2020

Green Audit Report 2020

GOA UNIVERSITY, TALEIGAO, GOA- 403 206

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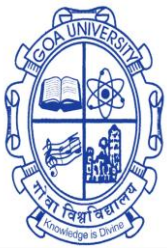

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PREFACE

The green audit is a measure to assess the environmental and energy initiatives of the campus and to direct the users to mobilize the resources to address the identified gaps and thereby contribute to the sustainable development of the targeted demography.

The campus of Goa University is rich in environmental ingredients like afforestation, flora and fauna, rainwater harvesting and conservation of the bio-species. The initiatives taken by the University authorities through internal and external support has resulted in sustainable campus. However, due to climate change and environmental impact, there is need for continual monitoring and assessment of environmental factors to have better control.

The green audit-cum-energy audit is an initiative to measure, assess and evaluate the interventions taken in the upgradation of environment as well as environmental parameters and take the remedial measures.

This report is the result of measurement, assessment and evaluation of different parameters and initiatives so as to identify the progress and gap for the campus development in context to environmental impact and benefits.

The report is based on the factual data. The observation, suggestions and recommendations are based on the global practices aiming towards attaining local environmental standards/benchmark and global environmental standards/ benchmark. This green-cum-energy audit has collected the data on the initiatives taken by the university as well as efforts taken to maintain and sustain environment. The action plan can be developed by the authorities based on the observations/suggestions/recommendations.

Prof. R. S. Gad

Co-ordinator USIC

Forward

Worldwide there is a global health and environmental emergency as dumpsites receive 40% of the global waste of which 38 out of 50 dumpsites directly threaten marine and coastal areas. Total of 50 biggest dumpsites directly affect the daily lives of the 64 million peoples which is a size of population of France. Challenges of the solid waste management are inadequate waste collection, low recycling, poor treatment, uncontrolled disposal, inadequate technology, and low awareness of health risks. It is estimated that 50 million tonnes of e-waste were generated globally in 2018. There is a urgent need for robust legal framework, policies align with SDG, reforms in line of circular economy while addressing these issues.

Goa University is committed to take a leadership in generating awareness in its own way to identify the standards and protocols for protection and conservation of the resilient environment around us for the generation to come. Over last five-year university has accepted various new and advanced technologies which are ecofriendly; such as water harvesting, hazardous waste management, water harvesting through bandharas, etc. Plantations of local and endemic species on campus is a big challenge and is accepted by the University. University has installed solar electrical panel for harvesting the renewable solar energy and is using the same for recharging the electrical grid in neighborhood. Goa University has taken forward the mandate of the Swatch Bharat Abhiyan and has installed the Swachh Bharat Summer Internship to initiate various swachata related activities on the campus and also in the various part of adopted villages of State of Goa. In the year 2019 total around 294 interns consisting of 60 teams participated in 100 hours for Seva-Bhav and community development activities.

I am very happy to forward this Green Energy Audit Report 2019-2020 of the Goa University, Taleigao, Goa. This is a first of its kind report generated from Goa University campus and required continuous upgradation to suit the regulation of environment protection is place. I hope report will be helpful to all the concern in the University to bring enhanced reforms in line of the Green initiative in coming future.

Varun Sahni

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INDEX

CHAPTER-I

ABOUT THE GOA UNIVERSITY

Goa University was established under the Goa University Act of 1984 (Act No. 7 of 1984) and commenced operations on 1 June 1985. The university provides higher education in the Indian state of Goa. It is located on Taleigao Plateau overseeing Zuari estuary on a picturesque campus spread over 402 acres with state-of-the-art infrastructure.

The university campus is located at (coordinates) Taleigao plateau on the outskirts of the capital city Panjim. The campus is spread over 427.9 acres on Taleigao plateau (Figure 1.1), overseeing the zuari estuary (goa.gov.in). The widespread campus is highly fragmented by various buildings and latest being Dr. Shyamaprasad Mukherjee indoor stadium. The Bambolim-Dona Paula highway bisects the campus adding to further fragmentation. Plateaus are often neglected as habitats and are considered wastelands due to their dry barren appearance during drier months and thus are a natural choice in the region for developmental projects (Desai, M. & A.B. Shanbhag 2012). The present scenario also depicts the large-scale encroachment and various developmental projects being located in the region. This has resulted in the destruction of the natural vegetation on the plateau surrounding the campus thus questioning the survival of its integrity.

Geographically, Goa is located in an ecologically sensitive region along the Western Ghats and the Arabian Sea (Figure 1.2) . Goa University has appropriately emerged as an important resource centre for research in the field of flora and fauna endemic to this region, as well as the marine environment. The Ministry of Earth Sciences has recognized Goa University's significant contribution in this domain, as a consequence of which a Centre of Excellence was established in Marine Microbiology. The Departments at the University have developed excellent research facilities. Large funding for research is received from Central Government agencies such as University Grants Commission, Department of Science & Technology, Ministry of Earth Sciences, Ministry of Environmental Sciences and Climate Change, Department of Biotechnology, etc. For a relatively small university, Goa University attracts generous funding of research projects from national funding agencies which reflects upon the high quality of research undertaken at the University.

The research study conducted at the University of Goa revealed an eye opener for conservation of plateau ecosystems study conducted by Minal Desai & A.B. Shanbhag (2012), A year-long study from October 2000 to September 2001 on the avifauna of the Taleigao Plateau, Goa resulted in documenting 114 species of birds belonging to 30 families and 12 orders which included 19 migratory species and six were distant migrants. This work was published in Journal of Threatened Taxa. One of the student Sadh, R. (1999), Studies on the bird population and the behavior of Lapwings in the Goa University Campus, M.Sc. Dissertation, Goa University, Goa, India. However, it is evident that a greater number of species is being recorded in the campus which is the evidence of healthy environment. The existence of Yellow Wattled Lapwing in the campus which is confined only to plateaus and restricted population in the state of Goa. Around 180+ species exist on the campus which is around 40% of the total species recorded in the state of Goa (476 +). There are different types of habitats within the campus and around the vicinity of

the campus. The campus has different habitats such as Grass land, shrub land, forest patches, and coastal areas.

The flora and fauna have been catalogued by the University department of the campus and the plateau. The specific research work has been done at University to catalogue and investigate taxa such as Avian, Lepidopteron, Arachnid and Herpetofauna of the region was initiated and found to be very rich. The campus has been a prime habitat for several avian species (Local, Migratory, etc). Prof. Shanbhag, A.B. & A. Gramopadhye (1993) studied the "Changing ecology of Taleigao Plateau and the bird life in its central zone", the Goa university campus.

Figure 1.1: Goa University Campus a teleview.


Figure 1.2: Goa University Campus panoramic view.

CHAPTER-II

GREEN GOA AND GREEN CAMPUS

Forest cover in Goa is diverse. Goa is India's smallest state terms of area and the fourth smallest in terms of population. Goa is located on the west coast of India in the region known as the Konkan Forest cover in Goa stands at 1,424 km², most of which is owned by the government. Government owned forest is estimated at 1224.38 km² whilst private is given as 200 km². Most of the forests in the state are located in the interior eastern regions of the state. The Western Ghats, which form most of eastern Goa, have been internationally recognized as one of the biodiversity hotspots of the world. In the February 1999 issue of National Geographic Magazine, Goa was compared with the Amazon and Congo basins for its rich tropical biodiversity.

Goa's state animal is the Gaur, the state bird is the Ruby-throated yellow Bulbul, which is a variation of Black-crested Bulbul, and the state tree is the Matti. The important forests products are bamboo canes, Maratha barks, chillar barks and the bhirand. Coconut trees are ubiquitous and are present in almost all areas of Goa barring the elevated regions. Much deciduous vegetation, including teak, sal, cashew and mango trees, is present. Fruits include jackfruits, mangos, pineapples and blackberries. Foxes, wild boars and migratory birds are found in the jungles of Goa. The avifauna includes kingfishers, mynas and parrots. Numerous types of fish are also caught off the coast of Goa and in its rivers. Crabs, lobsters, shrimps, jellyfish, oysters and catfish form some of the piscine catch. Goa also has a high snake population, which keeps the rodent population in control. Goa has many famous National Parks, including the renowned Salim Ali bird sanctuary.

The Goa University campus rests on a lateritic rocky plateau covered by a carpet of grass and ephemerals during the rainy season and of *karad (*dried grass) during summer. There are many sporadically distributed shrubs, tall trees and wild animals. The floral and faunal diversity of the Campus has been well-documented. It is a seasonal resting habitat for many migratory birds. through an innovative collaboration with an NGO, Western Ghats Kokum Foundation efforts have been made, for a **Biodiversity-Enrichment programme** whereby a permanent greening effort has resulted in the development of a mango orchard. There are 8 bore-wells in the Campus which augment the water needs of the University in a significant way.

The University has also made visible efforts to set up a **rainwater harvesting** facility which replenishes the underground aquifer. Goa University have an efficient water harvesting system recharging of groundwater reservoir on the campus which has become a model for many other institutions and industries to adopt for; scientifically planned and successfully implemented biodiversity plantations on the hard lateritic campus; concerted efforts to carry out campus greening to add to the Carbon credits of the region; care of the greenery on the campus by regular maintenance; conducting annual plantation program under "*Vanamahosthav*"; safe disposal of e-waste and proper hazardous-waste management; and, most importantly, conservation of the rich biodiversity extant on the campus in spite of

undertaking the much needed construction activity for faculty blocks, laboratories hostels and allied facilities.

The plantation block developed in the campus under the Goa University's Energy plantation program initiated in 1994 (funded by the Department of Non-Conventional Energy Sources (DNES), New Delhi) has total of **12 different species** of trees are growing in the DNES. Goa University has a **5 KVA hybrid** (wind and solar) power plant. The entire University Science Instrumentation Center (USIC) building electrical appliances (tube lights and fans) run on this power plant. In addition, the University campus has 83 solar lamps for street lighting.

The salient features of the green campus at the University includes-

— Greenery on the campus is taken care by regular maintenance(Figure 2.1) and also conducts annual plantation program under "*vanamahosthav*".

Figure 2.1: Yearly maintenance of University campus for wild grass. Stock of grass piles.

— Development of efficient **water harvesting system** on the campus facilitated recharging of groundwater reservoir on the campus for its use.
— Scientifically planned and successfully implemented biodiversity plantations on hard lateritic campus and sincere efforts have/are being carried out towards campus greening.
— Safe disposal of e-waste and proper hazardous waste management.
— Conservation of the existing rich biodiversity on the campus.

CHAPTER-III

THE BUILDINGS AND INFRASTRUCTURE

The Goa University is spread over 427.9 acres of land. The administrative and academic department and sections are located in 38 buildings located across the campus. The entire campus has rich flora and fauna, water bodies, plantation. The buildings are identified by certain codes and has different department/section in each building. The details are shown below in the table no. 3.1 and table no. 3.2.

Table No. 3.1: The details of each block including the various departments and sections.

Sr. No.	Name of Building	Building Code
1	Pure Science building	Block-A
2	Arts Faculty Building	Block -B
3	Applied science building	Block -C
4	Old management Building	Block -D
5	New Science Building	Block -E
6	New Commerce Faculty	Block -F
7.	Women's Hostel- I	
7a	PHD Girls Hostel -I	
7b	PHD Girls Hostel -II	
8	Guest House	
9.	International Guest House	
10.	Men's Hostel-I	
11.	Renovated ladies Hostel	
12.	Ph. D. Boys Hostel - II	
13.	International Masters in Business Administration Building	I.M.B.A Building
14.	University Science instrumentation centre Building	U.S.I.C Building
15.	Zoology building(old)	
16.	Library Building	
17.	Faculty Canteen	
18.	Administrative Building	
19.	Animal House (applied zoology bldg..)	
20.	New (A)& (B) Flats/Quarters	
21.	Old A & B type Qtrs.	
22.	C- Type Quarters	
23.	D-type Quarters	
24.	Gymnasium building	
25.	Computer Science Lab building	
26.	Shopping Centre complex	
27.	Sports Building	
28.	New sports Changing room building	

29.	New Health Centre building	
30.	Examination Building.	
31	Bungalow no 1	
32	Bungalow no 2	
33	Post Office building	
34	Centre for Latin American Studies Building	C.L.A.S Building
35	Human Resource Development Centre Building	H.R.D.C building
36	New Transit Accommodation type Quarters.	New TA Qtrs
37	Old A& B Type Qtrs	
38	Electrical Substation Building	

Table No. 3.2: The categorization of department in different buildings

Sr. No.	NAME OF BUILDING	DEPARTMENT/SECTION
1	Pure Science building	Botany , Mathematic, Physics department
2	Arts Faculty Building	Hindi, English, Marathi, Konkani, Philosophy, sociology, economics, French, Portuguese, history, Political science, Women's Studies department
3	Applied science building	School of Earth Ocean and Atmospheric science, M.C.A department
4	Management Building (Old)	Under Renovation
5	New Science Building	School of Chemical Sciences, Biotechnology, Microbiology and Zoology department
6	New Commerce Faculty	Goa Business School/ M.B.A & commerce
7	Women's Hostel- I	Accommodation for P.G students
8	PHD Girls Hostel -I	Accommodation for Research Scholars
9	Women's Hostel -II	Accommodation for P.G Students
10	Guest House	Accommodation for Examiners, HRDC Participants, Guests, Invited Speakers

12	International Guest House	Accommodation for Examiners, Guests, Invited Speakers
13	Men's Hostel-I	Accommodation for P.G Students
14	Renovated ladies Hostel	Accommodation for I. C. C. R Students (Under renovation)
15	Phd. Boys Hostel - II	Accommodation for Research Scholar
16	International Masters in Business Administration Building	Goa Business School (Dept of IMBA)
17	University Science instrumentation centre Building	Electronics, USIC
18	Zoology building (old)	Goa Business School (Dept of IMBA)
19	Library Building	Library Office, Reading Room, Office of Estate Admin.& Allied Services
20	Faculty Canteen	Canteen facility
21	Administrative Building	Office of Vice-Chancellor, Office of the Registrar, Administration (NT), Administration (T), Finance, Academic, computer Centre, Purchase, legal, Conference Hall, I.Q.A.C, Placement, Senate hall, DDLI section
22	Animal House (applied zoology bldg..)	Examination Annex (Currently under renovation)
23	New (A)& (B) Flats/Quarters	Accommodation for Professors, Associate Professors, Assistant Professors, Officers of Goa University
24	Old A & B type Qtrs	…..do…..
25	C- Type Quarters	Accommodation for Non-teaching…Group C Employees
26	D-type Quarters	Accommodation for Non-teaching…Group D Employees
27	Gymnasium building	Engineering & technical Division, Gymnasium
28	Old research Scholars Hostel	Security Staff accommodation

29	Computer Science Lab building	Computer Science
30	Shopping Centre complex	S. B .I branch, S.B.I ATM, Stationary & Xerox , General Store
31	Sports Building	Sport's Section
32	New sports Changing room building	Changing Room
33	Health Centre building	Health Centre, Clinic for Doctor, Clinic for homeopathy & Ayurveda resident accommodation of 108
34	Examination Building.	Office of C.O.E, Exam Post graduate (P.G), Exam Under graduate (U.G) & Professional section
35	Bungalow no 1	Used for residential Accommodation for V.R.P.P section
36	Bungalow no 2	Not in use
37	Post Office building	Sub Post Office, Goa University
38	Centre for Latin American Studies Building	Department of Centre of Latin American (C.L.A.S)
39	Human Resource Development Centre Building	H.R.D.C office, classrooms & canteen facility
40	TA type Quarters	Transit Accommodation for new recruit staff of teaching / Non-teaching till the time of allotting quarter as per eligibility
41	Electrical Substation Building	Substation of Goa University

CHAPTER-IV

FLORA AND FAUNA AT UNIVERSITY

4.1 The Flora And Fauna:

Forest cover in Goa is diverse. Goa is India's smallest state terms of area and the fourth smallest in terms of population. Goa is located on the west coast of India in the region known as the Konkan Forest cover in Goa stands at 1,424 km², most of which is owned by the government. Government owned forest is estimated at 1224.38 km² whilst private is given as 200 km². Most of the forests in the state are located in the interior eastern regions of the state. The Western Ghats, which form most of eastern Goa, have been internationally recognised as one of the biodiversity hotspots of the world. In the February 1999 issue of National Geographic Magazine, Goa was compared with the Amazon and Congo basins for its rich tropical biodiversity. Goa's state animal is the Gaur, the state bird is the Ruby-throated yellow Bulbul, which is a variation of Black-crested Bulbul, and the state tree is the Matti. The important forests products are bamboo canes, Maratha barks, chillar barks and the bhirand. Coconut trees are ubiquitous and are present in almost all areas of Goa barring the elevated regions. Much deciduous vegetation, including teak, sal, cashew and mango trees, is present. Fruits include jackfruits, mangos, pineapples and blackberries. Foxes, wild boars and migratory birds are found in the jungles of Goa. The avifauna includes kingfishers, mynas and parrots. Numerous types of fish are also caught off the coast of Goa and in its rivers. Crabs, lobsters, shrimps, jellyfish, oysters and catfish form some of the piscine catch. Goa also has a high snake population, which keeps the rodent population in control. Goa has many famous National Parks, including the renowned Salim Ali bird sanctuary.

