primary

- The first objective is to acquire, analyze data and find the necessary consumption pattern of the whole campus area.
- The second objective will be to calculate the wastage of energy pattern based on the results of the first objective.
- The final objective is to find and implement solutions that are acceptable and feasible in the most economical way.

#### Secondary

This would be the first exposure of university to this field hence experience gain would be vital (University themselves be able to identify the energy distribution).

This project will follow many follow up projects and hence helps to gain technical and management exposure required for future energy projects.

This will surely help create vital reductions hence will develop in overall achievement.

### 7.3 Indirect Benefits of Energy Audit

Every time the Energy Audit is carried out it, there shall be analysis of Energy Conservation is an important function. Energy Auditors sharing their experience and knowledge with the Plant Personnel helps in fueling the innovative ideas for further action of reduction in Specific Power consumption (SPC). Any loose connections or heating of cables come to timely vision. For a next unbiased vision, a few points for Energy Conservation may be visible each time when perform the audit and this would help in achieving further saving. Inform any irregularities in Energy meter HT connections for rectification.

### 7.4 Source of Energy

Total power requirement for university is **4,70,844.52 kW per annum (According to invoices from 1<sup>st</sup> April 2022 to 31<sup>st</sup> March 2023)** i.e., fulfilled by TPWODL.

## 7.5

## Indoor lighting fixtures

Different type of indoor lighting fixture											
S r. N o.	Locatio n	Locatio n of Fixture	Types of fixtures	No. of Lighting Fixture	Po wer (Watts)	Total Powe r consumed (Watts)	Total Powe r consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recom mended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
1	Adminis trator building	Ground Floor	LED Bulb	108	18	1944	1.944	2939.328	18	2939.328	0
			Tube Light	6	20	120	0.12	181.44	20	181.44	0
		First Floor	LED Bulb	121	18	2178	2.178	3293.136	18	3293.136	0
			Tube Light	1	20	20	0.02	30.24	20	30.24	0
		Second Floor	LED Bulb	93	18	1674	1.674	2531.088	18	2531.088	0
			Tube Light	1	20	20	0.02	30.24	20	30.24	0
		Third Floor	LED Bulb	4	18	72	0.072	108.864	18	108.864	0
			Tube Light	2	20	40	0.04	60.48	20	60.48	0
2	Annexe Building	Ground Floor	LED Bulb	43	12	516	0.516	780.192	12	780.192	0
			LED Bulb	1	18	18	0.018	27.216	18	27.216	0
			Tube Light (CFL)	15	36	540	0.54	816.48	20	453.6	362.88
			Tube Light	3	20	60	0.06	90.72	20	90.72	0
		First Floor	LED Bulb	76	12	912	0.912	1378.944	12	1378.944	0
			LED Bulb	3	9	27	0.027	40.824	9	40.824	0
			Tube Light	1	20	20	0.02	30.24	20	30.24	0
			Tube Light (CFL)	34	36	1224	1.224	1850.688	20	1028.16	822.528
3	Academ ic Building	OLD Ground Floor	LED Bulb	15	18	270	0.27	408.24	18	408.24	0
			LED Bulb	84	12	1008	1.008	1524.096	12	1524.096	0
			LED Bulb	5	9	45	0.045	68.04	9	68.04	0
			Tube Light (CFL)	19	36	684	0.684	1034.208	20	574.56	459.648
			Tube light	40	20	800	0.8	1209.6	20	1209.6	0
		OLD First Floor	LED Bulb	90	18	1620	1.62	2449.44	18	2449.44	0

**Different type of indoor lighting fixture**

S r. N o.	Location	Location of Fixture	Types of fixtures	No. of Lighting Fixture	Power (Watts)	Total Power consumed (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
			LED Bulb	76	12	912	0.912	1378.944	12	1378.944	0
			LED Bulb	12	9	108	0.108	163.296	9	163.296	0
			Tube Light (CFL)	2	36	72	0.072	108.864	20	60.48	48.384
			Tube light	17	20	340	0.34	514.08	20	514.08	0
		New Ground Floor	Tube Light (CFL)	67	36	2412	2.412	3646.944	20	2026.08	1620.864
			LED Bulb	13	18	234	0.234	353.808	18	353.808	0
			LED Bulb	2	9	18	0.018	27.216	9	27.216	0
			Tube light	70	20	1400	1.4	2116.8	20	2116.8	0
		New First Floor	Tube light	134	20	2680	2.68	4052.16	20	4052.16	0
			Tube Light (CFL)	10	36	360	0.36	544.32	20	302.4	241.92
4	Library	Ground Floor	Tube light	3	20	60	0.06	90.72	20	90.72	0
		First Floor	Tube light	10	20	200	0.2	302.4	20	302.4	0
			LED Bulb	27	18	486	0.486	734.832	18	734.832	0
		Second Floor	LED Bulb	127	12	1524	1.524	2304.288	12	2304.288	0
			Tube light	2	20	40	0.04	60.48	20	60.48	0
			LED Bulb	1	9	9	0.009	13.608	9	13.608	0
5	School of Education	Ground Floor	Tube Light (CFL)	31	36	1116	1.116	1687.392	20	937.44	749.952
			Tube light	4	20	80	0.08	120.96	20	120.96	0
			LED Bulb	1	9	9	0.009	13.608	9	13.608	0
			LED Bulb	3	20	60	0.06	90.72	20	90.72	0
		First Floor	LED Bulb	37	20	740	0.74	1118.88	20	1118.88	0
			Tube Light (CFL)	4	36	144	0.144	217.728	20	120.96	96.768

**Different type of indoor lighting fixture**

S r. N o.	Location	Location of Fixture	Types of fixtures	No. of Lighting Fixture	Power (Watts)	Total Power consumed (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
6	Teacher's Cubicle	Faculty Cabins	LED Bulb	50	12	600	0.6	907.2	12	907.2	0
			LED Bulb	4	18	72	0.072	108.864	18	108.864	0
			Tube light	4	5	20	0.02	30.24	5	30.24	0
7	PROFES SIONAL COURSE S DEPART MENT		LED Bulb	102	12	1224	1.224	1850.688	12	1850.688	0
			LED Bulb	1	9	9	0.009	13.608	9	13.608	0
8	LH 1		Tube Light (CFL)	120	36	4320	4.32	6531.84	20	3628.8	2903.04
			LED Bulb	70	20	1400	1.4	2116.8	20	2116.8	0
			LED Bulb	20	9	180	0.18	272.16	9	272.16	0
			Halogen Light	5	100	500	0.5	756	36	272.16	483.84
9	LH 2		LED Bulb	34	9	306	0.306	462.672	9	462.672	0
			Tube Light (CFL)	7	36	252	0.252	381.024	20	211.68	169.344
			Tube light	18	20	360	0.36	544.32	20	544.32	0
10	LH 3		Tube Light (CFL)	40	36	1440	1.44	2177.28	20	1209.6	967.68
			Tube light	43	20	860	0.86	1300.32	20	1300.32	0
			LED Bulb	13	9	117	0.117	176.904	9	176.904	0
			Halogen Light	6	200	1200	1.2	1814.4	72	653.184	1161.216
11	Old Eklavya		LED Bulb	18	9	162	0.162	244.944	9	244.944	0
			Tube Light (CFL)	14	36	504	0.504	762.048	20	423.36	338.688
			Tube light	12	20	240	0.24	362.88	20	362.88	0
			Halogen Light	1	100	100	0.1	151.2	36	54.432	96.768
			Halogen Light	1	30	30	0.03	45.36	20	30.24	15.12



