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 $Green \ Audit \ Report \ for \ Delhi \ College \ of \ Arts \ & \ Commerce \ (DCAC)$

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CHAPTER 1 INTRODUCTION & PREAMBLE



1.1 Introduction

Green Audit is the most efficient and ecological way to assess& monitor environmental performance and helps to create awareness & sensitize faculty, staff &students on environmental & sustainability issues.

The ICC defines Green/ Environmental Auditing as: "A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects."

A Green Campus is a place where environmental friendly practices and education combine to promote sustainability in the campus which ultimately offers an institution the opportunity to take the lead in redefining its environmental culture and developing new paradigms by creating sustainable solutions to environmental and economic needs by minimizing wasteful inefficiencies, conserving resources, encourage use of Renewable sources of energy, safe waste disposal, purchase of environment-friendly supplies and effective recycling program.

A large green cover and open spaces with a Plastic & Tobacco free policy in place encourage healthy living besides promoting an eco-friendly environment.

The greening of campus can be defined as the process of reducing the multitude of on- and off-site environmental impacts resulting from campus decisions and activities, as well as raising environmental awareness within the human communities of a college or university(Creighton, 1999).

A Green campus management programme with auditing at regular intervals & through continual improvement of green practices can open the pathway to obtain a prestigious Green rating & /or accreditations to either IGBC or GRIHA rating system, both of which are reputed National benchmark standards of excellence in this field & well recognised at the Global level

The rating systems are generally based on accepted energy and environmental principles and will seek to strike a balance between established practices and emerging concepts, both national and international.

The observation & recommendation of this report will help to motivate the Apex management of DCAC to focus on achieving this higher level of excellence in a time-bound schedule& enhance their corporate image & recognition amongst peers

1.2 Preamble

Delhi College of Arts and Commerce (DCAC), a premier institution of higher learning, is a constituent college of the Delhi University, financed partially by the Govt. of NCT, Delhi. The College was established in 1987 under the aegis of the Delhi Administration once the erstwhile G.D. Salwan College closed its operation. Though it is now an entity independent of the Salwan Trust, yet in its formative years, it transformed out of the erstwhile G.D. Salwan College that was located in Rajinder Nagar.



The college offers 18 undergraduate courses leading to the Bachelor with Honours/Programme Degree with various paper options for students to choose from both under the CBCS mode and the erstwhile semester/ FYUP mode. The college also offers various add-on and self-financed courses. It was also the pioneer college in Delhi University to introduce a three-year Honors Programme in Journalism in July-August 1989.

The college has also been making various efforts and initiatives to integrate cross-cutting issues as gender, climate change, environmental education, human rights, ICT, etc. through various cells, societies and community outreach programmes.

Indohaan Technologies Pvt Ltd offers comprehensive Health, Safety, Environmental and Risk management consultancy services for commercial buildings, manufacturing units, large industrial plants, educational institutions and office premises. Our key services include consulting and training in:

- Process /Personal and Fire Safety
- Risk Analysis
- Process Hazard Analysis
- Occupational Health
- Energy and Environment
- Sustainability

1.3 Methodology Adopted

To achieve the objectives stated in para1.1 above, a Physical inspection of the campus was carried out along with gathering of relevant data & current practices through interviews with responsible persons nominated by the Principal.

The Audit findings have been recorded in this report under the following heads, which are generally in line with concepts laid in the Green rating system.

- > Green policies, awareness & education
- Site planning & Green cover
- Water Management
- > Waste Management
- Health & Well-being

1.4 Study Team

Following team members visited the College premises on 9th January 2023 for a Walk through survey and data collection:

- Ms. Deepika Soorma
- Mr. Ashok Grover



CHAPTER 2

AUDIT OBSERVATIONS



2.1 Green Policy, Awareness & Education

While a formal Green policy is under finalization, the College management, faculty & students are committed to create, maintain & sustain a Green campus & promote Environment-friendly practices through collaborative efforts.

The College has dedicated faculty members for delivering prescribed curriculum relating to Environmental subjects & for providing their domain expertise in guiding the ongoing awareness efforts.

There is an Eco-club called *Prakriti*, which was established in year 2009 and takes a lead in the environmental activities of the college & organizes various awareness campaigns, nature walks and programs in the college campus and surrounding areas. In the past the walks have been led and directed by renowned bird watcher Mr. Ranjit Lal and Dr. Bharati Jagannathan of Miranda House.