The flora and fauna have been catalogued by the University department of the campus and the plateau. The specific research work has been done at University to catalogue and investigate taxa such as Avian, Lepidopteron, Arachnid and Herpetofauna of the region was initiated and found to be very rich. The campus has been a prime habitat for several avian species (Local, Migratory, etc). Prof. Shanbhag, A.B. & A. Gramopadhye (1993) studied the “Changing ecology of Taleigao Plateau and the bird life in its central zone”, the Goa university campus. Subsequently, Prof. Shyama, S.K. & V. Gowthaman (1995), A study was conducted on the avifauna of the Taleigao Plateau, Goa which resulted in documenting 43 species of birds representing 21 families. This work was published in Newsletter for Bird Watchers.

The plantation block developed in the campus under the Goa University’s Energy plantation program initiated in 1994 (funded by the Department of Non-Conventional Energy Sources (DNES), New Delhi) has total of **12 different species** of trees are growing in the DNES.

Goa University has a **5 KVA hybrid** (wind and solar) power plant. The entire USIC electrical appliances (tube lights and fans) run on this power plant. In addition, the University campus has 83 solar lamps for street lighting. The vegetation at Goa University campus mainly comprises of moist deciduous types with mixed evergreen species (Pandit and Pai IK 2017). Open lateritic rocky outcrops are predominated by grassland and patches of thick shrubs and trees like any other rocky plateau. Lateritic plateaus being shallow in soil content they have their own unique vegetation.

Campus is not being fenced and barricaded all around as a result cattles can be seen grazing adding to the nutrient content of the soil through their faecal matter and helping in seed dispersal. The afforestation at University includes, plantations done by forest department under university's afforestation drives which comprising of trees like *Mangifera indica, Acacia* species, *Tamrindus indica, phyllanthus emblica, Garcinia indica, Manilkara zapota (chiku), Azadirachta indica* and *Terminalia elliptica*. Open lateritic floor covered with grasses with occurrence of *ficus benghalensis* and patches of scrubs. Apart from these exotic species like *Lantana camara* and *Parthenium* species can be found dispersed all over the campus.

A comprehensive documentation of the spider fauna was conducted by the researchers of the University, Rupali Pandit and Pai I. K (2018) for the first time from the Taleigao plateau that revealed occurrence of 74 species of spiders belonging to 17 families. The investigation was carried out for 8 months i.e. from July 2016 to February 2017. The study has emphasized the need for conservation of the rich ecosystem of Taleigoa plateau by characterizing species diversity and highlighting endemic species. The work was published in Journal of Environmental Science and Public Health, Volume 1, Issue 4 and is also available worldwide in a book form, published by Lambert Academic Publishing.

Campus also hosts a rich diversity of Lepidoptera due to its rich existing host plants and nectar plants. A checklist of butterflies (Insecta: Lepidoptera) from Taleigao Plateau, Goa, India, was carried out by Dipak Bowalkar, Nadar Anal Gracy Micheal, Kiran Gaude & I.K. Pai (2017). A total of 98 species of butterflies belonging to 72 genera under five families were recorded that amounts to around 39% of the total reported butterfly fauna of the state. This work was published in Journal of Threatened Taxa. However serious research can reveal new records. Several species of moths (around 240 nos) have been recorded however no documentation is available. Presently the department of Zoology is in process of developing mini butterfly garden for the purpose of education and research within the campus. Same will be open for students across the states for study purpose. Idea is to introduce new species of butterfly.

Herpetofauna are very important to a region's ecosystem because they act both as prey for the other animals as well as they serve as predators (Figure 4.4). They present a multi-trophic level interaction which plays an important role in maintaining a balanced ecosystem. A good diversity of these animals indicates a healthy ecosystem. Being poikilothermic in nature they are susceptible to the fluctuations in the environmental temperature. They live in close contact with air, water and soil and are sensitive to the changes in their habitat. Campus host rich herpetological diversity (Reptiles & Amphibians). As mentioned above campus host several species of Herpetofauna, as per the niche preferences. We recorded around 18 species of snakes (Figure 4.1 to 4.2), 5 species of Geckoes (Figure 4.3), one species of Turtle. Campus also host Schedule species like monitor lizard and other species of skinks and Calotes. Species of snakes such as Common Spectacled Cobra, Indian krait, Russell's Viper and Saw Scaled Viper, these are known as 4 big snakes in the

country, as they are fatal to humans and commonly found all over. Campus also has a record of small Indian Civet, Palm Civet and Hare which forms integral part of our pristine ecosystem.

Figure 4.1: Photo of Saw Scaled Viper.

Common Name: - Saw Scaled Viper

Vernacular Name: - Furso

Scientific Name: - Echis carinatus

- ***A short venomous snake with keeled scales***
- ***Mostly found in dry areas.***
- ***Arrow mark on head.***
- ***Venom is Hemotoxic.***
- ***Gives warning by rubbing their body scales.***

This species is highly confined to plateaus and very common in University Campus. Most of the plateaus are utilized for development and this species is losing their habitat due to habitat destruction. Gives hissing sound when provoked by rubbing its scales. One among the four big venomous snakes.

Figure 4.2: Photo of Striped Keelback.

Common Name: - Striped Keelback, Vernacular Name: - Yevale

Scientific Name: - Amphiesma stolatum

- ***A yellow mouthed and two stripes on body.***
- ***Keeled scales.***
- ***Occurred mostly during monsoon.***
- ***Non-venomous snake.***
- ***Feeds on frogs and other small animals.***
- ***Common in the campus. It is nonvenomous water snake.***

Figure 4.3: Photo of Brooke's Gecko.

Common Name: - Brooke's Gecko, Vernacular Name: - Pall

Scientific Name: - Hemidactylus brookii.

- ***An 'X' marks on body.***
- ***Occurred mostly during night.***
- ***A common House Gecko.***
- ***Feeds on small insects and flies.***

Figure 4.4: Photo of Bronzeback tree snake.

Common Name: - Bronzeback tree snake

Vernacular Name: - Naneto

Scientific Name: - Dendrilaphis tristis

- ***A common tree snake.***
- ***Slender body and long tail.***
- ***Black strike on eye.***
- ***Tongue is red or pink.***
- ***Feeds on frogs, Gecko and other small animals.***
- ***Non venomous, commonly found across the state and very common in the campus. Its an arboreal snake.***

Figure 4.5: Photo of Scorpion

Common Name: - Scorpion

Vernacular Name: - Vinchu

Scientific Name: - *Heteromatrus longimanus*

- **They have eight legs with segmented tail and a pair of pedipalps for grasping prey.**
- **It is having a venomous sting at the end of curved back.**
- **Found in dry places and hiding in stones.**
- **Scorpions are predatory arachnids.**
- **Feeds on insects and other small invertebrates.**
- **Commonly found in the campus and across the state, adapted for different habitats.**

The campus serves as a breeding ground for several species of faunal assemblage, some species recorded are also given priority for conservation as per the Wildlife Protection Act 1972, therefore it is important to understand and plan our future developmental activities to avoid destruction of this prime habitat and execute it with more sustainable way. The distribution of an organism in a geographical range is determined by a variety of environmental parameters such as temperature, light, moisture and availability of food sources. Apart from these crucial parameters' other factors such as predators and human intervention (anthropogenic pressures) have effect on the pattern

of a species distribution. There are various factors that influence the diversity and distribution of faunal assemblage in a given habitat. To implement proper conservation measures it is imperative to have knowledge about these factors.

Figure 4.6: Photo of Fungoid Frog.

Common Name: - Fungoid Frog

Vernacular Name: - Bebo

Scientific Name: - Hydrophylax bahuvistara

- ***A common tree frog found in forest floor and lowest vegetation.***
- ***Body is truncated.***
- ***Upper body is varying in color from Brownish-Red to bright crimson.***
- ***Feeds on small insects and flies.***

4.2 Efforts for Carbon Neutrality

The Goa University campus and its surrounding area has a good vegetative cover with low vehicular traffic and hence the resultant emissions are minimal. Moreover, there being no polluting industry located close to the campus either, the measures for carbon neutrality are not a priority at the moment. The University has also undertaken various activities such as the annual plantation

drive like *Vanamahotsav*, water harvesting, etc. on the campus are efforts towards carbon neutrality. The Energy Plantation work on the campus was initiated in the year 1994 and presently there are about 600 tree species surviving. They include *Acacia auriculiformis, Bauhinia rosea, Pithocellobium dulce, Cassia fistula, Tamarindus indica, Leuceana leucocephala, Delonix regia, Casuarina equisetifoloia, Gmelinia arborea, Zizyphus jujuba, Alstonia scholaris,* and *Samanea saman*. Plantation has been carried out in the faculty enclave (Block A). The plantation is three years old and includes a variety of forest and fruit tree species such as *Syzygium cumini, Acharas sapota, Garcinia indica, Samanea saman, Leucanea leucocephala, Ficus bengalensis, Ficus religiosa, Thespesis populnea*, *Zizyphus jujuba, Anona muricata, Anona reticulata, Artocarpus integrefolia, Anacardium ocidentale* and *Mangifera indica.*

Some of the plant species around the old Zoology animal house includes *Pithocellobium dulce, Peltophorum ferrugiana, Alstonia scholaris, Lannea coromandelica, Zizyphus jujuba, Samanea saman*, *Bombax malabaricum, Phyllanthus emblica, Acacia* spp., *Samanea saman, Terminalia spp., Ficus racemosa, Ficus bengalensis, Thespesis populnea, Dalbergia sisso, Bambusa sp.,* and *Caraya arborea.* Plantations initiated near the Computer Science building include 150 plants belonging to 23 plant species including Mimosups elengi, *Artocarpus integrefolia, Anacardium ocidentale*, *Mangifera indica, Tamarindus indica, Thespesis populnea, Cassia fistula, Peltophorum ferrugiana, Pongamia pinnata, Ficus bengalensis, Garcinia indica, Terminalia catapa, Syzigium cumini, Zizyphus jujuba, Pithecellobium dulce, Leucanea leucocephala, Alstonia scholaris, Lannea coromandelica, etc.*

All the trees (except the ones in the residential areas of the campus) with ≥ 30 cm GBH have been measured and documented (Table 4.1) . The parameters such as GBH and height of the trees have been measured in the field and above ground biomass (AGB) and below ground biomass (BGB), total biomass and sequestered carbon have been worked out. For each individual using allometric analysis based on the models developed by Brown et al (1989) for AGB, MacDicken (1997) for BGB, using average wood density value from Warran and Patwardhan (2001). For Carbon sequestration formula of Ravindranath et al (1997) has been used.

Table 4.1: Biomass and Carbon sequestration potential of trees (with ≥ 30 cm GBH) in Goa University Campus (Jaydeep, 2014. MSc dissertation)

Sr. No.	Particulars	Quantity
1	Number of tree species with ≥ 30 cm GBH (excluding several species planted and which are < 30 cm GBH)	55
2	Number of individuals with ≥ 30 cm GBH	1826
3	Total biomass	263076 kg
4	Carbon sequestration potential	121014 kg
5	Carbon sequestration potential of GU campus	699.5 kg/ha

4.2.1 Water Harvesting:

Goa University is in the **forefront** with respect to rainwater harvesting and groundwater recharging since the last six years. The University has established two major rainwater harvesting structures on the campus and has been recharging the depleted groundwater reservoir to the tune of about 40 million liters per year. This amount to about two month's water consumption volume on the campus which is nearly 5 lakh liters per day.

University has successfully innovated the technology for rain water harvesting and groundwater recharging for the lateritic campus plateau. Besides conserving water, the sites have been used as educational tools to impart knowledge to school children and various stakeholders. The success of this project has led many industrial units and individuals to establish such structures. Looking at the success and need of the hour, the Government of Goa has made rain water harvesting mandatory for industrial units and housing colonies above certain threshold area. The University has been providing consultancy services to industries and individuals for installation and feasibility studies of rainwater harvesting. Department of Earth Sciences, responsible for this innovative programme, has also been successfully imparting awareness programmes at rural Panchayat levels and High School levels about the water conservation and rainwater harvesting activities.

4.2.2 Check dam construction

University has ensured **conservation** of pre-existing seasonal pools and ponds wherever possible and this has helped in conservation of aquatic biodiversity. Instead of check dams, the University uses diversion canals and '*jalkunds*' made from plastic sheets to store water.

4.2.3 Flowering plants

The Goa University campus is rich in biodiversity. Though 55 tree species with ≥ 30 cm GBH is recorded the total number of species recorded from the campus is 531 (Yadav & Janarthanam, 1994: Flowering plants of Taleigao Plateau – Checklist). Several species have been added to the list later and several other species have been planted subsequently. The updated list will be made available in November 2020. The campus is also known for herbaceous endemic species. The list of endemic species is given in Table 4.2.

Table 4.2: List of herbaceous endemic species to Western Ghats and Konkan in Goa University Campus.

Sr.No.	Family	Name of the taxa
1	Hydatellaceae	*Trithuria konkanensis*
2	Alismataceae	*Wiesneria triandra*
3	Commelinaceae	*Murdannia dimorpha*
4	Eriocaulaceae	*Eriocaulon belgaumensis*
5	Eriocaulaceae	*Eriocaulon eurypeplon Körn.*
6	Eriocaulaceae	*Eriocaulon kolhapurense*
7	Eriocaulaceae	*Eriocaulon palghatense*
8	Eriocaulaceae	*Eriocaulon sp. 1*
9	Cyperaceae	*Fimbristylis dauciformis*
10	Poaceae	*Bhidea burnsiana*
11	Poaceae	*Danthonidium gammiei*
12	Poaceae	*Dimeria blatteri*
13	Poaceae	*Dimeria woodrowii*
14	Poaceae	*Glyphochloa acuminata*
15	Poaceae	*Glyphochloa acuminata var. woodrowii*

16	Poaceae	*Glyphochloa talbotii*
17	Fabaceae	*Crotalaria lutescens*
18	Euphorbiaceae	*Euphorbia notoptera*
19	Lythraceae	*Rotala malampuzhensis*
20	Rubiaceae	*Neanotis subtilis*
21	Gentianaceae	*Canscora shrirangiana*
22	Apocynaceae	*Ceropegia attenuata*
23	Acanthaceae	*Lepidagathis keralensis*
24	Lentibulariaceae	*Utricularia malabarica*
25	Lentibulariaceae	*Utricularia praeterita*
26	Asteraceae	*Senecio belgaumensis*

Figure 4.7: Photo of planned forestation 800 fuel wood plant species.