**Different type of indoor lighting fixture**

S r. N o.	Locatio n	Locatio n of Fixture	Types of fixtures	No. of Lighting Fixture	Po wer (Watts)	Total Powe r consumed (Watts)	Total Powe r consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recom mended (wattage)	Total Consump tion After Recommendation	Annual Savings After Recommendation
12	New Eklavya		Tube Light (CFL)	168	36	6048	6.048	9144.576	20	5080.32	4064.256
			Halogen Light	8	30	240	0.24	362.88	18	217.728	145.152
13	Madhu maya Hostel		Tube Light (CFL)	36	36	1296	1.296	1959.552	20	1088.64	870.912
			Halogen Light	8	30	240	0.24	362.88	18	217.728	145.152
14	JP PG Hostel		LED Bulb	89	20	1780	1.78	2691.36	20	2691.36	0
			Tube Light (CFL)	11	36	396	0.396	598.752	20	332.64	266.112
			Halogen Light	4	50	200	0.2	302.4	18	108.864	193.536
15	Narayan i Panda Center	Ground Floor	LED Bulb	50	25	1250	1.25	1890	25	1890	0
		First Floor	Under Constructi on	0		0	0	0		0	0
		Second Floor	LED Bulb	39	25	975	0.975	1474.2	25	1474.2	0
		Out Side	LED Bulb	4	20	80	0.08	120.96	20	120.96	0
16	SJ Hostel		Tube light	120	20	2400	2.4	3628.8	20	3628.8	0
			Tube Light (CFL)	6	36	216	0.216	326.592	20	181.44	145.152
17	TF Hostel		Halogen Light	4	200	800	0.8	1209.6	72	435.456	774.144
			Tube Light	135	20	2700	2.7	4082.4	20	4082.4	0
			Tube Light (CFL)	31	36	1116	1.116	1687.392	20	937.44	749.952
			LED Bulb	4	9	36	0.036	54.432	9	54.432	0
<b>Total</b>				<b>2718</b>	<b>2259</b>	<b>60485</b>		<b>91453.32</b>		<b>73560.31</b>	<b>17893</b>



**Sambalpur, Odisha, India**

State Highway 10, Budharaja Rd, Modipada, Sambalpur, Odisha 768002, India

Lat 21.477118°

Long 83.976851°

09/10/23 11:21 AM GMT +05:30

**Indoor Lighting at G.M. University, Sambalpur**

**Assumption:**

1. Light functionate for 7 hours daily for 24 days in a month. 6 days considered as holiday.
2. Cost of 18-watt bulb of Philips is Rs. 282/-. (Rates taken is mentioned below)
3. Cost of 36-watt bulb of luminous is Rs. 749/-. (Rates taken is mentioned below)
4. Cost of 20-watt LED tube light is Rs. 187/-. (Rates taken is mentioned below)
5. Cost of 72-watt halogen light is Rs. 949/- (Rates taken is mentioned below)

Home > Home Lighting > Utility Lighting > Bulbs > PHILIPS Bulbs > PHILIPS 18 ...

PHILIPS 18 W Round B22 LED Bulb (White)

4.2 ★ 1,023 Ratings & 92 Reviews

Special price

**₹282** ₹400 29% off

Hurry, Only 4 left!

Home > Home Lighting > Utility Lighting > Bulbs > LUMINOUS B... > LUMINOUS 3...

LUMINOUS 36 W Capsule B22 D LED Bulb (White)

4.3 ★ 188 Ratings & 21 Reviews

**₹749** ₹1,060 29% off

Home > Home Lighting > Utility Lighting > Tube Lights > Crompton Tu... > Crompton La...

Crompton Laser Ray Neo 20W Straight Linear LED Tube Light (White)

4.2 ★ 363 Ratings & 37 Reviews

Special price

**₹187** ₹600 68% off

Minimum Order Quantity:2

Source Flipkart


**ViViD LED 72 Watt LED Street Light, 2 Years Warranty, Waterproof (White, Pack of 1)**  
 Visit the ViViD LED Store  
 5.0 ★★★★★ 1 rating

---

**-73% ₹949**  
 M.R.P.: ₹3,500  
 Inclusive of all taxes

Source Amazon

## Analysis

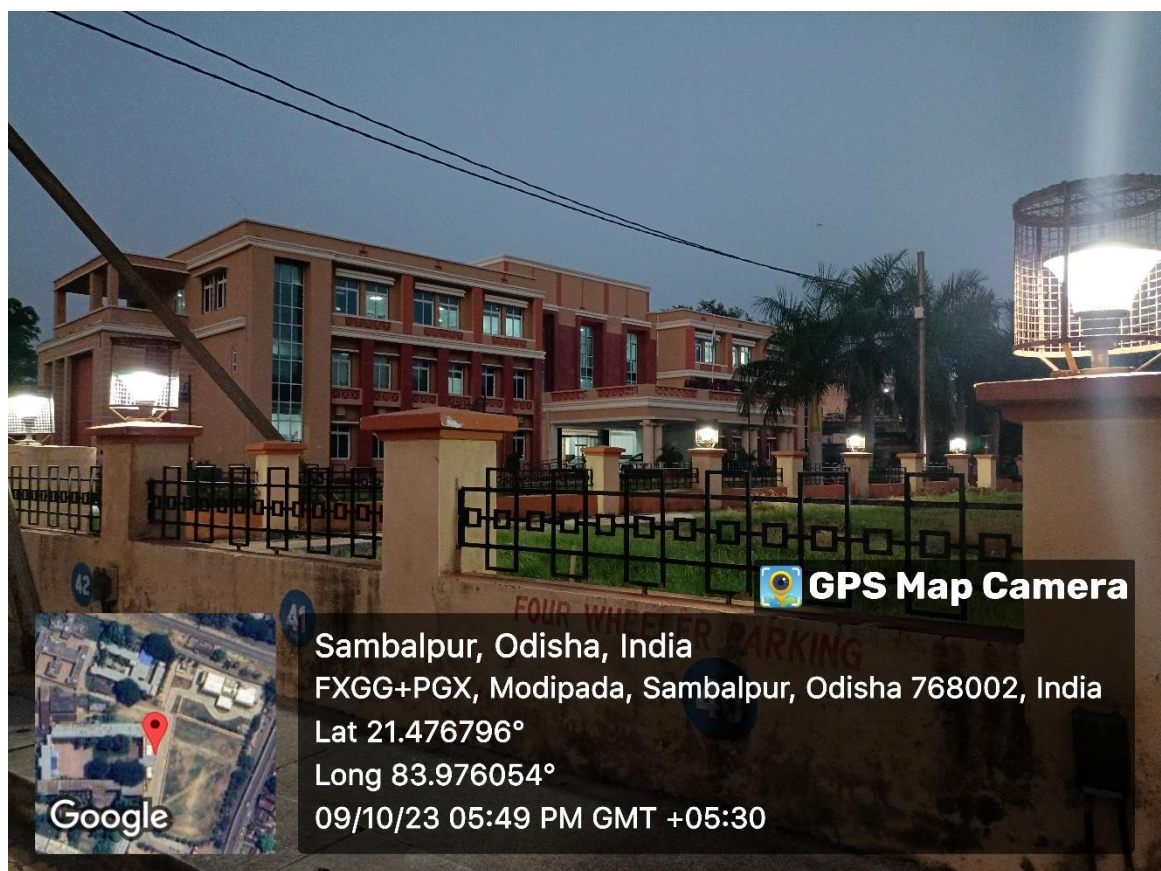
1. In indoor lightings there are total 2718 lights
2. After replacing 652 bulbs (if recommendation is accepted) by LED bulbs.