The club has a visible presence on the Social media platform as noted below with an impressive following with regular contributions by student members on concurrent issues & regular news updates are posted on current happenings at the National & International forums.

https://www.facebook.com/Prakritidcac

https://www.instagram.com/prakriti_dcac/?hl=en

The Instagram tagline "*Prakriti mein khonaa darasal paana hai*! brings out the true spirit of nature conservation & the eco-system at large & inspires the students to actively participate & contribute in protection and sustenance for the environment

Some of the noteworthy projects of the *Prakriti -Eco-club* as well as related events organized by **National Service Scheme (NSS)** & the Green Committee are listed below & also beautifully captured in the photos appended in Annexure -1

- An online gaming competition "Play4Eco "on Environment awareness was successfully conducted in February 2022 which garnered a tremendous responses and the participants showed a high level of excitement and gaming spirit.
- A cleanliness drive was organized in November 2021 along with "There Is No Planet B" at the 'Green Lungs of Delhi' supported by brilliant Earth warriors from not just *Prakriti* but also many other students of the college.

31 KG plastic, 75 KG non-plastics was collected plus immeasurable happiness and satisfaction of contributing to the cleanliness of the Ridge Forest.



- Poster-cum-slogan making competition organized in October 2021 on International Day of Climate Action. The theme of the competition was to bring out creative and innovative ideas to protect the Mother Earth from the exhaustive problems of use of plastic and ozone depletion.
- Green Railings' an initiative of *Prakriti* recycles PET bottles from the waste generated in the college canteen for decorative purposes. They also produced mini-plant pots that could be hung on the college railings to augment the college green cover
- > The college recycles waste paper efficiently through an initiative taken by *Prakarti*.
- Under the campaign 'Each One! Plant One! Protect One!' *Prakriti* encourages stakeholders in the college to sow seeds in an effort to make the campus green. The seeds include vegetables like Okra, Tomato, Chilli, Eggplant, Spinach etc.
- > The NSS wing of the college frequently carries out 'Clean and Green Drive' in the campus.
- Green committee- A five-member "Green committee "has been constituted in January 2023 which will look after the overall environmental sustainability aspect of the campus, such as the waste management, greenery of the campus, optimal utilization of water and carbon footprint and green library.
- The Department of Environmental Studies & the Green Committee in association with Prakirti organized a webinar on "Life on Earth: An Outcome of Interactions and its evolution" with Dr. Pratap Srivastava University of Allahabad as the guest speaker

Green facilities available at the campus & the worthy practices adopted as observed during the walkthrough survey are presented in the following sections

2.2 Site planning, Green cover

DCAC has a campus area of approximately 5 acres (= 20234 m2) with a built-up area of around 2.5 acres.

We have also mapped the entire Campus & the covered area on Google map (Figure 1) for an approximate reconfirmation of the plot area





Figure 1 Plot area mapped on Google map for visual clarity

Further based on the review of the layout map of the campus, visual assessment & Tree canopy calculations, the Green cover has been estimated as shown in Table 1 below

Table 1	Green	Cover	area
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Species	Approximate Area (m2) (Derived from layout drawing, Visual assessment & Tree canopy calculations*)	% Coverage of Total campus area of 20234 m2
Tree canopy	1100	5.4 %
Under Shrub	700	3.5 %
Lawn /Grass	3500	17.3 %
Total	5300	26.2%
*Canopy area of approx.155 Trees		Rounded off to
@ 3mtr average shade diameter =1096 m2		1100 m2

The Lawn /green cover meets the requirement specified in the Appraisal guideline 7.1.3 of GRIHA (acronym for Green rating for integrated habitat assessment) for minimising lawn area and restricting the same to 25% of the total area for water conservation





Figure 2 Green lawn in the Football field

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to about 22 kgs of carbon dioxide from the atmosphere, and release it as oxygen.

Moreover, the grown-up trees have a Zero Plant factor for in the computational methodology used for calculating irrigation Water requirement

In summary, while the campus inhabitants are busy in academic pursuits, all the Grown up trees especially the native species are also working hard to make the air cleaner for us, while consuming much less or zero water than other species.

The trees & the overall greenery in the campus provide good & soothing visual impact, which also helps to enhance mental health & well-being. See Figure 3 depicts a glimpse of greenery in the campus

A partial listing of trees & other plant species with their Botanical names is presented in Figure 4

The college also has a 'Herb Garden' and a 'Garden of Hope' where samples of our country's flora are planted in an attempt to conserve them.



In addition, the college also has over 800 potted plants placed at different locations. Some of the potted plants *include Jasmine, Harshingar, Aloe vera, Bougainvillea, Pansies, Croton, marigolds, Euphorbia* and different varieties of lilies, palms, roses, ficus, cactus etc. See Figure 5

Due to the high plant diversity, the college attracts a lot of birds such as babblers, sparrows, pigeons, red-vented bulbuls, etc.