Figure 4.8: Photo of 2100 tree species.

4.2.4 Organized Plantation

i. Plantation of trees within the Goa University Campus has been a regular feature since the inception of the University. Besides, the World Environment Day is observed on 5th June and *Vanamahostav* is also celebrated every year.

ii. Goa University's Energy plantation programme initiated as early as in 1994 and funded by the Department of Non-Conventional Energy Sources (DNES), New Delhi has been a success story. A total of 12 different species of trees are found growing in the DNES plantation block. Presently there are about **800 fuel wood plant species** growing at the site (Figure 4.7).

iii. Goa University has also made concerted efforts towards increasing the plantation on the campus. Initially, this hard-lateritic plateau had very sparse vegetation. The Biodiversity Plantations in the University campus was a joint initiative involving Goa University,

Western Ghats Kokum Foundation (an agro-eco promotion NGO), and State Bank of India, M/s Sesa Goa, M/s Chowgule industries and the Forest Department, Government of Goa. A total of 2100 plants were planted with selected tree species covering an area of 60 acres in the last 7 years(Figure 4.8).

iv. To mitigate the acute shortage of water, a new bore-well was dug. Four temporary ponds were set up to store the pumped-out water. Each plant was covered with shade net and adequately protected from monsoon wind, rain and stray cattle. Weedy grasses were cut by grass cutting machines and the plants were regularly watered throughout the winter and summer months. Presently sizeable portion of the campus is contiguously green. iv. Residents on the University campus have been encouraged to plant various fruit trees. This has added to the diversity and beauty of the campus. The faculty residential area as well residences occupied by non-teaching staff, the Hostels, the faculty canteen among others sport good diversity of fruit plants. Many residents have kitchen gardens.

v. By natural composting of litter, the campus permits natural mineralization of aboveground plant litter in mixed natural plant communities to conserve biodiversity and capture nutrients

vi. Raising plantations on the University campus has been difficult due to its hard-lateritic surface which hardly supports plant growth. Earlier afforestation efforts have met with little success as they encountered a high mortality rate. Besides stray cattle and campus fires were the other important constraints for plant growth and survival. Therefore, an innovative approach to initiate biodiversity plantations on the lateritic plateau of the campus was followed. Excavation of 2100 pits (1mx1mx1m), filling with garden soil and manure, and planting with selected tree species resulted in high (>90%) survival rate. The "Ratnagiri Irrigation System" was adopted to water each and every plant. In this system each plant was provided with 2-3 equidistantly positioned earthen pots at the base. These pots were manually filled with water once in every three days all through the summer months.

4.4.5 Conservation of Existing Rich Biodiversity

The rich diverse environment of the campus is a living laboratory and the students of biology often use it for conducting research exercises. By omitting eyesore tall buildings and respecting elevation controls, the university has taken care of merging-built environment with natural one.

There is a high density of peafowl and other avifauna on the campus. This is possible due to a relatively noise free and green environment. A large number of peafowls exist on the campus.

The interventions in the conservation of bio-diversity is practiced by the all department and sections in the University. The following are some of the academic intervention practiced by the different departments of the university.

a. Study of agaroses, xylanases, lipases and proteases of special characteristics of commercial importance from marine microorganisms. Biodiversity & ecology of hypersaline and sulphate reducing bacteria. Processes for preparation of toxins and other bioactive substances from bacteria and higher marine organisms. Biodegradation of oils spills and tar balls by selectively developed, genetically superior, marine microbial consortia. Establishment of methods to assess risks due to recombinant DNA in marine environment.

b. The department carries out research in the thrust areas like Marine Microbiology, Microbial ecology, Environmental microbiology, Molecular biology, Extremophiles.

c. The School of Earth, Ocean, and Atmospheric Sciences is established by the amalgamation of two departments that are related to planetary studies, viz., Earth Science (established in 1986) and Marine Sciences (1985) to deliver better together. Both these departments have a glorious past that would be carried forward to this school.

d. The significant coupling between lithosphere, atmosphere, hydrosphere, and cryosphere necessitated a holistic approach to study earth system science rather than addressing each component of the earth system separately. The earth system is highly dynamic. The

daunting task of Oceanographers, Earth Scientists, and Atmospheric Scientists are to understand the complex dynamics and wade through the present crisis of climate change and thus to create a sustainable environment for the human to survive.

e. MOU with Goa state Bio-diversity board.

4.4.6 The highlights of the green campus at the University includes

— Greenery on the campus is taken care by regular maintenance and also conducts annual plantation program under "*vanamahosthav*".
— Development of efficient **water harvesting system** on the campus facilitated recharging of groundwater reservoir on the campus for its use.
— Scientifically planned and successfully implemented biodiversity plantations on hard lateritic campus and sincere efforts have/are being carried out towards campus greening.
— Safe disposal of e-waste and proper hazardous waste management.
— Conservation of the existing rich biodiversity on the campus.

Goa University Monitoring Committee in accordance with UGC guidelines supervises the procurement, storage, usage and disposal of radioactive and other hazardous materials/chemicals etc. The Department of Biotechnology has the facility to carry out radioactive work. All radioactive wastes so far collected have been safely discarded. The Goa University campus is declared as plastic free and tobacco free zone under relevant State Acts.

CHAPTER-V

THE UTILIZATION OF ENERGY AT UNIVERSITY

The energy utilization by different department and sections is shown in the tabular form. The University departments and sections are placed I different buildings as per the Table given below. The data for utilization of energy by electrical items, machinery and equipment in different building is shown in the series of tables below.

Administrative Building

The administrative building has following sections/ departments.

- Office of Vice-Chancellor,
- Office of the Registrar,
- Administration (NT),
- Administration (T),
- Finance, Academic,
- computer Centre,
- Purchase, legal,
- Conference Hall,
- I.Q.A.C,
- Placement,
- Senate hall,
- DDLI section

The department wise/section wise details are provided in the subsequent tables.

Table 5.1: Names of the Department: Finance

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	Watt	2	14
2	Tube Light	Watt	87	3480
3	Ceiling Fans	Watt	26	2080
4	Wall Fans	Watt	4	200
5	Exhaust Fans	Watt	2	120
6	Window AC	1 ton	1	1 ton
7	Split AC	1Ton	1	1 ton
8	Computers/laptops	Watt	26	5200
9	Printers	Watt	13	4745
10	UPS	15KVA	1	15000KVA
11	PL Fixture	9Watt	8	72
12	Xerox machine	Watt	2	2560

Table 5.2: Name of the Office: Director Students Welfare

Sr. no	Item & Make	Quantity	Total Wattage
1	Computer / PC : Gateway, HCL, Acer	5	200 Walts
2	Printer + Scanner : Hp Laser Jet M1136 MFP	2	365 Walts
3	Printer : Hp laser Jet P1108	1	360 Walts
4	Laptop Lenovo	3	065 Walts
5	Computer / PC : Lenovo	4	150 Walts
6	RICHO Xerox Machine : MP 2000L2	1	1600 walts
10	Tube Light	21	
13	Celling Fans	10	80 Walts
17	Split AC	01	
22	UPS	06	

Table 5.3 : Name of the Section: Assistant Registrar

Sr. No.	Item & Make	Quantity	Total Wattage
1	Computer / PC : Gateway, HCL, Acer	06	1100 Walts
2	Printer : Hp laser Jet P1108	03	900 Walts
3	Tube Light	16	640W
4	Celling Fans	05	400 Walts
5	Wall Fans	02	120W
6	UPS	06	3600KVA

Table No 5.4 : Name of the Section: Legal

Sr. No.	Loads	Units	No	Total Wattage
1	Tube Light	Watt	82	3280
2	Ceiling Fans	Watt	10	800
3	Wall Fans	Watt	4	200
4	Exhaust Fans	Watt	2	120
5	Split AC	1Ton	1	1 ton
6	Computers/laptops	Watt	15	3000
7	Printers	Watt	5	2760
8	UPS	15KVA	1	15000KVA
9	Xerox machine	Watt	2	4360

Table No. 5.5: Name of the Department: Section IV

Sr. No.	Item	Units	Number	Total Wattage
1	Tube light		5	
2	Ceiling Fan		4	
3	Computer	Lenovo V310z AIO, Model No. A00JIG, 20v,6.0A	1	
4	Printer	220-240V AC, 50/60Hz, 3.0 A	1	
5	UPS	230V, 50Hz	1	

Table No. 5.6: Name of the Department: Directorate of Digital Learning and Initiative

Sr. No.	Loads	Unit	No	Total Wattage	Year of Installation / Make
1	Tube lights (28Watts)	28 Watt	2	54 Watts	2018 (Surya)
2	Florescent Light (11Watts)	11 Watt	36	396 Watts	2017 (Philips)
3	Celling Fans	80 Watt	1	80	2000 (N/A)
4	Wall Fans	Watt	0		
5	Exhaust Fans	Watt	0		
6	Window AC / Ducted	Ton	2		2013 (Hitachi)
7	Split AC	1 Ton	1		2013 (Hitachi)
8	Computers	250 Watt	7	1750	(Apple / Benq / View Sonic / Acer /Samsung 2010-2018
9	Printers	250 Watt	1	250	HP 2010
10	UPS	KVA	4		Techsters/ Exide 2005
11	Any Other	Studio			

12	Florescent tube	58 Watts	34	1972	200 / Canara 2010
13	Studio Halogen Bulb	650 Watts	8	5200	Canara 2010

Applied science building

The applied science building has following departments.

- School of Earth Ocean and Atmospheric science,
- M.C.A department

The department wise information is shown in the below tables.

Table No. 5.7: Name of the Department: EARTH SCIENCE

Sr. No.	Loads	Unit	No.	Total Wattage	Year of Installation/make
1	Ceiling Fans	Watt	33	80Wx33=2640 W	-
2	Wall Fans	Watt	2	48 Wx2=96 W	-
3	Exhaust Fans	Watt	1	30.6 Wx1=30.6W	-
4	Window AC	Three AC 1.5 ton&one AC 1.0 ton	4	(1250W of 1.0 tonx1=1250)+(1745 W of 1.5 tonx3)=2995W	1)AC-2008 2)AC-2008 3)AC-2017 4)AC-2006
5	Split AC	4 AC1.5 Ton&2AC of 2.0 ton	6	1709W of 1.5 tonx4=6836W 2210W of 2.0 tonx2=4420W Total: 11256 W	1)AC-2016 2)AC-2016 3)AC-2016 4)AC-2013 5)AC-2006 6)AC- 2010
6	Computers (Desktop)	Watt	8	200 Wx8=1600W	1)Computer-2015 2)Computer-2015 3)Computer-2012 4)Computer -2014 5)Computer-2014 6)Computer (not mention) 7)Computer-2015 8)Computer-2017
7	Printers	Watt	4	450Wx4=1800W	1)Printer-2004 2)Printer-2018 3)Printer-2007 4)Printer-2017

8	UPS	KVA	6	1100Wx6=6600W	1)UPS-2015 2)UPS-2015 3)UPS-2014 4)UPS-2015 5)UPS-2012 6)UPS-2017
9	PG Laboratory Equipment'S List Separately)	Watt	Enclosed separately		
10	Ovens	Watt	-	-	2006
11	Furnace	Watt	-	-	2006

Table No. 5.8: Name of the Department: EARTH SCIENCE(PG Laboratory Equipment List)

Sr. No.	Loads	Unit	No.	Total Wattage	Year of Installation/make
1	a) Microscopes	Watt	4No	5 WX4=20W	1)Microscopes-2006 2)Microscopes-2014 3)Microscopes-2014 4)Microscopes -2016
2	b) Dehumidifier (2 Units)	Watt	2 No	22 Wx2=44W	2018
3	c)Thin Section unit	Watt	1 No	90Wx1=90W	2015
4	d) Polishing Machine	Watt	1No	1200Wx1=1200W	2015
5	e) DGPS Mapping unit Pentax surveying Instrument Model: G3100-R2	Watt	1 No	-	2015

Arts Faculty Building

The arts faculty building has following departments.

- Hindi,
- English,
- Marathi,
- Konkani,
- Philosophy,
- sociology,
- economics,

- French,
- Portuguese,
- history,
- Political science,
- Women's Studies department

The department wise data on the utilization of energy is shown In the following tables.

Table No. 5.9: Name of the Department: Hindi

	Name of the Department: Hindi				
Sr. No.	*Loads*	*Unit*	*No*	*Total Wattage*	*Make*
1	Tube lights	Watt	36	40	*1440*
2	Ceiling Fans	Watt	14	80	1120
3	Wall Fan	Watt	8	80	640
4	Window AC	Watt	2	4800	LG
5	Split AC	Watt	1	3650	Lloyd
6	Split AC	Watt	2	13100	Voltas
7	Computers	Watt	1	200	ACER
		Watt	7	1400	Lenovo
		Watt	1	200	Zenith
8	Laptop	Watt	1	60	HCL
9	Scanner	Watt	1	25	HP
10	Printers	Watt	5	1250	HP
11	UPS	VA	20	600	Numeric
		VA	1	600	I ball
		VA	7	600	Artis
		VA	1	600	Artis
		VA	1	600	Techser
12	Laptop	Watt	1	65	HCL
13	Digital Copier Printer	Watt	1	17.4	Cannon
14	TV	Watt	1	60	Sony
15	LCD Projector	Watt	1	200	Hitachi
16	LCD Projector	Watt	1	200	Epson
17	Camera	Watt	1	1300	Nikon

Table No. 5.10: Name of the Department: English

	Name Of Department: - English			
Sr. No.	Loads	Unit	No.	Total Wattage

1	LED Lights (Tube)	Watt	53	40
2	Ceiling Fan	Watt	24	80
3	Exhaust Fans	Watt	1	80
4	Split AC	Ton	4nos	2 ton
5	Computers	Watt	31	150
6	Printers	Watt	04	100 watts
7	UPS	KVA	29	600 V

Table No. 5.11: Name of the Department: KOKANI

Sr. No.	Loads	Unit	Number	Purchase -Year
1	Computers	200 Watt	05	2009, 2018
2	LED lights	150 Watt	0	------
3	Split AC	1.5 and 2 Ton	02	To be install 2018
4	Ceiling fans	80 Watt	11	------
5	Wall fans	30 Watt	14	2013
6	LCD Projector	200 Watt	02	2011
7	Acer Laptop	232Watts	02	2018
8	Tube lights	40 Watt	27	--------
9	Canon(Xerox Machine) 2420L, Multifunctional printer Canon	1373 Watt	02	2015,2018
10	Exhaust Fans	ISO Watt 30	0	---------
11	Podium	100 Watt	01	2018
12	Printers 1)HP laser jet 1020Plus 2)HP Laser jet P1007	365watt	2	2013,2018
13	UPS	600 2 KVA	03	2017,2018
14	Window AC	1 ton	02	2006
15	Water heater	1350watts	01	2016
16	Acer Machine	200 watt	03	2018