## Observation

1. Cost of different light have been mentioned above.
2. Policy should be drawn that in future the balance to be phased out with LED bulbs.

## 7.6 Outdoor lighting Fixtures

Different type of Outdoor Lighting System											
Sr . No.	Location	Location of Fixture	Product Type	No. of Lighting Fixture	Power (Watts)	Total Power consumed (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
1	Outdoor Lighting System	Campus Road Light	Streetlight	6	9	54	0.054	194.4	9	194.4	0
			Flood Light	12	150	1800	1.8	6480	72	3110.4	3369.6
			Field Boundary Light	54	12	648	0.648	2332.8	12	2332.8	0
			Field Boundary Light	10	9	90	0.09	324	9	324	0
			Pole Light	40	200	8000	8	28800	72	10368	18432
			Pole LED Mini Light	20	12	240	0.24	864	12	864	0
<b>Total</b>				<b>142</b>	<b>392</b>	<b>10832</b>		<b>38995.2</b>		<b>17193.6</b>	<b>21801.6</b>



**Outdoor lighting at G.M. University, Sambalpur**

**Assumption**

1. Cost of 72-watt halogen light of is Rs. 949/- (Rates taken is mentioned above).
2. Light functionate for 10 hours daily for 30 days in a month.



3. Policy needs to be drawn that replace 52 in future.

### Analysis

1. Total outdoor fittings are 142.
2. Total numbers replaced 52.

### Observation

1. Cost of different light have been mentioned above.
2. Policy should be drawn that in future the balance to be phased out with LED bulbs.

## 7.7 Ceiling Fan, Exhaust Fan & Wall Fan

The detail of the equipment is given in the below table: (Different type of Ceiling, Wall And Exhaust Fan System)

Sr. No.	Location	Location of Fan	Type of Fan	Number of Fan	Power (Watts)	Total Power (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
1	ADMINISTRATIVE BUILDING	Ground floor	Exhaust fan	7	70	490	0.49	576.24	45	370.44	205.8
		First Floor	Exhaust fan	8	70	560	0.56	658.56	45	423.36	235.2
		Second Floor	Exhaust fan	2	70	140	0.14	164.64	45	105.84	58.8
		Ground floor	Ceiling fans	4	70	280	0.28	329.28	26	122.304	206.976
		First Floor	Ceiling fans	2	70	140	0.14	164.64	26	61.152	103.488
		Second Floor	Ceiling fans	27	70	1890	1.89	2222.64	26	825.552	1397.088
		Ground floor	Wall fan	27	60	1620	1.62	1905.12	60	1905.12	0
		First Floor	Wall fan	23	60	1380	1.38	1622.88	60	1622.88	0
		First Floor	Stand fan	1	60	60	0.06	70.56	50	58.8	11.76
2	ANNEXE BUILDING	Ground floor	Exhaust fan	6	70	420	0.42	493.92	45	317.52	176.4
		First floor	Exhaust fan	6	70	420	0.42	493.92	45	317.52	176.4
		Second Floor	Exhaust fan	3	70	210	0.21	246.96	45	158.76	88.2
		Ground floor	Ceiling fan	22	70	1540	1.54	1811.04	26	672.672	1138.368
		First floor	Ceiling fan	37	70	2590	2.59	3045.84	26	1131.312	1914.528



The detail of the equipment is given in the below table: (Different type of Ceiling, Wall And Exhaust Fan System)

Sr . N o.	Location	Location of Fan	Type of Fan	Number of Fan	Power (Watts)	Total Power (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
		Second Floor	Ceiling fan	26	70	1820	1.82	2140.32	26	794.976	1345.344
3	ACADEMIC BUILDING	Ground floor	Ceiling fan	37	70	2590	2.59	3045.84	26	1131.312	1914.528
			Ceiling fan	3	200	600	0.6	705.6	26	91.728	613.872
		First floor	Ceiling fan	38	70	2660	2.66	3128.16	26	1161.888	1966.272
			Ceiling fan	2	80	160	0.16	188.16	26	61.152	127.008
			Ceiling fan	2	120	240	0.24	282.24	26	61.152	221.088
		Second Floor	Ceiling fan	25	70	1750	1.75	2058	26	764.4	1293.6
			Ceiling fan	1	150	150	0.15	176.4	26	30.576	145.824
		Ground floor	Wall fan	6	60	360	0.36	423.36	60	423.36	0
		First Floor	Wall fan	5	60	300	0.3	352.8	60	352.8	0
		Second Floor	Wall fan	11	60	660	0.66	776.16	60	776.16	0
		Ground floor	Exhaust fan	1	70	70	0.07	82.32	45	52.92	29.4
		Second Floor	Exhaust fan	1	70	70	0.07	82.32	45	52.92	29.4
		New First Floor	Ceiling fan	90	70	6300	6.3	7408.8	26	2751.84	4656.96
			Ceiling fan	17	150	2550	2.55	2998.8	26	519.792	2479.008
			Ceiling fan	4	100	400	0.4	470.4	26	122.304	348.096
			Ceiling fan	3	200	600	0.6	705.6	26	91.728	613.872
			Wall fan	16	60	960	0.96	1128.96	60	1128.96	0
			stand fan	1	70	70	0.07	82.32	50	58.8	23.52

The detail of the equipment is given in the below table: (Different type of Ceiling, Wall And Exhaust Fan System)

Sr . No.	Location	Location of Fan	Type of Fan	Number of Fan	Power (Watts)	Total Power (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
			Table fan	2	120	240	0.24	282.24	55	129.36	152.88
		New Ground floor	ceiling fan	55	70	3850	3.85	4527.6	26	1681.68	2845.92
			ceiling fan	13	200	2600	2.6	3057.6	26	397.488	2660.112
			ceiling fan	4	150	600	0.6	705.6	26	122.304	583.296
			Wall fan	2	60	120	0.12	141.12	60	141.12	0
			Exhaust fan	2	70	140	0.14	164.64	45	105.84	58.8
4	LIBRARY	Ground floor	Ceiling fan	3	70	210	0.21	246.96	26	91.728	155.232
		First Floor	Ceiling fan	19	70	1330	1.33	1564.08	26	580.944	983.136
		Second Floor	Ceiling fan	33	70	2310	2.31	2716.56	26	1009.008	1707.552
		First Floor	Wall fan	3	60	180	0.18	211.68	60	211.68	0
		Second Floor	Wall fan	2	60	120	0.12	141.12	60	141.12	0
5	SCHOOL OF EDUCATION		ceiling fan	53	70	3710	3.71	4362.96	26	1620.528	2742.432
			exhaust fan	1	70	70	0.07	82.32	45	52.92	29.4
6	TEACHER CUBICLES		ceiling fan	25	70	1750	1.75	2058	26	764.4	1293.6
7	PROFESSIONAL COURSES DEPARTMENT		Ceiling fan	24	70	1680	1.68	1975.68	26	733.824	1241.856
			Ceiling fan	1	100	100	0.1	117.6	26	30.576	87.024
			Wall fan	10	60	600	0.6	705.6	60	705.6	0
			Exhaust fan	1	70	70	0.07	82.32	45	52.92	29.4

The detail of the equipment is given in the below table: (Different type of Ceiling, Wall And Exhaust Fan System)

Sr . N o.	Location	Location of Fan	Type of Fan	Number of Fan	Power (Watts)	Total Power (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
8	LH 1		ceiling fan	89	70	6230	6.23	7326.48	26	2721.264	4605.216
			ceiling fan	42	150	6300	6.3	7408.8	26	1284.192	6124.608
			Table fan	1	60	60	0.06	70.56	55	64.68	5.88
9	LH 2		ceiling fan	29	70	2030	2.03	2387.28	26	886.704	1500.576
			Wall fan	1	60	60	0.06	70.56	60	70.56	0
10	LH 3		Ceiling fan	65	70	4550	4.55	5350.8	26	1987.44	3363.36
11	OLD EKALAVYA		Ceiling fan	24	70	1680	1.68	1975.68	26	733.824	1241.856
12	NEW EKALAVYA HOSTEL		Ceiling fan	130	70	9100	9.1	10701.6	26	3974.88	6726.72
			Exhaust fan	32	70	2240	2.24	2634.24	45	1693.44	940.8
13	MADHUMAYA HOSTEL		Ceiling fan	30	70	2100	2.1	2469.6	26	917.28	1552.32
			Exhaust fan	8	70	560	0.56	658.56	45	423.36	235.2
14	JPPG HOSTEL		Ceiling fan	86	70	6020	6.02	7079.52	26	2629.536	4449.984
			wall fan	3	60	180	0.18	211.68	60	211.68	0
15	NARAYANIPANDIT SKILL CENTRE	Ground floor	ceiling fan	13	70	910	0.91	1070.16	26	397.488	672.672
			wall fan	8	60	480	0.48	564.48	60	564.48	0
16	SJ HOSTEL		Ceiling fan	78	70	5460	5.46	6420.96	26	2384.928	4036.032
			Ceiling fan	2	200	400	0.4	470.4	26	61.152	409.248
17	TF HOSTEL		Ceiling fan	95	70	6650	6.65	7820.4	26	2904.72	4915.68
			wall fan	6	60	360	0.36	423.36	60	423.36	0

The detail of the equipment is given in the below table: (Different type of Ceiling, Wall And Exhaust Fan System)

Sr. No.	Location	Location of Fan	Type of Fan	Number of Fan	Power (Watts)	Total Power (Watts)	Total Power consumed (Kilowatts)	Annual Consumption in (Kilowatts)	Recommended (wattage)	Total Consumption After Recommendation	Annual Savings After Recommendation
Total kW				1459	5750	109100		128301.6		51430.008	76871.592

### Assumption


1. Fans functionate for 7 hours daily for 24 days a month for 7 months. 6 days considered as holiday.

### Analysis

1. All 1253 ceiling fans are normal types which need to be replaced with 26-watt BLDC fans.
2. All 78 Exhaust fans need to be replaced with 45-watt Exhaust fans.
3. All 2 Pedestal fans need to be replaced with 50-watt Pedestal fans.
4. All 3 Table fans need to be replaced with 55-watt Table fans.


### Observation

1. The cost of 1 Bajaj BLDC fan is Rs. 2999/-. (Rates taken is mentioned below)
2. The cost of 1 Exhaust fan is Rs. 1325/-. (Rates taken is mentioned below)
3. The cost of 1 Bajaj Pedestal fan is Rs. 2699/-. (Rates taken is mentioned below)
4. The cost of 1 Usha Table Fan is Rs. 2570/-. (Rates taken is mentioned below)
5. Policy to be drawn that in future any fans are to be purchased it should be energy efficient fans.



Sponsored  
**BAJAJ Energon 5 Star 1200 mm BLDC Motor 3 Blade Ceiling Fan**  
 3.5★ 24 Ratings & 3 Reviews

- Blade Sweep: 1200 mm
- BEE Energy Rating: 5 Star
- 2 Year Product Warranty

**₹2,999**   
 ₹6,200 51% off  
 Free delivery  
 Top Discount of the Sale  
 Bank Offer

26-watt BLDC fans, Source: Flipkart



## Veto 10 inch 250mm 45 Watt Exhaust Fans, White

Visit the Veto Store

5.0 ★★★★★ 1 rating

₹1,325

Inclusive of all taxes

EMI starts at ₹120 per month. EMI options

### Offers

#### Bank Offer

Upto ₹2,000.00 discount on select...

24 offers >

#### Partner Offers

Get GST invoice and save up to 28% on...

1 offer >

### 45-watt Exhaust Fan, Source: Amazon

Home > Home & Kitch... > Home Appla... > Fans > BAJAJ Fans > BAJAJ Esteem...

## BAJAJ Esteem 400 mm 3 Blade Pedestal Fan (Multicolor, Pack of 1)

4 ★ 1,412 Ratings & 144 Reviews

Extra ₹234 off

₹2,699 ~~₹3,399~~ 20% off ⓘ

### 50-watt Pedestal Fan, Source: Flipkart



Click to open expanded view



## Usha Maxx Air 400mm 55-Watt Table Fan (White)

Visit the USHA Store

4.2 ★★★★★ 3,818 ratings

Amazon's Choice for "usha max air"

-17% ₹2,570

M.R.P.: ₹3,199

Inclusive of all taxes

EMI starts at ₹125. No Cost EMI available EMI options

### Offers

#### No Cost EMI

Upto ₹115.74 EMI interest savings on Amazon Pay ICICI...

1 offer >

#### Bank Offer

Upto ₹2,000.00 discount on select Credit Cards, HDFC...

24 offers >

#### Partner Offers

Get GST invoice and save up to 28% on business purchases.