Table No. 5.12 : Name of Department: French and Francophone studies

Name of the Department : French & Francophone Studies				
Loads	Unit	No	Total Wattage	Year of Installation/make
Florescent Light (Tubelight)	Watt	37 (1 N.W.)	40	
Ceiling Fans	Watt	09	80	
Desktop Computers	Watt	03	200	(DELL,2012 Lenovo, 2016 Lenova)
Printers	Watt	02 (1 N.W.)	250	HP Laserjet 1020 plus 2012
CPU	Watt	03	65	2012 Lenova, 2009 Zenith
UPS	KVA	02	600	2012 Lenova 1 · 2
UPS	KVA	02		To be installed 2018 1 · 2
LCD Projector	Watt	02	244	Epson EBX10
Projector	Watt	02		To be installed 2018
Laptop	Watt	01	60	Lenovo
Xerox Machine	Watt	01	1200	Canon 2420L
TV	watt	01	80	2006 Samsung
Split AC	Tons	02		To be installed 2018 2

Table No. 5.13: Name of the Department: Marathi

	Department: Marathi				
Sr. No.	Loads	Unit	No.	Total Wattage	Year of Installation/Make
1	Tube Lights	Watt	19	40	Crompton/2003
2	Ceiling Fans	Watt	12	80	Lakhani-1nos. Crompton-5 Goldline-6 2003
3	Wall Fans	Watt	2	55	Bajaj-2nos. 2003
4	Split AC	Watt	3	2005	Panasonic-2nos. /2010 Voltas-1 (not yet installed)
5	Computers	Watt	10	200	HCL-2nos./2010 Lenovo-3no/2010 Acer-1no./2010 Zenith-2/2008 Acer-2/September 2018
6	Printers	Watt	8	360	HP Laserjet-7nos.2008-2010 Cannon-1 /September 2018
7	UPS	KVA	10		Numeric-7 nos./2008- Artis-3 nos./ 2010

8	Xerox	Watt	1	1200	Sharp-1nos./2011

Table No. 5.18: Name of the Department: Portuguese and Lusophone Studies

Name of the Department : Portuguese and Lusophone Studies				
Loads	Unit	No.	Total Wattage	Year of Installation/make
Florescent Light	Watt	26 (1N.W.)	40	
Ceiling Fans	Watt	6	80	
Window AC	Ton	2 (1 N.W.)	1.5	3 Ton
Split AC	Ton	2		To be installed 2018
Computers	Watt	3	200	2016(Lenovo),2014 (Acer),2016 (Lenovo)
Printer	Watt	1	250	HP Laserjet 1022
UPS	KVA	3 (1N.W.)		
Any others LCD Projector TV (LCD) Projector		 1 1 2	 600 80	 2012 To be installed 2018

Table No. 5.19: Name of the Department: Economics

	Name Of Department :- Economics			
Sr. No.	Loads	Unit	No.	Total Wattage
1	Tube lights	Watt	29	40
2	Ceiling Fan	Watt	16	80
3	Computers	Watt	6	150
4	Printers	Watt	05	100
5	UPS	KVA	4	600 V

Table No. 5.20: Name of the Department: HISTORY

Sr. No.	Loads	Unit	Number	Purchase -Year
1	Computers	200 Watt	08	2000, 2002,2007
2	LED lights	40 to 60 Watt	02	------
3	Split AC	1.5 and 2 Ton	03	2018
4	Ceiling fans	80 Watt	17	------
5	Wall fans	30 Watt	08	------
6	LCD	250 Watt	02	2007,2011,2015,2016
7	Pedestrial Fan	75 Watt	04	2010
8	Tube lights	40 Watt	41	--------
9	Scanners	50 Watt	03	2000,2007
10	Exhaust Fans	ISO Watt 30	02	---------

11	Podium	100 Watt	01	2018
12	Printers	35 to 50 Watts	06	2000,2004,2007,2009, 2011,2012,2014
13	UPS	1000 watts KVA	09	2000,2003,2006, 2008,2012, 2013,2014,2016,2017

Table No. 5.21: Name of the Department: POLITICAL SIENCE

Sr. No.	Loads	Unit	No.	
1	CFL(Tuble lights)	Watt	29	
2	Ceiling Fan	Watt	17	
3	Printers	Watt	03	
4	UPS	KVA	5	

Table No. 5.22: Name of the Department: Women's Studies

Sr. No.	Loads	Unit	No	Year of Installation/ Make
1	Ceiling Fan	Watt	19	
2	Wall Fans	Watt	7	Crompton Greaves
3	Split Ac	T on 1.5	2	Under Rusa 2018 (not yet installed) Voltas
4	Computers	Watt	4	2015 Desktops /Acer
5	Printer	Watt	4	2007/2014 Canon (2Nos) 2011/HP (2 Nos)
6	UPS	KVA	4	2015/Numeric
7	Laptop	Watt	4	2011/2016 Dell (2) 2017/2014 Lenove (2)
8	Projector	Watt	3	2016/EPSON (1)2011/2014 HITACHI (2)
9	Water heater cattle	Watt	1	Morphy
10	T.V	Watt	1	2008/Samsung
11	Pedestrial fan	Watt	1	2012/ Crompton
12	Voice Amplifier AP System	Watt	1	2017/ IBan speaker karaoke booster tower

Table No. 5.23: Name of the Department: Philosophy

Sr. No.	Name of the Department: Philosophy Department			
	Loads	Unit	No	Total Wattage
2	Florescent Light	Watt	23	
3	Ceiling Fans	Watt	15	80 watts each

4	Split AC : 1 Computer lab 1 Under RUSA	Ton	2	Not Known 2 Ton
5	Computers	Watt	8	150 watts each
6	Printers 1. InkJet 1007 2. LaserJet M1136 MFP	Watt	2	300 watts 375 watts
7	UPS	KVA	8	150VA each

Table No. 5.24: Name of the Department: Sociology

Sr. No.				
	Loads	Unit	No.	Total Wattage
1	Fan	watt	10	800W
2	Computer	Watt	01	150W
3	laptop	Watt	4 No	400W
4	Printer	Watt	1 No	100W
5	UPS	KVA	2No	1200KVA
6	Tube lights	Watt	19	950W

Table No. 5.25: Name of the Department: Centre for Study of Social Exclusion & Inclusive Policy

Sr. No.	Loads	Unit	No	Total Wattage	Year of Installation/ Make
1	Ceiling Fan	Watt	7		
2	Split Ac	Ton Power - 2480Watt.	1		LG Electronics, AC-rated power supply-230V/50HZ I phase, current -11.35A; Power -2480Watt, Refrigerant Weight – R-22, 1.25kg.
3	Computers	Watt	1		2009, Zenith PC
4	Printer	Watt	2		1) 2009, HP Laserjet 1007 2) 2012, HP 1136 Laser jet MFP

Table No. 5.26: Name of the Department: UGC CENTRE FOR LATIN AMERICAN STUDIES, GOA UNIVERSITY (UGC-CLAS)

Sr. No.	Loads	Unit	No	Total Wattage	Year of Installation/Make
1	Ceiling Fans	Watt	18	-	-
2	Exhaust Fans	Watt	05	-	2016
3	Split AC	Ton	04	-	2 LG 2009 and 2 Lloyd 2017
4	Computers	Watt	07	-	3 HCL-2009, 2 Zenith-2013, 2Dell-2016
5	Printers	Watt	03	-	HP Laser printers 2011(2nos) and 2018(1 no.)
6	UPS	KVA	05	-	3 HCL- 2009 and 2 Numeric- 2013
7	Water Filter	Watt	01	-	2017 Eureka Forbes
8	Photocopy Machine	Watt	01	-	2008 Sharp copier

Table No. 5.27: Department: Department of Computer Science and Technology

Sr. No.	Loads	Unit	No	Total Wattage	Year of Installation/Make
1	Computers	65 Watts	140	9100 Watts	Make: Acer, Asus, HP, Zenith, Lenovo
2	Printers	40 Watt	6	240 Watts	Make: Konica Minolta (1 No.), HP (4 Nos.), Cannon (1 No.)
3	UPS	15 KVA	5	75 KVA	Make: Techser (5 Nos.)
		10 KVA	1	10 KVA	Make: Techser (1 No.)
4	Window AC	2 Ton	3	6	Make: Logicool (3 Nos.)
5	Split AC	2 Ton	22	44 Ton	Make: LLyod (17 Nos.), Totalline (4 Nos.),Videocon (1 No.)
		1.5 Ton	4	6 Ton	Panasonic (2 Nos.)

Table No. 5.28: Section : Electrical Substation Building

Sr. No.	Loads	Unit	No.	Total Wattage
1	LED Lights	Watt	5	60w
2	Florescent Light	Watt	2	400W
3	Ceiling Fans	Watt	6	480W
4	Water filter	Watt	1	50W

Section: Examination Building (Office of C.O.E, Exam Post graduate (P.G), Exam Under graduate (U.G) & Professional section)

Table No. 5.29: **Section1 : Examination Section (UG)**

Sr. No.	Loads	Units	No	Total Wattage
1	CFL	23Watt	1	23
2	Tube Light	Watt	24	960
3	Ceiling Fans	Watt	15	1200
4	Wall Fans	Watt	4	200
5	Exhaust Fans	Watt	2	120
6	Split AC	1Ton	8	8 ton
7	Computers/laptops	Watt	9	1800
8	laptops	Watt	1	65
9	Printers	Watt	6	2190
10	UPS	KVA	10	6000
11	Copier machine	Watt	1	365
12	Riso Machine	Watt	1	500
13	Aqua guard	Watt	2	700

Table No. 5.30: **Section 2: Examination Section (pG)**

Sr. No.	Loads	Units	No	Total Wattage
1	Tube Light	Watt	4	160
2	Ceiling Fans	Watt	1	80
3	Split AC	1Ton	1	1 ton
4	Computers/laptops	Watt	3	600

5	Refrigerator	Watt	1	170 liters

Table No. 5.31: **Section: Guest House**

Sr. No.	Loads	Units	No	Total Wattage
1	Tube Light	Watt	85(40W) 79(20W)	4980W
2	Ceiling Fans	Watt	72	5750
3	Window AC	1.5Ton	06	9 ton
4	Split AC	1.5Ton	20	30 ton
5	1 Hp Motors	HP	1	1HP
6	Geazer	2K Watt	47	94000
7	Computers/laptops	Watt	1	200
8	Printers	Watt	1	365
9	UPS	KVA	1	600

Section :Gymnasium building

Table No. 5.32: **Section 1: Engineering and technical Division**

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	Watt	2	14
2	CFL	23Watt	5	115
3	Florescent Light	20Watt	2	40
4	Tube Light	Watt	26	1040
5	Ceiling Fans	Watt	10	800
6	Wall Fans	Watt	4	200
7	Exhaust Fans	Watt	2	120
8	Split AC	1Ton	1	1 ton
9	Computers/laptops	Watt	7	1400

10	Printers	Watt	1	365
11	UPS	600VA	7	4.2 KVA
12	PL Fixture	9Watt	2	112

Table No. 5.33: **Section2**: **Gymnasium**

Sr. No.	Loads	Unit	No.	Total Wattage
1	LED Lights	Watt	5	60w
2	Florescent Light	Watt	1	200W
3	Ceiling Fans	Watt	6	480W
4	Exhaust Fans	Watt	2	100W
5	Split AC	1.5 tone	2	3 tons
6	Water filter	Watt	1	50W

Table No. 5.34: **Name of the Department**: **Health Centre**

Sr. No.	Loads	Units	No	Total Wattage
1	CFL	23Watt	16	368
2	Florescent Light	Watt	14	560
3	Ceiling Fans	Watt	9	720
4	Exhaust Fans	Watt	2	120
5	Split AC	1.5Ton	1	1.5 ton
6	Computers/laptops	Watt	1	200
7	Printers	Watt	1	365
8	UPS	KVA	1	600

Table No. 5.35: **Name of the Department**: **International Guest House**

Sr. No.	Loads	Units	No	Total Wattage
1	Tube Light	Watt	96(40W)	3840W
2	MV (Mercury-vapor) Light	Watt	08(85W)	680W
3	Ceiling Fans	Watt	34	2720

4	Split AC	1.5Ton	27	40.5 ton
5	1 Hp Motors	HP	2	2HP
6	3 Hp Motors	HP	5	5HP
7	Geazer	2K Watt	26	52000
8	Computers/laptops	Watt	1	200
9	Printers	Watt	1	365
10	UPS	KVA	1	600

Table No. 5.36: **Name of the Department: Goa Business School (Dept of IMBA)**

Sr. No.	Loads	Units	No	Total Wattage	Year of Installation/Make
1	MV (mercury-vapor) Lights	Watt	124	40	-
2	Ceiling Fans	Watt	78	80	-
3	Wall Fans	Watt	1	55	-
4	Exhaust Fans	Watt	4	160	-
5	Split AC	Ton	39	1.5	2015
6	Computers/laptops	Watt	8	200	-
7	Printers	Watt	8	35	-
8	Water Purifier	Watt	1	700	2016
9	Podium	Watt	8	120	2017
10	LCD projector	Watt	7	300	2018

Department: Library Building

Table No. 5.37: **The library building has following two sections., Section 1: LIBRARY BUILDING**

Sr. No.	Loads	Unit	Per Unit wattage	NO.	Total Wattage	Year of Installation/Make
1	CFL (Tube lights)	Watt	40	353	14120	1994
2	Ceiling Fans	Watt	80	164	13120	1994
3	Wall fans	Watt	75	3	225	1996
4	Exhaust fan	Watt	50	26	1300	2000
5	Split AC	Ton	1.5 ton	9	13.5 ton	2003
6	3 Hp Motors	HP	220	1	220	1994
7	Computers	Watt	100	44	4400	2009
8	Printers	Watt	20	5	100	2009
9	UPS	KVA	2KVA	2	4KVA	2009
10	Mechanical/Electrical Equipment	Watt/KVA	220	1	220	1994

11	Xerox Machine	Watt	200	1	200	2016
12	Standing Fan	Watt	55	8	440	2015
13	Book Scanner	Watt	130	1	130	2017

Table No. 5.38: **Section 2: Engineering and technical Division**

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	Watt	2	14
2	CFL	23Watt	5	115
3	Florescent Light	20Watt	2	40
4	Tube Light	Watt	26	1040
5	Ceiling Fans	Watt	10	800
6	Wall Fans	Watt	4	200
7	Exhaust Fans	Watt	2	120
8	Split AC	1Ton	1	1 ton
9	Computers/laptops	Watt	7	1400
10	Printers	Watt	1	365
11	UPS	600VA	7	4.2 KVA
12	PL Fixture	9Watt	2	112

New Science Building

The new science building has following departments.