1 offer >



10 days Replacement



Amazon Delivered



1 Year Warranty



Free Delivery

### 55-watt table fan, Source: Amazon



## 7.8 Air Conditioners

The details of Different type Airconditioning System								
Sr. No.	Location	No. of ACs	Air Conditioning			Power Consumption in		Annual Consumption in (Kilowatts)
			Type	Star	Ton	Watt	Total (kW)	
1	Academic Building	24	Split AC	3	2	5150	5.15	4449.6
2	School of Education	11	Split AC	5	2	7034	7.034	6077.376
3	Teachers Cubicle	15	Split AC	1	1.5	6446	6.446	5569.344
4	Narayani Panda Center	7	Split AC	2	2	6100	6.1	5270.4
5	Administrative Building	6	Centralized ACs				67.5703	21000
<b>Total</b>		<b>63</b>				<b>24730</b>	<b>24.73</b>	<b>42366.72</b>



**ACs at G.M. University, Sambalpur**

### Assumption

1. Fans functionate for 6 hours daily for 24 days a month for 6 months. 6 days considered as holiday.
2. Centralized Acs is functioning for approximately 310 hrs.

## 7.9

## Pumping System

Details of Pumping System Installed						
Sr. No	Location	Pump of Capacity (HP)	Depth (Feet)	Power Measurement		
				Voltage (V)	Current Amp	Measured Power (KW)
1	JP PG Hostel	2 HP	10 ft	220 V	10-12 AMP	5226.88
2	Madhu maya Hostel	2 HP	10 ft	220 V	10-12 AMP	
3	New Eklavya Hostel	2 HP	10 ft	220 V	10-12 AMP	
4	TF Hostel	2 HP	10 ft	220 V	10-12 AMP	
5	LH I	2 HP	10 ft	220 V	10-12 AMP	
6	LH II	2 HP	10 ft	220 V	10-12 AMP	
7	LH III	2 HP	10 ft	220 V	10-12 AMP	
8	Old Eklavya Hostel	2 HP	10 ft	220 V	10-12 AMP	
9	SJ Hostel	2 HP	10 ft	220 V	10-12 AMP	



Pumping System at G.M. University

## Assumption

1. Water pumps are used for alternate purpose.

## 7.10

## DG Set

DG Set					
DG set	kVA	Phase	Total kVA	PF (0.8)	in kW
3	125	3	375	300	112500
1	320	3	320	256	81920
Total					194420



DG Set at G.M. University, Sambalpur

## 7.11

## Other Appliances

P.C., Printer, laptop, Induction, Fridge, T.V & Projector				
Sr. No.	Appliances	Total Quantity	Wattage	Annual Consumption in (Kilowatts)
1	Total No. of printer	60	675	46656
2	Total No. of PC	369	150	63763.2
3	Total No. of laptop	5	65	374.4
4	Total No. of Induction	3	2000	5760
5	Total No. of Fridge	10	500	43800
6	Total No. of TV	12*55"	125	1728



P.C., Printer, laptop, Induction, Fridge, T.V & Projector				
Sr. No.	Appliances	Total Quantity	Wattage	Annual Consumption in (Kilowatts)
7	Total No. of Projector	7	300	2419.2
<b>Total</b>		<b>466</b>		<b>164500.8</b>

### Assumption

1. Printer, Projector, PC & Laptop are functioning for 6 Hrs. daily for 24 days in a month of 8 months.
2. Induction is functioning for 4 hrs. for 30 days in a month of 8 months.
3. Fridge is functioning for 24 hrs. for 365 days.
4. TV is functioning for 6 hrs. for 24 days in a month of 8 months.

### 7.12 Details of Connected Load (kW) Till 31<sup>st</sup> March 2023

Sr. No.	Connected Load	Load in kW
1	Indoor light	91453.32
2	Outdoor light	38995.2
3	Fan	128301.6
4	Water Pump	5226.88
5	Acs	42366.72
6	Other Appliances	164500.8
<b>Total kW per annum</b>		<b>4,70,844.52</b>

### 7.13 Payback Period

If we consider only indoor lighting, outdoor lighting & fans, there is a lot of scope to save energy. Based on our assumption, the university can save 116566.2 units per annum only from replacement of our suggestions. In terms of money the university can save Rs. 722710.44.

Sr. No.	Name of Fixtures	Total kW saving per annum	Total amounts save per annum	Cost of replacement of fixtures	Payback period (in months) approx.
1	Indoor lighting	17893.008	110936.65	134816	15
2	Outdoor lighting	21801.6	135169.92	49348	4
3	Fans	76871.592	476603.87	3874205	98

**Note: -**

If in the first phase only 21 wattage ceiling fans will be replaced (If our recommendation will follow the university) by the university and their replacement cost will be Rs. 62979 (Approx.) then payback period of the replacement of 21 ceiling fans will be 28 months approx. only.

## **7.14 Lighting system**

Lighting is an essential service in all industries, Universities, Hospitals, Malls, etc. Innovation and continuous improvement in the field of lighting, have given rise to tremendous energy-saving opportunities in this area. Lighting is an area, which provides some major scope to achieve energy efficiency at the design stage, by incorporation of modern energy-efficient lamps, luminaries, and gears, apart from good operational practices.

Basic Terms in Lighting System and Features:

### **Lamps**

Lamp is equipment, which produces light. The most used lamps are Described briefly as follows:

#### **Incandescent lamps**

Incandescent lamps produce light by means of a filament heated to incandescence by the flow of electric current through it. The principal parts of an incandescent lamp, also known as GLS (General Lighting Service) lamp include the filament, the bulb, the filling, and the cap.

#### **Reflector lamps**

Reflector lamps are basically incandescent, provided with a high-quality internal mirror, which follows exactly the parabolic shape of the lamp. The reflector is resistant to corrosion, thus making the lamp maintenance free and output efficient.

#### **Gas discharge lamps**

The light from a gas discharge lamp is produced by the excitation of gas contained in either a tubular or elliptical outer bulb. The most used discharge lamps are as follows:

- Fluorescent tube lamps (FTL)
- Compact Fluorescent Lamps (CFL)
- Mercury Vapor Lamps
- Sodium Vapor Lamps
- Metal Halide Lamps

## **7.15 Energy Management Strategy**

Energy Management should be seen as a continuous process. Strategies should be reviewed annually and revised as necessary. The key activities suggested have been outlined below:

### **University Corporate Approach**

The starting point in energy management is to identify a strategic corporate approach to energy management. Clear accountability for energy usage needs to be established, appropriate financial and staffing resources must be allocated, and reporting procedures initiated. An energy management program requires commitment from the whole organization to be successful. A record of Energy consumption must be kept and monitored on regular basis, to optimize the Energy consumption. For this, various meters may have to be installed.



### ***Designate an energy manager***

An Energy Manager must be identified, and time bound responsibility must be given to him in getting implemented the findings of the Energy Audit points, which the Plant Establishment has planned to implement.

### ***Setup an energy monitoring and reporting system***

Successful energy management requires the establishment of a system to collect/analyses and report the energy costs and consumption pattern. This will enable an overview of energy use and its related costs, as well as facilitating the identification of savings that might 'otherwise not be detected. The system needs to record both historical and ongoing energy use, as well as cost information from billing data, and capable of producing summary reports on a regular basis. This information will provide how trends can be analyzed and reviewed for corrective measures.

### ***Implement a staff awareness and Training program***

A key ingredient to the success of an energy management program is maintaining a high level of awareness among staff. This can be achieved in several ways, including formal training, newsletters, posters and publications. It is important to communicate program plans and case studies that demonstrate savings, and to report results at least at 12-month intervals. Staff may need training from specialists on energy saving practices and equipment.

## Recommendations

### 1. Water Audit:

- I. It is recommended to **install water meters** to monitor the consumption of water.
- II. Monitoring of consumption should be done on a daily basis.
- III. Monthly consumption to be reviewed in periodical meetings at senior level.
- IV. 6 monthly reviews are recommended at apex level.
- V. Leakages should be identified & the method to plug them be defined.
- VI. Consumption of water should be optimum & where it is felt as misused, action to be taken accordingly.
- VII. **TDS level at J.P. Boys Hostel Mess, Library, Ladies Hostel-I, New Women Hostel II, Old Ekalavya Ladies Hostel & Indumati Hostel** is recommended to increase.
- VIII. Policy for **Zero discharge of wastewater** is recommended.

### 2. Ambient Air Quality Audit:

- I. Except Lecture Gallery II & New Ekalavya Hostel, AQI of the whole University campus area is more than 50. Need to install Exhaust fan.
- I. This has been achieved due to plantation & greenery.
- II. Action to be taken to reduce further AQI within 30.
- III. This can be achieved by reducing the PM<sub>2.5</sub> size particles.
- IV. More grassy area to be made so that dust may not fly in atmosphere.
- V. More plantation to be done & rate of survival should be monitored.
- VI. The University has declared the campus as **NO SMOKING ZONE**.

### 3. Waste Management:

- I. It is recommended to set – up a **biogas plant** to utilise the kitchen waste as well as dry leaves, cuttings of grasses etc.
- II. New **E – Waste** policy has been implemented from 1<sup>st</sup> April 2023, must be adhered.
- III. **Ban on Single use plastic** has been implemented from 1<sup>st</sup> July 2022 must be ensured by penalty or whichever deemed fit by administration.
- IV. Policy for **Net Zero waste Management** is recommended for inclusion.

### 4. Biodiversity Audit:

- I. Greenery in the campus is in abundance.
- II. Normally, minimum 15% area is required for a campus but GMU is having 50% + area with greenery.
- III. Some more area with grassy land scape should be searched out where dust is flowing in the atmosphere to reduce AQI to 30.
- IV. Plantation is sufficient & survival rate has also increased in the preceding years. Further planning to be done to further increase the survival rate.
- V. Lots of animals, insects & birds etc. were visible in the campus area.
- VI. It is recommended to develop some small-small water bodies in different locations to attract these creatures.

### 5. Fire Safety Audit:

- I. GMU is fully equipped with fire safety devices.
- II. It is recommended to check at least one of the building fire safety devices annually.
- III. Also train some of the NCC or whatever deemed fit by administration regarding operation of the devices in case of emergency.
- IV. Periodicity of the checking of the installation including smoke devices to be monitored.

## 6. Sanitization & Hygiene:

- I. The university is well conversant with hygiene & sanitization.
- II. Incineration plant for females need to be installed in women hostel.
- III. Mess & canteen staff should be counselled to wear head & hand gears.
- IV. In general toilets were found to be neat & clean in the whole campus area.

## 7. Energy & Renewable Audit

- I. It is recommended that **the policy** be framed so that in future whenever the bulbs are to be replaced, it **should be replaced with LED bulbs & Lights only**.
- II. In the **policy**, further recommended that in future if normal fans are to be replaced, it **shall be replaced with BLDC fans only**.
- III. **All future purchases should be for LED bulbs, lights, BLDC fans & star-rated appliances.**
- IV. Implementation of the policy for becoming NET ZERO in energy by 2030 be planned accordingly.

## References

1. Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008.
2. Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016 with amendments.
3. Various News Papers.
4. From EPA (Environment Protection Agency, USA) guidelines.
5. IS 10500:2012.
6. Water (Prevention and Control of Pollution) Act, 1974.
7. Air (Prevention and Control of Pollution) Act, 1981.
8. Environment Protection Act, 1986 (with amendment).
9. The Ministry of New and Renewable Energy (MNRE) guidelines.
10. Ministry of Power guidelines.
11. Central Pollution Control Board Guidelines.
12. State Pollution Control Board Guidelines.
13. E- Waste (Management) Rules, 2016 & 2022.
14. Ministry of Jal Shakti guidelines.
15. Solid Waste Management Rules, 2016.
16. National Ambient Air Quality Standards 2019
17. The Ministry of Drinking Water and Sanitation guidelines.
18. National Building Code (Vol. II) 2016, Chapter 11.
19. Data provided by the university.
20. Guidelines issued by the Hon'ble NGT and Hon'ble Supreme Court from time to time.



भारत सरकार  
Government of India  
सूक्ष्म, लघु एवं मध्यम उद्यम विभाग  
Ministry of Micro, Small and Medium Enterprises



## UDYAM REGISTRATION CERTIFICATE

UDYAM REGISTRATION NUMBER : **UDYAM-UP-32-0023384**  
 NAME OF ENTERPRISE : **G C CONSULTANCY SERVICES**  
 TYPE OF ENTERPRISE \* : **MICRO ( Based on FY 2020-21 )**  
 MAJOR ACTIVITY : **SERVICES**  
 SOCIAL CATEGORY OF ENTREPRENEUR : **GENERAL**  
 NAME OF UNIT(S) :

S.No.	Name of Unit(s)
1	G C Consultancy Services

### OFFICAL ADDRESS OF ENTERPRISE

Flat/Door/Block No.	614	Name of Premises/ Building	Nearest Enclave
Village/Town	GORAKHPUR	Block	GORAKHPUR
Road/Street/Lane	Rajender Nagar	City	GORAKHPUR
State	UTTAR PRADESH	District	GORAKHPUR , Pin 273015
Mobile	7007794292	Email:	gco4114@gmail.com

DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE : **26/02/2022**

DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS : **26/02/2022**

### NATIONAL INDUSTRY CLASSIFICATION CODE(S)

S.No.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity
1	63 - Information service activities	6399 - Other information service activities n.e.c.	63999 - Other information service activities n.e.c.	Services

DATE OF UDYAM REGISTRATION : **08/11/2022**

\* In case of graduation (upward/downward) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2123(E) dated 26.06.2020 issued by the M/o MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from <https://udyamregistration.gov.in> & Date of printing:- 08/11/2022

For any assistance, you may contact:

1. District Industries Centre: **GORAKHPUR ( UTTAR PRADESH )**
2. MSME-DFO: **KANPUR ( UTTAR PRADESH )**

Visit : [www.msme.gov.in](http://www.msme.gov.in) ; [www.dcmsme.gov.in](http://www.dcmsme.gov.in) ; [www.udyamregistration.gov.in](http://www.udyamregistration.gov.in)



Follow us @minmsme\_s @msme







# Certificate of Training

TNV hereby certifies that

**ASHUTOSH KUMAR SRIVASTAVA**

has successfully completed the 5 days

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- QM: Quality Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