- **School of Chemical Sciences,**
- **Biotechnology,**
- **Microbiology and Zoology department**

Table No. 5.39: **Section1: Chemistry**

CHEMISTRY DEPARTMENT						
I. BASEMENT AREA						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	CFL	36	4	144	Bajaj	2013
2	Tubelight	36	1	36	Philips	2013
3	CCTV Camera	100	7	700	Panasonic	2016
4	AC split	1.5 T	3	4.5 T	Lloyd, LG	2013

5	Exhaust Fan	80 W	1	80	Bajaj	2017
6	Elevator	KW	1	7.5 KW	Thyssennkrupp	2012
7	Central Vacuum Machine	7.5 HP	2	15 HP	Ingersolrand	2012
8	Central Air Compressor	5 T	2	10 T	Ingersolrand	2012
II. GROUND FLOOR						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	CFL	18	95	1710	Wipro	2012
2	CFL	36	318	11448	Wipro	2012
3	Mercury Light	70	76	420		2012
4	Tubelight	36	6	216	Crompton	2018
5	Ceiling Fan	80	72	5760	Bajaj	2012
6	Wall fan	70	6	420	Usha	2017
7	Pedestal fan	80	2	160	Bajaj	2017
8	Split AC	1.5 T	16	24 T	Daikin, Voltas	2012, 2018
9	Casette AC	1.5 T	8	12 T	Daikin	2012
10	Exhaust Fan	80	14	1120	Bajaj	2017
11	Big Exhaust Fan	410	6	2460	Bajaj	2017
12	Fumehood motor	0.5 HP	1	0.5 HP	Bhuta	2012
13	Speakers	80	5	400	Philips	2018
14	Amplifier	150	1	150	Philips	2018
15	LCD Projector	800	3	2400	Panasonic	2018
16	Chemical Refrigerator	100	2	200	Cryoscientific	2017
17	Water Cooler	850	2	1700	Aquaguard	2013
III. FIRST FLOOR						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	CFL	18	98	1764	Wipro	2012
2	CFL	36	377	13572	Wipro	2012
3	Tubelight	36	6	216	Crompton	2015
4	Ceiling Fan	80	58	4640	Bajaj	2012
5	Pedestal fan	80	2	160	Crompton	2015
6	Split AC	1.5 T	5	7.5 T	Diakin, Voltas	2012, 2018
7	Casette AC	1.5 T	32	48 T	Daikin	2012
8	Exhaust Fan	80	17	1360	Bajaj	2017

9	Big Exhaust Fan	410	3	1230	Bajaj	2017
10	Fumehood motor	0.5 HP	5	2.5 T	Bhuta	2012
11	Table Fan	70	2	140	Bajaj	2015
12	Refrigerator	100	3	300	Kelvinator, LG	2013, 2015
13	Oven	1500	2	3000	Morya	2016
14	MW Oven	1000	3	3000	LG, Kenstar	2016
15	Muffle Furnace	3000	7	21000	Gupta, Antceramic	2013, 2016
16	Xerox Machine	1000	1	1000	Canon	2012
17	Centrifuge Machine	100	1	100	Remi	2016
18	Vacuum Pump	0.5 HP	1	0.5 HP	Morya	2015
19	AC susceptibility	200	1	200		2015
20	Dielectric Constant	1500	1	1500		2015
21	Resistivity	2.7 KW	1	2.7 KW		2012
22	4-probe Instrument	200	1	200		2016
23	Thermoelectric Power	2.7 KW	1	2.7 KW		2015
24	LCD projector	800	1	800	Panasonic	2017
25	Water Cooler	850	2	1700	Aquaguard	2015
IV. SECOND FLOOR						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	CFL	18	101	1818	Wipro	2012
2	CFL	36	451	16236	Wipro	2012
3	Ceiling Fan	80	91	7280	Bajaj	2012
4	Pedestal fan	80	13	1040	Usha/Surya	2018
5	Split AC	1.5 T	6	9 T	Voltas	2018
6	Casette AC	1.5 T	29	43.5 T	Daikin	2012
7	Exhaust Fan	80	35	2800	Bajaj	2017
8	Fumehood motor	0.5 HP	21	10.5 T	Bhuta	2012
9	Refrigerator	100	8	800	Haier/ LG	2018
10	Oven	1500	6	9000	Perfit/Morya	2015
11	Muffle Furnace	3000	3	9000	Metalab	2010
12	Vacuum Pump	0.5 HP	7	3.5 HP	VT	2014
13	Analytical Balance	200	6	1200	Metlertoledo	2017
14	Rotavapour	60	2	120	Buchi	2017
15	D. Distillation Unit	3000	1	3000	Borosil	2015
16	Chiller	2500	1	2500	Subzero	2018
17	LCD Projector	800	2	1600	Panasonic	2018

A. PG Organic Laboratory Part I & II						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	Oven	1500	2	3000	Morya	2013
2	Refrigerator	100	1	100	Samsung	2016
3	Chemical Refrigerator	100	1	100	Cryoscientific	2017
4	Fumehood Motor	0.5 HP	3	1.5 HP	Bhuta	2012
5	Fumehood CFL	36	7	252	Bhuta	2012
6	Water Bath	1000	15	15000	Morya	2014
7	Vacuum Pump	0.5 HP	2	1 HP	VT	2014
8	Heating Mantles	150	20	3000	Morya	2014
9	Analytical Balance	200	5	1000	Metlertoledo	2014
10	MW Oven	1000	1	1000	Kenstar	2017
11	Rota Mantle	150	4	600	Remi	2017
12	Hotplate	2000	1	2000	Morya	2016
13	Hotplate Stirre	150	8	1200	Remi	2017
14	Iceflaker	400	1	400	Icematic	2018
15	Rotavapour	60	1	60	Lab India	2017
16	Single Distallation Unit	3000	1	3000	Bhanu	2017
B. PG Inorganic Laboratory Part I & II						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	Oven	1500	2	3000	Morya	2013
2	Refrigerator	100	2	200	Samsung	2016
3	Chemical Refrigerator	100	1	100	Cryoscientific	2017
4	Fumehood Motor	0.5 HP	4	2 HP	Bhuta	2012
5	Water Bath	200	4	8000	Morya	2014
6	Vacuum Pump	0.5 HP	3	1.5 HP	VT	2014
7	Analytical Balance	200	4	800	Metalertoledo	2014
8	Rotavapour	60	1	60	Lab India	2017
9	Hotplate	2000	4	8000	Morya	2014
10	Muffle Furnace	3.5 KW	2	7 KW	Antceramic	2016
11	D. Distillation Unit	3000	2	6000	Borosil	2014
12	Chiller	2500	2	5000	Subzero	2018
C. PG Physical Laboratory Part I & II						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year

1	Oven	1500	2	3000	Morya	2013
2	Refrigerator	100	2	200	Samsung	2016
3	Chemical Refrigerator	100	1	100	Cryoscientific	2017
4	Fumehood Motor	0.5 HP	1	0.5 HP	Bhuta	2012
5	Water Bath	200	5	1000	Morya	2014
6	Vacuum Pump	0.5 HP	1	0.5 HP	VT	2014
7	Analytical Balance	200	4	800	Metalertoledo	2014
8	Rotavapour	60	1	60	Lab India	2017
9	Hotplate	2000	2	4000	Morya	2014
10	Muffle Furnace	3.5 KW	2	7 KW	Antceramic	2016
11	Single Distillation Unit	3000	1	3000	Millipore	2012
12	D. Distillation Unit	3000	1	3000	Borosil	2014
13	Chiller	2500	1	2500	Subzero	2018
14	centrifuge	100	1	100	Remi	2016
D. PG Analytical Laboratory Part I & II						
Sr. No.	LOAD	UNIT (W)	Nos.	Total Watts	Make	Installation Year
1	Oven	1500	2	3000	Morya	2013
2	Refrigerator	100	2	200	Samsung	2016
3	Chemical Refrigerator	100	1	100	Cryo Scientific	2017
4	Fumehood Motor	0.5 HP	6	3 HP	Bhuta	2012
5	Water Bath	1500	2	3000	Labline	2014
6	Chiller	2500	2	5000	Subzero	2018
7	Hotplate	2000	4	8000	Morya	2014
8	Distillation Unit	3000	1	3000	Infusil	2014
9	D. Distillation Unit	3000	1	3000	Borosil	2014
10	UV chamber	100	2	200	Chemline	2013
11	Analytical Balance	200	4	800	Metlerteledo	2014
We have 5Nos.cathode ray monitors and 42Nos LCD monitors and do not have LED monitors.						
There are 47Nos computers and UPS in department.						

Table No. 5.40: Section 2 : Department of Microbiology

Sr. No.	Loads	Unit	No.	Total Wattage	Year of Installation/Make
1	LED Lights	Watt (23)	218	8,280	2013-14,2010
2	CFL	Watt	8	330	

3	Ceiling Fans	Watt (80)	21	1,680	Bajaj
4	Walls fans/Pedestal fan	Watt(53)	4	212	Orient
5	Exhaust Fans	Watt (40)	4	160	2017
6	Split AC	Ton (1.5)	19		2009-10,2014-15/Voltas, Onida, Daikin
7	Computer	Watt(150)	22	3,300	2009-10/Acer;2018 Acer
8	Laptop	Watt (65)	3	260	
9	Xerox Mchine	Watt (1500)	1	1,500	
10	Printer	Watt (259)	4	1036	
11	UPS (connected to PC)	VA (600)	22	13,200	Microtex/Numeric
12	UPS	KVA 4	3	12	
13	UPS	20 KVA	2	40	
14	Ovens	Watt (1000)	7	7,000	1973-74,2015-16,2017-18/Bio Technicas India
15	Water –bath	Watt (1000)	8	6,000	2013-14,2014-15/Bio-Technical India
PG Laboratory Equipment's (List separately)					
1	Centrifuge	Watt(100)	9	900	1996,2007,2014,2015,2016/Eppendorf,Remi,Biosafe
2	Water purification	Watt	4	6,800	
3	Magnetic Stirrer	Watt	4	4,800	1998,2004,2013/Remi
4	Thermol Cyceler	Watt	1	3000	2013/BIO RAD
5	Biospectrometer	Watt	1	30	2013/Eppendorf
6	Electrophoreses/Voltage Ragulator	Watt 300	6	1800	1994, 1998,2012/Narang Sceintifics,Vguard
7	Eporator	Watt	1	367	
8	Cyclo Mixer	Watt 150	4	600	1978,1994/Remi
9	Microscope	Watt 360	4	1440	1994.2004.2014/Nikon
10	Nanodrop Spectrophotometer	Watt 18	1	18	2014/Termo Sceintifics
11	Gel Documentation System	Watt 90	2	180	2013/Syngene
12	Real Time System	Watt	1	600	2013/Bio Rad
13	G. Box Documentation System	Watt	1	100	2009/Alpha Innotech

14	pH Meter	Watt	4	10	2013/Eutech Instruments
15	BOD Incubator	Watt 860	5	4,300	2007,2014,2017/Labtop,Remi
16	Mini Protean tetra Cell	Watt	1	100	2009/BIO RAD
17	Water- bath(Proj)	Watt	1	1480	2005/Julabo
18	Mini autoclave	Watt	1	2,200	2014,2015,2017/Equitron
19	Big autoclave	Watt	3	9,000	
20	Ice flake machine	Watt	1	550	
21	DGGE	Watt	1	25	
22	IEF	Watt	1	10	
23	Orbital Incubator Shaker	Watt	6	600	1996,2007,2009,2018/Remi
24	LCD Projector	Watt (800)	5	4000	2014
25	Luminar Air flow	Watt	6	90	1986,1997,2008, 2009,2013/Rescholar Equipments,Pohes Technology
26	Mini spin	Watt	1	700	
27	Refrigerator	Watt (100)	7	700	1994,2009,2014/L.G.,Celfrost,Samsumg
28	OGGE/IEF	Watt	2	20	Bio Rad
29	Servo Stabilizer	Watt	1	1700	
30	Eppendorf master cycle	Watt	1	0	
31	Audio Sonic	Watt (80)	3	240	2018-19 Philips
32	Weighing Balance	Watt 24	3	73	2013,2016/Shimadzu
33	Biosafety Cabinate	Watt	1	400	2018
34	L.G. image analyzer	Watt	1	10	2015-16
35	UV Spectrophotometer	Watt 1000	4	4000	1995/Shimadzu
36	Vaccum pump	Watt (0.5 HP)	3	1.5hp	2015-16,2010
37	Induction	Watt	4	8,000	2013,2016/Prestige
38	OHP	Watt 287	2	574	1998
39	- 20°C deep frezeer	Watt 350	2	700	2004
40	Sonicator	Watt	1	20	1999/Brown
41	Gas Chromotograhpy	Watt	1	480	1997/Wipro,HP
42	Fermentor with accessories	Watt	2	2000	1994/B Brown,NBS
43	Fume Hood	Watt 60	3	180	2014 &2017
44	ASS with accessories	Watt	1	0	

45	HPLC	Watt	1	8000	
46	Rheometer	Watt	1	365	Brookfield DV III +
47				114172	

Table No. 5.41: **Section 3: Department of Zoology**

Sr. No.	Name	Unit (W)	Nos	Total Wattts	Year of Purpose
Instrumentation Lab					
1	Freeze Dryer	850	1	850	2000
2	PCR	950	1	950	2011
3	Microplate Reader	80	1	80	2013
4	Research Microscopic Zeiss	12	6	48	96-97.2001 and 2010
5	Osometer	250	1	250	2008
6	SONICATOR	245	1	245	2005
7	Microtome	850	1	850	99-2000
8	Cooling Centrifuge	100	1	100	2015
9	Cooling Centrifuge (REMI)	100	1	100	97
10	BOD INCUBATOR (MIC)	60	1	60	2013
11	Gas Chromatography (Chemito)	440	1	440	2000
12	UPS- Numeric	3KVA	1	3 KVA	2015
13	High Performance Liquid Chromatography	185	1	185	2013
14	Spectoflurophotometer (Shimadzu)	600	1	600	97
15	Spectoflurophotometer (Shimadzu)	600	1	600	2004
16	UV-Visible Spectophotometer (UV-2450)	190 VA	1	190 VA	2001-02
17	Gel DOC (Bio RAD)	40	1	40	2017
18	Ovanizor	1500	1	1	2002
19	Tube lights	36	8	288	2014
20	Computer	360	6	2160	
21	Central AC		2		
Research Lab					
1	Whirlpool Refrigerator	100	1	100	2016
2	Hot Air Oven	1400	1	1400	2008
3	Digital Balance (Sartorius)	200	1	200	2009
4	Weighing Balance (Sartorius)	200	1	200	2008
5	Water Bath Digital Controller	800	1	800	2011
6	Shaker - Orbitech	25	1	25	2017
7	Water & Soil Analytical Kit				2016
8	Canon Printer	300	1	300	2001
9	Deep Freezer (Haier) Horizontal	100	1	100	2018
10	Magnetic Stirrer	80	1	80	3-Apr

11	Electrophoresis Unit & Power Supply	300	1	300	2000
12	Tube lights	36	15	540	2014
13	Central AC		4		2014
Optical Lab					
1	(Shimdzu) Gas Chromatography	3 KW	1	3 KW	2016
2	Ultracentrifuge (Optima XPN-100)	475	1	475	2012
3	Spit AC	1.5 ton	n	1.5 ton	2017
4	Central AC		2		2014
5	UPS 3 KVA	3 KVA	1	3 KVA	2016
6	Tube lights	36	9	324	2014
Main Lab					
1	Refrigerator LG	100	1	100	2009
2	Remi Centrifuge	100	1	100	2017
3	Flame Photometer	100	1	100	2014
4	UV- Visible Spectophotometer (Bio Era)	220V	1	220v	2018
5	Weigh Balance	200	1	200	2013
6	Fume Hood	0.5 HP	1	0.5 HP	2017-18
7	Electrophoresis Unit	300	1	300	2018
8	Visible Spectrophotometer	120	1	120	2018
9	Tube lights	36	8	288	2014
10	Computer	250	1		2017
11	Central AC		2		
TISSUE CULTURE					
1	Balance	200	1	200	2017
2	Autoclave	1800	2	3600	2013 & 2018
3	Oven	1400	1	1400	1995
4	Lab Incubator	750	1	750	2008
5	BOD Incubator	750	1	750	2018
6	CO2 Incubator	750	1	750	2016
7	Spinwin Centrifuge	90	1	90	2009
8	Magnetic Stirrer	80	1	80	2000-01
9	Laminar Air Flow	100	3	300	2012,2011,&2009
10	Centrifuge mini	125	1	125	2018
11	Tube Roller	50	1	50	2018
12	Tube lights	36	9	324	2014
13	Central AC		2		
PG DIPLOMA LAB					
1	Homogenizer	220	1	220	2015
2	Muffle Furnance	2500	1	2500	4-May
3	Deep Freezer (Remi)	100	1	100	2018
4	Refrigerator (Whirlpool)	100	1	100	2015