**ISO 9001:2015**

Issue Date: 26<sup>th</sup> Jul. 2021

Training Date: 14<sup>th</sup> to 18<sup>th</sup> Jul. 2021

Certificate Number : 2107280221020102

Authorised Signatory  
(Pragya Singh)

**This course is certified by Exemplar Global vide registration number TN001**

*Note: The course conforms to the principles and practices of the ISO 9001:2015 Management Systems for compliance with standards. This certificate remains valid for 5 years. For more information, this certificate is recognized by Exemplar Global. For any queries, please write to Mail: info@tnvindia.com.*

isplay



## Certificate of Training

TUV hereby certifies that

**ASHUTOSH KUMAR SRIVASTAVA**

has successfully completed the 40 hours

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EM: Environmental Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

**ISO 14001:2015**

Issue Date: 28<sup>th</sup> Sep. 2021

Certificate Number : 2109280721030101

Authorised Signatory  
(Pragya Singh)

**This course is certified by Exemplar Global vide registration number TN006010**

*Note: The course conforms to the principles and practices of audit of Management Systems for compliance with standards. This certificate remains the property of TUV. If this certificate is recognized by Exemplar Global, for verification of the certificate, please write to: Mail: info@isotube.com*





# Certificate of Training

TNV hereby certifies that

**ASHUTOSH KUMAR SRIVASTAVA**

has successfully completed the 40 hours

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- FS: Food Safety Management Systems
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

**ISO 22000:2018**

Issue Date: 28<sup>th</sup> Sep. 2021

Certificate Number : 2109281721020101

Authorised Signatory  
(Pragyesh Singh)

**This course is certified by Exemplar Global vide registration number TN006009**

*Note: The course conforms to the principles and practice of audits of Management Systems for compliance with standards. This certificate remains the property of TNV and this certificate is recognized by Exemplar Global. For verification of this certificate, please write to Mail: [info@isoindia.org](mailto:info@isoindia.org)*



# Certificate of Training

TNV hereby certifies that

**ASHUTOSH KUMAR SRIVASTAVA**

Has successfully completed the 40 hours

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- OH: Occupational Health and Safety
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

**ISO 45001:2018**

Issue Date: 28<sup>th</sup> Sep. 2021

Certificate Number : 2109281221030101

Authorised Signatory  
(Pragya Singh)

**This course is certified by Exemplar Global vide registration number TN006100**

*Note: The course conforms to the principles and practice of audits of Management Systems for compliance with standards. This certificate remains the property of TNV. For this certificate is recognized by Exemplar Global. For verification of this certificate, please write to Mail: [info@isoindia.org](mailto:info@isoindia.org)*





# Certificate of Training

TNV hereby certifies that

**ASHUTOSH KUMAR SRIVASTAVA**

has successfully completed the 40 hours

Auditor / Lead Auditor Training Course which meets the training requirements of the Exemplar Global and has been declared as competent in the following competency units

- EnMS: Energy Management System
- AU: Management Systems Auditing
- TL: Leading Management Systems Audit Teams

**ISO 50001:2018**

Issue Date: 12<sup>th</sup> Sep. 2022

Certificate Number : 2209123622030102

Authorised Signatory  
(Prayesh Singh)

This course is certified by Exemplar Global vide registration number 1 N000

Note: The course conforms to the principles and practices of Exemplar Global for compliance with standards. This certificate is recognized by Exemplar Global. For more information, please write to Mail: info@exemplarglobal.com





Confederation of Indian Industry  
125 Years - Since 1895

This is to certify that

**A K SRIVASTAVA**

is a

**CII Certified Expert in Sustainable Waste Management**

**K S Venkatagiri**  
Executive Director  
CII-Godrej GBC

**Pradeep Bhargava**  
Chairman  
Environment & Recycling Council

**Hussain Shaikh**  
Chairman  
GreenCo Education Centre



Issued by CII Sohrabji Godrej Green Business Centre

Issued on 11 July 2020

CII GBC-SWM/0720-008



Confederation of Indian Industry

This is to certify that

**A K SRIVASTAVA**

is a

**CII Certified Resource  
Efficiency and Environmental  
Sustainability Auditor**

**K S Venkatagiri**

Executive Director  
CII-Geedee IGBC

**Pradeep Bhargava**

Chairman  
CII-Geedee Council





Indian Green Building Council  
C/o. Confederation of Indian Industry  
CII - Sohrabji Godrej Green Business Centre  
Survey No 84, Kotbaguda Post, Near HITEC City  
R R District, Hyderabad - 500684  
Tel: 91-40-44185111 Fax: 91-40-44185189  
Email: [igbc@cii.in](mailto:igbc@cii.in)  
Website: [www.greenbusinesscentre.com](http://www.greenbusinesscentre.com) ;  
[www.igbc.in](http://www.igbc.in)

V Suresh  
Chairman

### TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr Ashutosh Kumar Srivastava** is one of the Individual Members of Indian Green

Building Council (IGBC) for the Year Jan 2020 to Dec 2024.

Mr Ashutosh Kumar Srivastava membership number is 'IGBC - IM - 10500131'.



V Suresh



Confederation of Indian Industry  
125 Years: 1895-2020

This is to certify that

**ASHUTOSH KUMAR SRIVASTAVA**

is a

**CII Certified Expert in  
Climate Change &  
Environmental Sustainability**

**K S Venkatagiri**

Executive Director  
CII-Godrej IGBC

**Pradeep Bhargava**

Chairman  
Environment & Recycling Council

**Hussain Shariyari**

Chairman  
GreenCo Education Committee



Issued by CII-Schroder Godrej Green Business Centre

Issued on 10 June 2020

CII/BC/CECCES/04/20258



Confederation of Indian Industry

## The Indian Green Building Council

hereby certifies that

**Ashutosh Kumar Srivastava**

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

## IGBC Accredited Professional

**K S Venkatagiri**

Executive Director  
Ovi-Godrej GBC

9562

**V Suresh**

Chairman  
Indian Green Building Council

06 June 2020

**Gurmit Singh**

Vice-Chairman  
Indian Green Building Council



# Certificate of Surveillance



This is to certify that Quality Management System of

## GC Consultancy Services

1<sup>ST</sup>, 17/30, NEAR BY RAMGARH TAL, MALHAR SAHARA STATE COLONY,  
GORAKHPUR, UTTAR PRADESH - 273015, INDIA

is in accordance with the requirements of the following standard

## ISO 9001:2015

(Quality Management System)

### SCOPE

Conducting Environmental audits in coordination with CII Green Co Certifications  
which includes Energy, Renewable Energy, Water Conservation,  
Waste Water Management, Life Cycle Assessment

Certificate Number : SCK/01/GCC/22/91/1845  
1<sup>st</sup> Surveillance Done : 20-Jul-2023

**To verify certificate, visit at :**

[www.sckcerts.com](http://www.sckcerts.com)  
[www.iafcertsearch.org](http://www.iafcertsearch.org)

Initial Registration Date : 20-Jul-2022  
1<sup>st</sup> Surveillance Date : 20-Jun-2023  
2<sup>nd</sup> Surveillance Date : 20-Jun-2024  
Certificate Expiry Date : 19-Jul-2025

Issued by SCK Certifications Pvt. Ltd.