5	Induction	1200	1	1200	2013
6	Tube lights	36	8	288	2014
7	Central AC		2		2014
WASHING ROOM					
1	Fume Wood	0.5 HP	1	.5 HP	2017-18
2	Split AC	1.5 t	1	1.5 ton	2017
3	Tube lights	36	2	72	2016-17
4	Ceiling Fan	80	1	80	2016-17
Museam					
1	Split AC	1.5 Ton	1	1.5 ton	2017-18
2	Ceiling Fan	80	2	160	2016-17
3	Tube lights	36	4	144	
Coputer lab					
1	Computer acer Desk top	250	8	2000	2009 & 2018
2	Central Air Compressor	5T	1	5T	2016-17
3	LCD	800	1	800	2016-17
4	Tube lights	36	4	144	2014
5	Central AC		1		
PG Class room					
1	LCD	800	1	800	2016-17
2	Computer	250	1	250	2009
3	Spilt AC	1.5 T	1	1.5 T	2017-18
4	Tube light	36	5	180	2016-17
5	Ceiling Fan	80	1	80	2016-17
6	Central AC		1		
Store room					
1	Exhaust fans	80	2	160	2016-17
2	Ceiling Fans	80	3	240	2016-17
3	Tube Lights	36	4	144	2014
Office & cabins					
1	Tube light	36	10	360	2014
2	Printer	300	2	600	2011
3	Computer	360	5	1800	2009
4	Central AC		5		2014
M.Sc. Class room					
1	LCD	800	1	800	2016-17
2	Computer	360	1	360	
3	Spilt AC	1.5 T	2	3T	2017-18
4	Tube light	36	8	288	2014
5	Ceiling Fan	80	6	480	2014

Table No. 5.42 : **Name of the Laboratory: BIOTECHNOLOGY**

SrNo	Items	Unit (W)	Nos	Total Watts	Make	Installation Year
1	CFL	36	76	2736	Wipro	2012
2	Tubelight	36	12	432	Bajaj,Philips	2013,2017
3	Split AC	1.5T	06	9T	Voltas	2017
4	Exhaust Fan	80W	06	480	Bajaj	2017
5	Cassette AC	1.5T	29	43.5T	Daikin	2012
6	Fume Hood	0.5 HP	1	0.5HP	TEL	2018
7	LCD Projector	800	1	800	Hitachi	2016
8	Ceiling fans	80	3	240	Bajaj	2012
9	Amplifier	150	1	150	Crowm	2017
10	Computer	80	14	1120	Dell, Acer, Acer,HCL	2010,11 &15
11	Printer	200	02	400	Hp	2011,2007
12	Visi Cooler	100	02	200	Voltas	2014
13	P A Lectern Amplifier cum speaker	150	1	150	Lectern	2017
14	Double door Fridge	100	1	100	L G	2008
15	Micro Wave oven	500	1	500	IFB	2014
16	Standimg Fan	80	1	80	Remi	2007
17	Qubit Flourometer	80	1	80	Life Technologies	2013
18	Cold Room	2T	1	2T	Ice Make	2018

19	Iceflaker Mechine	400	1	400	Scotsman	1995
20	Induction Heater	1500	1	1500	Prestige	2015
21	Circualting Water Bath	2500	1	2500	Equitron	2009
22	Vacuum Evaporator system	2000	1	2000	Equitron	2009
23	Chilling water Circulator	1500	1	1500	Equitron	2010
24	Hot Air Oven	1500	1	1500	Kumar	1993
25	Ref. TableTop centrifuge	500	1	500	Eppendrof	2013
26	-20 deg DeepFreezer	850	1	850	Newtronics	2015
27	Refrigerator	100	1	100	LG	2005
28	BOD Incubator	100	1	100	Biotechnics	2014
29	Visi Cooler	200	1	200	Celfrost	2008
30	Visi Cooler	200	2	400	Voltas	2014 ,16
31	Weighing Balance	200	1	200	Shimadzu	2009
32	Vacuum Pump	1HP	1	1HP	Millipore	2004
33	Vacuum Pump	0.5 HP	1	0.5HP	Truvac	2016
34	Orbital Shaker	1000	1	1000	Brunswick	1993
35	Laminar Air Flow	500	1	500	Toshibha	2007
36	Biosafety Cabinet	500	1	500	Microfilt	2009
37	Ph Meter	100	4	400	Eutech	2013
38	Microwave Oven	500	1	500	Samsung	2003
39	Visi Cooler	100	1	100	Western	2003
44	Fridge	100	02	200	LG	2008
41	Visi cooler	100	1	100	Elanpro	2018
42	Fridge	100	1	100	LG	2017

43	Printer	200	2	200	Cannon	2018
44	Fridge	100	1	100	Whirpool	2012
45	Fraction Collector	100	1	100	G E Health Care	2009
46	Compound Microscope	80	5	400	Kyowa	2009
47	Collini Counter	80	1	80	Medica Instruments	2014
48	Programmeable Test Chamber	200	1	200	Remi	2009
49	Laminar Air Flow	500	2	1000	Imset	2018
50	Fridge	100	1	100	Godrej	2006
51	Photo copier	200	1	200	Sharp	2010
52	Vertical Autoclave	2000	1	2000	Equiptron	2016
53	Visi cooler	100	1	100	Elanpro	2013
54	Automatic Water Still	3000	2	6000	Medica	2011, 2016
55	MicroWave Oven	500	1	500	IFB	2014
56	Precision Balance	200	1	200	Wensor	2017
57	Bacteriological Incubator	250	1	250	Biotechnics	2014
58	Elite Oven	500	1	500	Elite	2000
59	Laminar Air Flow	500	1	500	Biotechnics	2013
60	Mixer	200	1	200	Remi	2000
61	Orbital Shaker	500	1	500	Biotechnics	2008
62	Weighing Balance	200	2	400	Denver	2011
63	AutoClave semi Automatic	2000	1	2000	Biotechnics	2014
64	Laminar Air Flow	500	1	500`	Ravson	1995
65	Hot Air Oven	1500	1	1500	Biolinx	2017
66	Circulaing Water Bath	200	1	200	Biotechnics	2014

67	Double Door Fridge	100	1	100	LG	2008
68	Fridge	100	1	100	Godrej	2001
69	High Precision Balance	80	1	80	Wensor	2016
70	Laminar Air Flow	500	1	500	Biotechnics	2015
71	Hot Air Oven	1500	1	1500	Biotechnics	2014
72	Microwave oven	500	1	500	IFB	2014
73	Pentro Meter	80	1	80	Pento	2018
74	Visi cooler	100	2	200	Elanpro	2013
75	Satorius Balance	80	1	80	Satorius	2018
76	Ph meter	80	1	80	Equiptronics	2011
77	Milli Q System	200	1	200	Millipore	2011
78	Computer	80	1	80	Acer	2010
79	U V Tranilluminator	200	1	200	FotoDyne	1989
80	Microplate Reader	200	1	200	BioRad	2016
81	Gel Doc	150	1	150	Uvitec	2009
82	Fermentor	400	1	400	Esedra	2011
83	Table Top Centrifuge	250	1	250	BioEra	2016
84	Fermentor	400	1	400	Bio Raca	2016
112	Lyophilisor	200	1	200	Scanvac	2009
113	Vacuum Pump	0.5 HP	1	0.5 HP	Vacuubrand	2009
114	Vibra Cell Sonicator	200	1	200	Sonics	1990
115	-80 Deep freezer	500	1	500	Cryo	2009
116	Fridge	100	1	100	L G	2016
117	Water Circulating Bath	200	1	200	Biotechnics	2014

118	U V Spectrophotometer	200	1	200	Shimadzu	2016
119	Heating water Bath	250	1	250	Rivotek	2010
120	Double Beam Spectrophotometer	200	1	200	Chemito	2007
121	Incubator Shaker	150	1	150	Labtop	2009
122	High Speed Centrifuge	500	1	500	Thermofisher	2013
123	Ultra Centrifuge	500	1	500	Beckman	2011
124	Fluorescence Microscope	150	1	150	Law & Mayo	2009
125	Incubator Shaker	200	1	200	Progen Biotech	2012
126	Fluorescent Microscope	150	1	150	Wild Lietz	1989
127	Table Top Ultra centrifuge	500	1	500	Beckman	2011
128	Compound Microscope	80	5	400	Kyowa	2009
129	Orbital Shaker	150	1	150	Sciengenic	2001
130	Compound Microscope	80	11	880	Law & Mayo	2015
131	Incubator Shaker	150	1	150	Remi	2018
132	Compoud Microscope	80	5	400	Law & Mayo	2009
133	Protein Purification System	200	1	200	Akta Start G E	2018
134	PCR	100	1	100	Biorad	2007
135	Incubator	100	1	100	Classic	2006
136	Incubator Shaker	250	1	250	Remi	2009
137	Table Top Micro Centrifuge	200	1	200	Hettich	2012
138	Spectrophotometer	100	1	100	Shimadzu	2004

Residential Area: Old A & B type Qtrs

Accommodation for Professors, Associate Professors, Assistant Professors, Officers of Goa University

Table No. 5.43 **Section 1: A Quarters**

	Name of the Department: A Quarters (15 nos)				
Sr. No.	**Loads**	**Unit**	**No.**	**Total Wattage**	**15 Quarters**
1	LED Lights	Watt	16	120w	1800W
2	Florescent Light	Watt	3	600W	9000W
3	Ceiling Fans	Watt	6	480W	7200W
4	Exhaust Fans	Watt	2	100W	1500W
5	Split AC	1.5 tone	1	1.5 tons	22.5 Tons
6	3 Hp Motors	HP	1	3HP	45Hp
7	Ovens	Watt	1	2000W	30000W
8	Geazer	Watt	1	500W	7500W
9	Computers (Desktop)	Watt	1	200W	3000W
10	refrigerator	Watt	1	1000W	15000W

Table No. 5.44: **Section 2: B Quarters (OLD B)**

	Name of the Department: A Quarters (25 nos)				
Sr. No.	**Loads**	**Unit**	**No.**	**Total Wattage**	**25 Quarters**
1	LED Lights	Watt	16	120w	3000W
2	Florescent Light	Watt	3	600W	15000W
3	SV(sodium-vapor)Light	Watt	N.A	N.A	
4	Ceiling Fans	Watt	6	480W	12000W
5	Exhaust Fans	Watt	2	100W	2500W
6	Split AC	1.5 tone	1	1.5 tons	22.5 Tons
7	3 Hp Motors	HP	1	3HP	75Hp
8	Ovens	Watt	1	2000W	30000W
9	Geazer	Watt	1	500W	12500W
10	Computers (Desktop)	Watt	1	200W	5000W
11	refrigerator	Watt	1	1000W	25000W

PURE SCIENCE BUILDING

The pure science building has following departments.

- Botany,
- Mathematic,
- Physics department

Table No. 5.45: **Section 1: Department of Botany**

Sr. No.	***Loads***	***Unit***	***No***	***Total Wattage***	***Make***
1	CFL Light	Watt	1	14	
2	Florescent Light (Small)	Watt	13	20	
3	Florescent Light (Big)	Watt	136	55	
4	Ceiling Fans	Watt	42	75	
5	Pedelstand Fan	Watt	1	55	
6	Exost Fan	Watt	2	60	
7	Window AC	Watt	1	1200	Ikon
		Watt	2	1965	Carrier
		Watt	1	1500	LG
8	Split AC	Watt	4	2480	LG
		Watt	1	1260	Kelvinator
		Watt	2	2005	Lloyd
		Watt	4	1500	Lloyd
		Watt	1	1500	LG
		Watt	3	1500	Videocon
		Watt	4	1970	LG
		Watt	1	2400	Lloyd
9	Desktop Computers	Watt	5	200	HCL
		Watt	10	200	Lenovo
		Watt	4	200	HP
		Watt	7	200	HCL
		Watt	4	200	ACER
		Watt	1	200	Dell
		Watt	1	200	Samsung
10	Laptop	Watt	2	60	ACER
		Watt	1	60	Lenovo
11	Printers	Watt	6	360	HP
		Watt	1	420	HP
		Watt	1	10	HP
		Watt	2	250	HP

		Watt	1	22	Canon
		Watt	1	20	Canon
		Watt	1	10	HP
12	Scanner	Watt	2	2.5	Canon
		Watt	1	25	HP
13	UPS	VA	20	600	Numeric
		VA	1	600	I ball
		VA	7	600	Artis
		VA	1	3500	Artis
		VA	1	3000	Techser
	AF-43 (PG Laboratory - I)				
1	Dubble Distilation Unit	Watt	1	2000	Borosil
2	Weighing Balance	Watt	1	2	Sartorius
3	pH Meter	Watt	2	2	Eutech
4	Heating Mantle	Watt	1	300	Perfit
5	Centrifuge	Watt	1	500	Eltek
6	Microscope	Watt	1	5	Olympus (SZ)
7	Digital Flame Photometer	Watt	1		Esico
8	Magnetic Stirrer with Hot plate	Watt	1	1170	Tarson
9	Water Bath Shaker	Watt	1	350	Remi
10	Hot Plate	Watt	1	1500	Lab Hosp
11	Fuming Chamber	Watt	1	1500	Suprashesh
12	Water bath	Watt	1	1500	Pathak
13	Microwave Oven	Watt	1	1500	IFB
14	UV Transmitor	Watt	1		Electronic
15	Refrigerator	Watt	1	150	Samsung
16	Mixer Grinder	Watt	1	500	Bajaj
	AF-40 (PG Laboratory - II)				
1	UV-VIS Spectrophotometer	Watt	1	200	Shimadzu
2	Centrifuge	Watt	1	1200	Hermle
3	Water bath	Watt	1	1500	Pathak
4	Water bath	Watt	1	2000	MIC
5	pH Meter	Watt	1	2	Eutech
6	Split AC	Watt	1	1970	LG
7	Split AC	Watt	1	2480	LG
8	Microscope	Watt	4	5	Nikon (E200)