*Ashish K*  
Director



Accreditation Board : 3060, Saturn Street, Suite 100, Brea, California 92821-1732, USA

This certificate remains the property of SCK and must be returned to SCK on Cancellation or Suspension of the certificate. Validity of the certificate is subject to successful completion of surveillance audits. Further clarification regarding the scope of this certificate and the applicability of standard may be obtained by consulting the Organisation on [info@sckcerts.com](mailto:info@sckcerts.com)

# Certificate of Surveillance



This is to certify that Environmental Management System of

## GC Consultancy Services

1<sup>ST</sup>, 17/30, NEAR BY RAMGARH TAL, MALHAR SAHARA STATE COLONY,  
GORAKHPUR, UTTAR PRADESH - 273015, INDIA

is in accordance with the requirements of the following standard

**ISO 14001:2015**  
(Environmental Management System)

## SCOPE

Conducting Environmental audits in coordination with CII Green Co Certifications  
which includes Energy, Renewable Energy, Water Conservation,  
Waste Water Management, Life Cycle Assessment

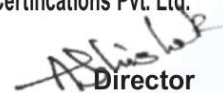
Certificate Number : SCK/02/GCC/22/91/1846  
1<sup>st</sup> Surveillance Done : 20-Jul-2023

To verify certificate, visit at :

[www.sckcerts.com](http://www.sckcerts.com)  
[www.iafcertsearch.org](http://www.iafcertsearch.org)

Initial Registration Date : 20-Jul-2022  
1<sup>st</sup> Surveillance Date : 20-Jun-2023  
2<sup>nd</sup> Surveillance Date : 20-Jun-2024  
Certificate Expiry Date : 19-Jul-2025

Issued by SCK Certifications Pvt. Ltd.

  
Director



Accreditation Board : 3060, Saturn Street, Suite 100, Brea, California 92821-1732, USA

This certificate remains the property of SCK and must be returned to SCK on Cancellation or Suspension of the certificate. Validity of the certificate is subject to successful completion of surveillance audits. Further clarification regarding the scope of this certificate and the applicability of standard may be obtained by consulting the Organisation on [info@sckcerts.com](mailto:info@sckcerts.com)



# Certificate of Surveillance



This is to certify that Occupational Health & Safety Management System of

## GC Consultancy Services

1<sup>ST</sup>, 17/30, NEAR BY RAMGARH TAL, MALHAR SAHARA STATE COLONY,  
GORAKHPUR, UTTAR PRADESH - 273015, INDIA

is in accordance with the requirements of the following standard

# ISO 45001:2018

(Occupational Health & Safety Management System)

## SCOPE

Conducting Environmental audits in coordination with CII Green Co Certifications  
which includes Energy, Renewable Energy, Water Conservation,  
Waste Water Management, Life Cycle Assessment

Certificate Number : SCK/03/GCC/22/91/1847

1<sup>st</sup> Surveillance Done : 20-Jul-2023

To verify certificate, visit at :

[www.sckcerts.com](http://www.sckcerts.com)

[www.iafcertsearch.org](http://www.iafcertsearch.org)

Initial Registration Date : 20-Jul-2022

1<sup>st</sup> Surveillance Date : 20-Jun-2023

2<sup>nd</sup> Surveillance Date : 20-Jun-2024

Certificate Expiry Date : 19-Jul-2025

Issued by SCK Certifications Pvt. Ltd.

  
Director



Accreditation Board : 3060, Saturn Street, Suite 100, Brea, California 92821-1732, USA

This certificate remains the property of SCK and must be returned to SCK on Cancellation or Suspension of the certificate. Validity of the certificate is subject to successful completion of surveillance audits. Further clarification regarding the scope of this certificate and the applicability of standard may be obtained by consulting the Organisation on [info@sckcerts.com](mailto:info@sckcerts.com)



**National Accreditation Board  
for Certification Bodies**



## *Accreditation Certificate*

**NABCB**

*hereby confirms that*

**Bosai Safety Private Limited**

H-69, C/o Shilp Indya, SCC Builders,  
Sector-63, Noida, Uttar Pradesh-201301, India  
*complies with*

**NABCB Accreditation Criteria for Inspection Bodies**

(ISO/IEC 17020:2012)

as Type 'A' Inspection Body

*to carry out*

**Inspection**

as per accompanying


Schedule I : Scope of Accreditation

Schedule II : Office(s) under Accreditation

**Accreditation Certificate No.:** IB 085  
**Date of Initial Accreditation :** October 26, 2021  
**Validity of Accreditation :** October 25, 2024

**October 26, 2021**  
**Issue Date**

(Please refer <http://nabcb.qcl.org.in> for validity of the certificate or contact NABCB for any related queries)

  
**(Rajesh Maheshwari)**  
**Chief Executive Officer**

Page 1 of 1



# CERTIFICATE OF ACHIEVEMENT



**intertek**  
Total Quality. Assured.

**LS CHAUHAN**

has successfully completed the following CQI-IRCA certified course:

**ISO 9001:2015 Lead Auditor  
Quality Management Systems  
Training course**

- The Course includes the assessment and evaluation of Quality Management Systems to conform to the requirements of ISO 9001:2015 and ISO 19011:2011
- The course meets the training requirements for individuals seeking certification under the IRCA Auditor Certification Scheme

**UNIQUE DELEGATE NUMBER**  
123543

**TRAINING DATE:**  
6<sup>th</sup> – 10<sup>th</sup> August 2018



Organised by:  
National Institute of Training for Standardization  
BUREAU OF INDIAN STANDARDS

Head, NITS (BIS)

**COURSE ID:**  
18086

Authorised Signature



For IRCA Membership Application To Be Made Within 3 Years From Last Day of Course



123543





# NATURE SCIENCE FOUNDATION

(An ISO 9001:2015 Certified & Ministry of MSME Registered Organization)

LIG-II, 2669, Gandhi Managar, Peelamedu,  
Coimbatore – 641 004, Tamil Nadu, India.

Email: [directornsf@gmail.com](mailto:directornsf@gmail.com), Phone: 0422 2510006, Mobile: 95667 77255, Website: [www.nsfonline.org.in](http://www.nsfonline.org.in).



## Certificate of Lead Auditor Course

This is to certify that **Lokendra Singh Chauhan, Retired (Scientist -D/ Joint Director), Bureau of Indian Standards** has successfully completed a Lead Auditor Course on “Environment Management System, Green Campus Audit, Energy Audit and Hygiene Audit to Educational Institutions and Industrial sectors” (Third Series) organized by the Nature Science Foundation, Coimbatore – 641 046, Tamil Nadu, India from 09<sup>th</sup> May 2022 to 13<sup>th</sup> May 2022.

NSF/LAC/2022/49

Motto of NSF

‘Save the Nature to Save the Future’ & ‘Go Green to Save the Planet’



*Rajiv*

Chairman

Nature Science Foundation

*Ashu*

Certified ISO Auditor

Environment Management System



*B. H. Phale*

Certified Auditor IGBC AP

Indian Green Building Council

*Uday*

Certified BEE Auditor

Bureau of Energy Efficiency