9	Microscope	Watt	1	5	Olympus (CH30)
10	Muffle Furnace	Watt	1	2000	
11	Centrifuge	Watt	1	350	Remi
12	Weighing Balance	Watt	1	2	Sartorius
13	Frezzer Drier	Watt	1	800	Scanva
14	Rotary Evaporator	Watt	1	1400	Heidoph
15	Digital Water Bath	Watt	1	1000	Nutronics
16	Dry Water bath	Watt	1	300	Wise Therm
17	SEM	KVA	1	30	Techser
	Others Scientific, analytical, Mechanical, Electrical Equipments & Instruments				
1	Xerox Machine	Watt	1	1200	Sharp
2	LED TV	Watt	1	66	LG
3	Oven	Watt	1	2250	Metalab
		Watt	1	2000	MIC
		Watt	2	1750	Bio technics
4	Microwave Oven	Watt	1	1350	LG
5	Muffle Furnace	Watt	1	5000	MIC
6	Orbital Shaker	Watt	4	1500	Scigenic Biotech
7	Orbital Shaker Incubator	Watt	1	1500	Labtop
8	Micro-Centrifuge	Watt	1	850	Eppendorf
9	Centrifuge	Watt	2	350	Remi
		Watt	1	1650	Eppendorf
		Watt	1	90	Tarson
		Watt	1	500	Eltek
		Watt	1	350	Elanpro
10	Dubble Distilation Unit	Watt	4	2000	Borosil
11	Magnetic Stirrer	Watt	1	390	Tarson
12	Magnetic Stirrer with Hot plate	Watt	1	390	Spinot
		Watt	1	1115	Spinot
13	Heating Mantle	Watt	2	450	Perfit
		Watt	2	200	Perfit
		Watt	1	150	Perfit
		Watt	2	60	Perfit
14	Laminar Air Flow	Watt	1	450	Microfilt
		Watt	4	450	
		Watt	1	450	Rescholar Equipment
15	Vortex Shaker	Watt	1	150	Perfit
		Watt	1	50	Spinix
16	Rotary Shaker	Watt	1	500	Neuation

17	pH Meter	Watt	1	2	Equiptronics
		Watt	2	2	Eutech
18	Weighing Balance	Watt	1	2	Kern
		Watt	2	2	Citizen
		Watt	1	2	Contech
		Watt	1	2	Sartorius
19	Dehumidifier	Watt	1	20	GE
20	Plant Growth Chambor	Watt	1	1500	MIC
		Watt	1	4800	Labtech
21	Sonicator	Watt	1	400	Bendelin
22	Ultra Sonicator	Watt	1	400	Spactralab
23	Refrigerator	Watt	6	150	LG
		Watt	1	150	Samsung
		Watt	1	150	Kelvinator
		Watt	1	150	Godrej
24	Deep Freezer	Watt	1	2000	Newtronics
		Watt	1	4000	MIC
		Watt	2	2000	Cryo
25	Homogenizer	Watt	1	850	Miccra
26	Mini PCR	Watt	1	400	MJ
27	RT PCR	Watt	1	240	Corbett
28	Chlorophyll fluorometer	Watt	1	300	Walz
29	Infra Red Gas Analyzer	Watt	1		ADC Bio Scientific Ltd.
30	Spectroflurometer	Watt	1	200	Shimadzu
31	Mixer Grinder	Watt	3	750	Bajaj
32	UV-VIS Spectrophotometer	Watt	1	200	Shimadzu
33	Gas Chromatography	Watt	1	200	Shimadzu
34	Gel Drop system	Watt	1	95	Biorad
35	HPLC	Watt	1		Water
36	Gel Electrophoresis Unit	Watt	1	80	Tarson
37	Autoclave	Watt	2	3000	Lab-Hosp
		Watt	1	2000	Ketan
		Watt	1	4000	Lab-Hosp
38	Microscope	Watt	1	5	Olympus (CX31)
		Watt	4	5	Olympus (BX41)
		Watt	2	5	Olympus (SZ)
		Watt	1	5	Leitz (Biomed)
		Watt	1	5	Leitz (FZ)
		Watt	1	5	Leitz (DME)

		Watt	1	5	Olympus
		Watt	1	5	Olympus (CH30)
		Watt	1	5	Leica (Wild M10)
		Watt	2	5	Zeiss
		Watt	1	5	Wiloverts
		Watt	7	5	Nikon (Eclipse E200)
39	Stereo Microscope	Watt	1	5	Nikon (SMZ1000)
40	Fluroscence Microscope	Watt	1	5	Nikon (Eclipse E800)
41	Stereo Microscope	Watt	6	5	Nikon

Table No. 5.46 : Section 3: Department of Mathematics

Sr. No.	Loads	Unit	No.	Total Wattage	Remarks
1	LED Lights	Watt	NA		
2	CFL	Watt	NA		
3	Florescent Light	Watt	NA		
4	MV(mercury-vapor)Lights	Watt	NA		
5	SV(sodium-vapor)Light	Watt	NA		
6	Ceiling Fans	Watt	6	480W	
7	Wall Fans	Watt	9	540W	
8	Exhaust Fans	Watt	4	160W	
9	Window AC		NA		
10	Split AC	1.5 tone	3	4.5 Tons	All ACs not working
11	3 Hp Motors	HP	0		
12	Ovens	Watt	1	2000W	Not used by any body
13	Water filter	Watt	1	50W	
14	Geazer	Watt	NA		
15	Computers (Desktop)	Watt	10	1500W	
16	Printers	Watt	2	500W	
17	UPS	KVA	6	3600KVA	
18	refrigerator	Watt	NA		

Shopping Centre complex

Other Centers : Shopping Centre complex.

- S. B. I branch,
- S.B.I ATM,
- Stationary & Xerox,
- General Store

Table No. 5.47 : Section1: Shopping Complex

Sr. No.	Loads	Unit	No.	Total Wattage	
1	LED Lights	Watt	10	120w	
2	Florescent Light	Watt	1	200W	
3	Ceiling Fans	Watt	6	480W	
4	Exhaust Fans	Watt	2	100W	
5	Split AC	1.5 tone	5	7.5 tons	
6	Computers (Desktop)	Watt	5	1000W	
7	refrigerator	Watt	1	1000W	

Table No. 5.48 : Section 2 : Goa University Employees Co-operative Credit Society Ltd.,

Sr. No.	Loads	Units	No	Total Wattage	Year of Installation/make
1	SV (Sodium –Vapor) Lights	Watt	2	40	
2	Ceiling Fans	Watt	1	80	
3	Computer	Watt	1	200	04-03-2015
4	Printer	Watt	1	250	
5	UPS	KVA	1	750	

Table No. 5.49 : **Sports Building**

Sr. No.	Loads	Unit	No.	Total Wattage
1	LED Lights	Watt	5	60w
2	CFL	Watt	5	200W
3	Florescent Light	Watt	3	600W
4	Ceiling Fans	Watt	6	480W
5	Exhaust Fans	Watt	2	100W
6	Split AC	1.5 tone	1	1.5 tons
7	Computers (Desktop)	Watt	5	1000W
8	refrigerator	Watt	1	1000W

University Science instrumentation center Building

— Instrumentation Workshop

— Electronics,

Table No. 5.50: Section 1 : Instrumentation Workshop

Sr. No.	Loads	Unit	No	Total Wattage	Year of Installation/Make
1	LED Lights	Watt 20	2	40	
2	Tube Light	Watt	24	960	
3	Ceiling Fans	Watt	7	560	560
4	Wall Fans	Watt	1	60	60
5	Exhaust Fans	Watt	1	30	30
6	Split AC	Ton	2	2 tone	250
7	Computers	Watt	2	500	
8	Printers	Watt	1	250	
9	Xerox	Watt	1	1500	700
10	UPS	KVA	1	5kva	100
11	Furnace	Watt	1	2000	
12	SEM	Watt/KVA	1	6.5kva	
13	EDAX	Watt/KVA	1	2KVA	
14	Milling Machine	Watt/KVA	1	4kva	
15	Drilling Machine	Watt/KVA	2	700	
16	Leath Machine	Watt	1	10hp	
17	High Vacuum Pump Station	Watt/KVA	1	100	

Women's Hostel -II

Table No. 5.51 : **Name of the Department: Woman Hostel-I (Cavalosim)**

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	Watt	42	504
2	CFL	Watt	30	690
3	Tube Light	Watt	318	12720
4	SV (sodium-vapor) Light	Watt	2	500
5	Ceiling Fans	Watt	133	10640
6	Exhaust Fans	Watt	2	160
7	5 Hp Motors	HP	1	5HP
8	Geazer	Watt	5	10000
9	Computers/laptops	Watt	1	100
10	Printers	Watt	1	365
11	UPS	KVA	1	600
12	Induction Cooker	Watt	1	2000
13	Water Cooler	Watt	2	500

14	Deep Freezer	Watt	1	2000
15	Grider Big	Watt	1	800
16	TV	Watt	1	80

Table No. 5.52 :**Name of the Department**: **Woman Hostel-II (Palolem)**

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	12Watt	20	240
2	CFL	23Watt	163	3749
3	Tube Light	Watt	13	520
4	SV (sodium-vapor) Light	Watt	1	250
5	Ceiling Fans	Watt	5	400
6	Exhaust Fans	Watt	5	400
7	3 Hp Motors	HP	1	3HP
8	Induction Cooker	Watt	1	2000
9	Water Cooler/filter	Watt	5	2500
10	Deep Freezer	Watt	1	2000
11	TV	Watt	1	80

Table No. 5.53 :**Name of the Department**: **Woman Hostel-III (Arambol)**

Sr. No.	Loads	Units	No	Total Wattage
1	LED Lights	12Watt	3	36
2	CFL	23Watt	21	483
3	Tube Light	Watt	100	4000
4	Ceiling Fans	Watt	33	2640
5	Exhaust Fans	Watt	4	320
6	Geazer	Watt	2	4000
7	Water Cooler/filter	Watt	2	4000
8	Deep Freezer	Watt	1	2000
9	TV	Watt	1	80

CHAPTER-VI

THE UTILIZATION OF WATER ON THE UNIVERSITY CAMPUS

The University campus is utilized by the students, teaching and non-teaching staff, habitants staying at hostel and quarters and the visitors. There are 3000 students studying at university and 863 population are provided with the residential facilities in hostels/quarters. The campus has facility of canteen, mess, etc. The total population served on campus and the water utilization is shown in the table below. The University has also developed rain water harvesting system for collection of rain fall water.

Table No. 6.1 : Building covered under rainwater harvesting on University campus.

THE RAIN WATER HARVESTING ON UNIVERSITY CAMPUS				
Sr. No	Particulars	Quantity	unit	Total
1	Rain Water Harvesting	130 (jubilee hall) 75 (USIC) 90 (E block)	Sqm	295.00
2	Capacity of Boys Hostel	168 (PG Hostel) 28 (Phd Hostel)	nos	196.00
3	Capacity of Mess	96	nos	96.00
4	Total number of Canteens on campus	07	nos	07.00
5	Total seating capacity of Canteens	Faculty Canteen – 92 E Block – 32 F Block – 36 Guest House – 36 Int Guest House – 24 Men's Hostel – 96 Women's Hostel - 108	nos	424.00
6	Monthly use of drinking water on campus	75.00 lakhs litres	litres	75.00 lakhs
7	Number of habitants staying in the quarters* and Guest House#	A type - 27 B type - 87 C Type - 36 D Type - 36 TA type – 33 St Cruz Flats - 24 GH – 46 rooms IGH – 26 rooms	nos	243.00
9	Total capacity of the underground and ground water tanks	12.50 lakhs litres	litres	12.50 lakhs
10	Water bodies on campus	Nil	litres	Nil

Table No. 6.2 : Sector wise water consumption at different buildings.

Sr No	LOCATION	NO. OF TANKS	CAPACITY in lit	TANK TYPE
1	New Commerce Faculty			
	Block F	1	1,35,000	RCC Sump
2	New Science Building			
	=Block E	2	1,27,800	RCC Sump
3	Ladies Hostel	1	30,000	RCC Sump
4	Guest House	1	20,000	RCC Sump
5	New Boys Hostel-I	1	80,000	RCC Sump
6	New Teachers Qtrs.	1	40,000	RCC Sump
7	Library	1	20,000	RCC Sump
8	At Pump house, next to new commerce Bldg	3	1,50,000	RCC Sump

Table No. 6.3 : The Rain water harvesting details in Goa University

Sr. No.	Location	Area in Sq. M.	Catchment Area in Sq. M.
1	Opposite USIC Bldg	75.00 m2	400 m2
2	Next to Exam section	130 m2	15000 m2
3	At Science Building	90 m2	---

6.1 Rain Water Harvesting at Goa University

The University located on the Taleigao Plateau has a picturesque campus spread over 420 acres which hosts around 2500 people that includes student, teaching and non-teaching staff as well as families of resident staff. The University has taken initiatives in environmental research among students and has also aroused interest in energy and water conservation from its inception. The University draws its water supply from 6 bore-well units located within the precincts of the campus. During the summer months of April-May, there is a depletion in the water table on the plateau, during times the water supply is augmented by drawing water from Public Works Department (PWD) pipeline.

The first Roof-top harvesting (Figure 6.1) is carried out from the buildings of the Department of Electronics.

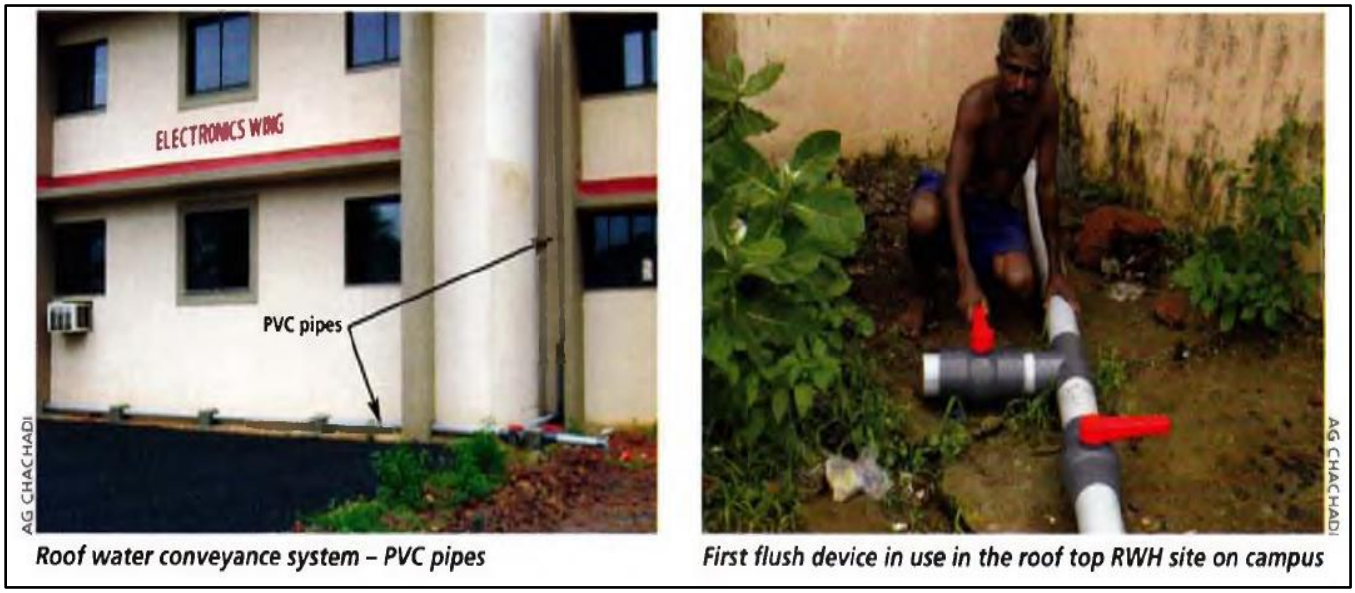

Figure 6.1: USIC building under rainwater harvesting.

The groundwater harvesting and recharge structure is built to augment six operational bore wells whose combined capacity totaled 75000 cubic meters of ground water every year, with the total drainage area contributing surface run off of 30000 square meters. The average surface run of collected per day is about 300 cubic meters. The ratio calculated for recharge to run off collection is 250/300 square meters, the remaining being lost due to seepage evapotranspiration and other factors.

Figure 6.2: Open area water harvesting and recharging.

Figure 6.3: Recharging well of open water harvesting and recharging.

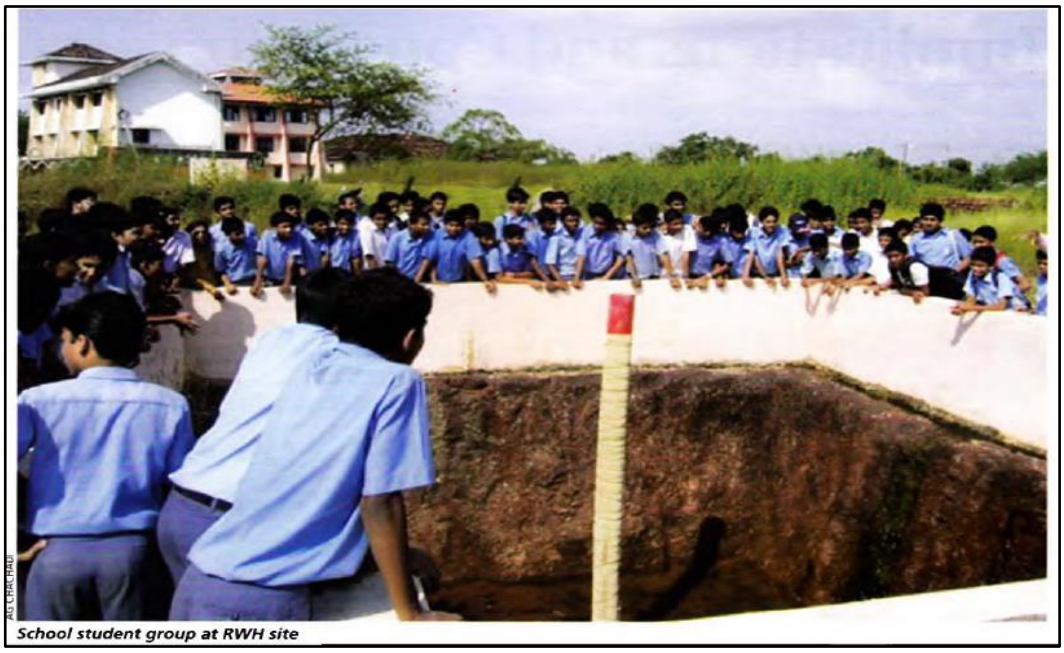

Figure 6.4: Youth awareness on Science day on water harvesting.

The rainwater harvesting project at the New Science Building taking the collected roof-top rainwater from the roof top and channelized through the down take pipes of the roof to the siltation chamber. The filtration chamber filters the water and this purified water is then recharged into the ground.

The catchment area is 350 square meters, with a rainwater harvesting potential of 945000 meters per year, with the average recharge per month being 262500 liters.

Figure 6.5 : Installations of Siltation, Filtration Chamber and Borewell Pits

Figure 6.6: School of Chemical Science building under rainwater harvesting..

Figure 6.7: School of Chemical Science building under rainwater harvesting piping Connections from Roof for downtakes

Figure 6.8 : School of Chemical Science building under rainwater harvesting and recharging final Layout

The University now in an attempt to augment the water resource in the campus is undertaking to impound the surface runoff by constructing a small embankment in the central eastern part of the campus which will aid in the availability of the water resource in the campus and also be a new habitat in campus for flora and fauna.

Figure 6.9 : Water harvesting bandhara(bandh) implemented. (Back view)

Figure 6.9 : Water harvesting bandhara(bandh) implemented. (Front view)

CHAPTER-VII

THE WASTE MANAGEMENT

7.1 Hazardous Waste Management

Goa University Monitoring Committee in accordance with UGC guidelines supervises the procurement, storage, usage and disposal of radioactive and other hazardous materials/chemicals etc. The Department of Biotechnology has the facility to carry out radioactive work. All radioactive wastes so far collected have been safely discarded. The Goa University campus is declared as plastic free and tobacco free zone under relevant State Acts.

7.1.1 Hazardous waste management

Raising plantations on the University campus has been difficult due to its hard-lateritic surface which hardly supports plant growth. Earlier afforestation efforts have met with little success as they encountered a high mortality rate. Besides stray cattle and campus fires were the other important constraints for plant growth and survival. Therefore, an innovative approach to initiate biodiversity plantations on the lateritic plateau of the campus was followed. Excavation of 2100 pits (1mx1mx1m), filling with garden soil and manure, and planting with selected tree species resulted in high (>90%) survival rate. The "Ratnagiri Irrigation System" was adopted to water each and every plant. In this system each plant was provided with 2-3 equidistantly positioned earthen pots at the base. These pots were manually filled with water once in every three days all through the summer months.

7.1.2 E-waste management

Every department store the e-waste till sufficient material is available for auctioning to metal scrap dealers. Some parts are cannibalized for recycling in working instruments.

The Goa University has enrolled in Karo Sambhav Bulk Consumer Programme the venture of Goa Waste Management Corporation (GWMC). The University transfer the e-waste material to the Karo Sambhav Pvt. Ltd. For recycling in accordance with the E-Waste (Management) Rules, 2016. In the year 2020, the e-waste weighing 5356.97 Kgs handed over to the agency.

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Table 7.1 : The list of E-Waste items segregated with SBSI internship and Earn While learn program

S.No.	ITEM Category as per e-waste rules, 2016	Item Description	Quantity in Kgs
1	Router	ITEW1	1
2	Switches	ITEW1	30.3
3	UPS	ITEW2	765.5
4	CPU	ITEW2	12.6
5	LCD Monitors	ITEW2	74
6	CRT Monitors	ITEW2	1878
7	Mouse	ITEW2	20
8	SMPS	ITEW2	235.5
9	Mother Boards	ITEW2	229
10	Keyboards	ITEW2	116.3
11	DVD Drive	ITEW2	118.8
12	Floppy Drive	ITEW2	37
13	Hard Disk	ITEW2	13.9
14	Laptop	ITEW3	1
15	MFD Printer	ITEW6	55
16	Printers	ITEW6	300.81
17	Printer Cartridges	ITEW6	60
18	Scanner	ITEW7	30.7
19	Telephones	ITEW12	153.56
20	TV	CEEW1	164
21	Refrigerator	CEEW2	610
22	AC	CEEW4	450
Total Weight – 5356.97 Kgs			

Receipt of Condemned E-Waste Collected

Sr. No.	Equipment	EEE Code	Quantity
1	Router	ITEW1	5
2	Switches	ITEW1	12
3	UPS	ITEW2	169
4	CPU	ITEW2	2
5	LCD Monitors	ITEW2	24
6	CRT Monitors	ITEW2	140
7	Mouse	ITEW2	100
8	SMPS	ITEW2	208
9	Mother Boards	ITEW2	266
10	Keyboards	ITEW2	163
11	DVD Drive	ITEW2	165
12	Floppy Drive	ITEW2	94
13	Hard Disk	ITEW2	121
14	Laptop	ITEW3	1
15	MFD Printer	ITEW6	2
16	Printers	ITEW6	70
17	Printer Cartridges	ITEW6	200
18	Scanner	ITEW7	8
19	Telephones	ITEW12	251
20	TV	CEEW1	5
21	Refrigerator	CEEW2	14
22	AC	CEEW4	14
23	Nikon Camera	NON-SCHEDULED E WASTE	1
24	Dissolved Oxygen	NON-SCHEDULED E WASTE	1
25	Conductivity	NON-SCHEDULED E WASTE	3
26	Colorimeter	NON-SCHEDULED E WASTE	4
27	Chromato Graphy	NON-SCHEDULED E WASTE	1
28	Fan - Only Top Part	NON-SCHEDULED E WASTE	7
29	Centre Fuse	NON-SCHEDULED E WASTE	5
30	Stirrer	NON-SCHEDULED E WASTE	7
31	Furnace	NON-SCHEDULED E WASTE	3

Figure 7.1 : E-Waste Segregation at Goa University through SBSI (Swachh Bharat Student Internship) internship.

Figure 7.2 : E-Waste collection drive and segregation through SBSI (Swachh Bharat Student Internship) internship at one of the college.

CHAPTER-VIII

THE ENERGY AUDIT

The University uses both conventional and non-conventional sources of energy. The University also practice the use of energy conserving devices/units such as LED bulbs and tubes. The energy conservation practices such as minimum use of air conditioners, instructions for optimum use, etc. are adopted by the University.

Goa University has a **5 KVA hybrid** (wind and solar) power plant. The entire USIC electrical appliances (tube lights and fans) run on this power plant. In addition, the University campus has 83 solar lamps for street lighting.

The utilization of energy and the average monthly energy bill for the year 2019-2020 is 129405 units and Rs.897930.00 respectively.

The details of utilization of energy and power bill is shown in the table below.

Table No. 8.1: The table showing the details of utilization of energy and bill paid to the agency (2019-20)

Month	Units consumed	Monthly bill in Rs. Lakh
April-2019	157100	1053797.00
May-2019	132870	941174.00
June-2019	116740	835474.00
July-2019	132940	900933.00
August-2019	124070	852612.00
September-2019	116460	810640.00
October-2019	126990	895615.00
November-2019	136180	948169.00
December-2019	124360	833536.00
January-2020	129670	913172.00
February- 2020	126080	892112.00
March-2020	--	----

The daily energy saved by utilization of LED bulbs and tube lights is 46738 watts. The details are shown in the table No.8.2.

Table No. 8.2 : The energy utilization from LED

Sr. No.	Particulars	Numbers	Units	Total Watts
1	Number of LED bulbs on the campus	303	Watts	3748 watts
2	Number of LED tubes on the campus	2566	watts	42,990 watts

The energy saving by use of renewable energy, LED bulbs and tube lights and other measures has resulted in the saving of the University revenue as stated in the table.

Table No. 8.3 : The energy saving utilization from LED

Sr. No	Energy	Reduction of usage
1	Electricity	10 %
2	Generator	20 %
3	Solar	30%

Table 8.4 : The amount spends on energy such as electricity, gas, firewood, etc. in a month (Monthly)

Month	Electric meter reading	LPG Consumption	Fuel for Generator
Jun.-2016	197620	Rs.5000	Rs.50000
Jul.- 2016	220180	Rs.5000	Rs.50000
Aug.- 2016	208070	Rs.5000/-	Rs.50000
Sept.-2016	190260	Rs.5000/-	Rs.50000
Oct.-2016	208230	Rs.5000	Rs.50000

CHAPTER-IX

THE WATER AUDIT

The variables and parameters with respect to the utilization of water on the campus are number of habitants, the water storage capacity, the utilization of water for drinking purpose and the water collected from the rain water harvesting system. These different parameters are shown in the table below.

Table No.9.1: The parameters and value of Water Utilization on University campus

THE RAIN WATER HARVESTING ON UNIVERSITY CAMPUS				
Sr. No	Particulars	Quantity	unit	Total
1	Rain Water Harvesting	130 (jubilee hall) 75 (USIC) 90 (E block)	Sqm	295.00
2	Capacity of Boys Hostel	168 (PG Hostel) 28 (Phd Hostel)	nos	196.00
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4	Total number of Canteens on campus	07	nos	07.00
5	Total seating capacity of Canteens	Faculty Canteen – 92 E Block – 32 F Block – 36 Guest House – 36 Int Guest House – 24 Men's Hostel – 96 Women's Hostel - 108	nos	424.00
6	Monthly use of drinking water on campus	75.00 lakhs litres	litres	75.00 lakhs
7	Number of habitants staying in the quarters* and Guest House#	A type - 27 B type - 87 C Type - 36 D Type - 36 TA type – 33 St Cruz Flats - 24 GH – 46 rooms IGH – 26 rooms	nos	243.00
9	Total capacity of the underground and ground water tanks	12.50 lakhs litres	litres	12.50 lakhs
10	Average water consumption per capita	135	liters	-

There are 3000 students coming on campus every day. The University is providing the residential facility to approximately 900 residents. By assuming average per capita consumption of water as 90 liters per head per day, the daily water required on campus for the residential staff and student is (900X90) 81,000.00 liters. The monthly requirement for the residential campus goes up to 24.30 lakh liters and the

water consumed by the visitors and student per month goes up to 4.62 Lakh liters [(3000-900) x10lx22days].

The monthly water requirement on campus is 28.92 lakhs per year.

The water collection from the rain water harvesting system is used for the watering of plants. The amount of water collection from the rain water harvesting is,

2. 9Mx295Sq.M.x120days= 102660 M3 i.e. 1026.60 lakh liters.

The ground water level is recharged through the surface run off of 30000 square meters and recharge the structure that constitutes six operational bore wells with combined capacity of 75000 cubic meters of ground water every year. From the official records, the average surface run of collected per day is about 300 cubic meters. The ratio calculated for recharge to run off collection is 250/300 square meters by considering the loss due to seepage, evapotranspiration and other factors.

CHAPTER-X

THE CARBON AUDIT

Global warming, enhanced by carbon emissions, is a major threat to the World. Trees play a key role in carbon sequestration and act as carbon sinks. There is an awareness towards understanding their role in urban areas. The Higher Educational Institutes in rural areas with urban character such as Goa University shall play a prominent role by setting an example. As there are several documented benefits of biotic carbon sequestration, Goa University carefully nurtured the greenery in the campus. In spite of area being hard lateritic rocks, efforts have been made to convert this savannah type habitat into a wonderful oasis without changing the unique habitat rich in herbaceous endemics.

It is observed from the research work carried out at University, all the trees (except the ones in the residential areas of the campus) with ≥ 30 cm GBH have been measured and documented. The parameters such as GBH and height of the trees have been measured in the field and above ground biomass (AGB) and below ground biomass (BGB), total biomass and sequestered carbon have been worked out. For each individual using allometric analysis based on the models developed by Brown et al (1989) for AGB, MacDicken (1997) for BGB, using average wood density value from Warran and Patwardhan (2001). For Carbon sequestration formula of Ravindranath et al (1997) has been used.

Table 10.1: Biomass and Carbon sequestration potential of trees (with ≥ 30 cm GBH) in Goa University Campus (Jaydeep, 2014. MSc dissertation)

S.No.	Particulars	Quantity
1	Number of tree species with ≥ 30 cm GBH (excluding several species planted and which are < 30 cm GBH)	55
2	Number of individuals with ≥ 30 cm GBH	1826
3	Total biomass	263076 kg
4	Carbon sequestration potential	121014 kg
5	Carbon sequestration potential of GU campus	699.5 kg/ha

Table 10.2: Number of vehicles and their fuel consumption at different Buildings. (Provide building wise and department wise data)

Sr. No.	Vehicle	Four wheelers	Two wheelers	Total fuel liters/month	Total fuel liters/year
1	No. of vehicles	08	02	640 liters	7680 liters

2	Average liters of fuel/ month	580 liters	60 lit		
3	Maximum	700 liters	65 liters		
4	Minimum	500 liters	55 iters		

Table 10.3: Total number of vehicles on campus and their fuel consumption

Sr. No	Name of Building	No. of four-wheeler vehicles	No. of two-wheeler vehicles	Average fuel used by four-wheeler/ month	Average fuel used by two wheelers/month	Total fuel used lit/month	Total fuel used lit/year
1	EA & AS	06	01	410 liters	35 liters	445	5340
2	Administration	01	01	100 liters	25 liters	125	1500
3	Controller of Exam	01	Nil	70 liters	Nil	70	840