Figure 3 Campus Greenery





Common Nati	ne	Botanical Name		. And the	1 Alle	de la	1	The second
Neem	13 nos	Azadirachta indica		Sec. 1	and the state		1	
Peepal	4 nos	Ficus religiosa	CONTRACTOR OF A		Sector Distances		100 C 100 M	100
Amaltas	20 nos	Cassia fistula	No.				Part of the State	
Babool	3 nos	Acacia nilotica		1 B U	C N ROT	10 A A A A A A A A A A A A A A A A A A A	Service Anna	
Kanak Champa	3 nos	Pterospermum acerifolium		A 17 2 1		ting a line	and the second	
Ashok	24 nos	Polyalthia longifolia	-		With She the	22 - B		1
Bottle paim	11 nos	Hyophorbe lagenicaulis			A CALL OF	16 N - 18	A DECK	
Als services a			1.4	All states	San Ash	1.00	CTR STOR	prob
Sheesham	9 nos	Dalbergia sissoo	ALC: NO	100		(B)	ALL .	-
Shatoot	3 nos	Morus alba	125				and the	1
Guava	2 nos	Psidium guajava	1.1.		19	12. S. 11.	100 - 20	983
Kaner	8 nos	Nerium indicum	-	a gent	AND A DAY	- 4	and the second	100
Lasoda	9 nos	Cordia myxa				1 A 10	ALC: NO.	Sec.
Arjun	3 nos	Terminalia arjuna	1	3 3 1	Electric Contraction	10 March 10	and the second	Sec
				1	Service of the servic		Statement of the local division of the local	12.1
Bargad	1 no	Ficus bengalensis		1 5560 10	1-43	8.2	Contraction of the	-
Goolar	3 nos	Ficus racemose			Sec. 1		Contract of the	
Sebal	8 nos	Bombax Ceiba						
Aam	4 nos	Mangifera indica		Contraction of the local division of the loc	The second s		111	
Kadi patta	4 nos	Murraya koenigii		Street, Square, Square	and the owner of the	A COLUMN	1000	
Gulmohar	1 no	Delonix regia		And and a second second	The second se	and the second s	Statement of	-
Areca palm	5 nos	Areca catechu		Statement of the local division in which the local division in the	and the second division of the second divisio		Statement of the local division in which the local division in which the local division is not the local division in which the local division is not the local division in which the local division is not the local division in which the local division is not the local division in which the local division is not the local division in which the local division is not the local division in which the local division is not the local division is not the local division in which t	
Amla	2 nos	Phyllanthus emblica			Statement of the	and the second second		
Sagwan	2 nos	Tectona grandis		the sub-	Concession of the local division of the loca	-	Contraction of the local division of the loc	
Jamun	2 nos	Syzygium jambolana				ALC: NOT	and the second value of th	
Pilkhan	2 nos	Ficus virens		- A -			and the second se	

Common Name	Botanical Name	
Morpankhi	Thuja orientalis	1
HarShringar	NyCtanthesarbor	ié.
Chandani	Tabernaemontana divaricate	2
Chinese orange	Citrus microcarpa	÷.
Gudhal	Hibiscus rosa-sinensis	9
Weeping fig	Ficus benjamina	1
Guidavari	Chrysanthemum morifolium	2
Croton	Codiaeum variegatum	
Marigoid	Tagetes	1
Geranium	Bauhinia pururea	
Lilium	Liliummacklinine	
Genda	Calendula officianiisTageteserecta	2
Aloe Vera	Aloe vera	
Gulab	Rosa indica	
Enermy	Clerodendrumphlomials	1
Murraya	Murrayapaniculta	2
BuganBel	Bougainviilea spectabilis	a

Shrubs, Ornamental & potted plants

Figure 4 List of Trees (above) & Shrubs, Ornamental & potted plants (below)



The entire greenery is managed efficiently with conventional hose piping using Bore well water. The use of multi-point sprinklers & flooding techniques are recommended to improve irrigation efficiency & promote water conservation.

Figure 5 Shrubs & potted plants





2.3 Water management

Water auditing is conducted for the evaluation of facilities of Raw water intake & its efficient treatment, distribution, consumption & effective utilization and for determining the facilities for wastewater treatment and reuse.

The Water supply service from the Municipal Corporation is regular & moreover, the water table in the campus area also appears to be sufficiently high & therefore the College is adequately resourceful in this aspect

Table 2 below provides a listing of Water source, consumption as per Water bills & details of the already available capacities of the Storage Tank for each service involved under Water management Table 2 Listing of Water source, Consumption & Storage capacities

Description	Consumption/ capacity	
1) Water consumption & Source 20 KL per day		
a) 2 Running Bore well		
b) Supply from Municipal Corporation		
c) Rain Water Harvesting		
2) Storage 300 KL Total		
3) Sewage Tank		

Rain water harvesting: The campus has an effective Rain harvesting water system at 2 locations along with an adequate storage facility to collect & use the same in subsequent non-rainy days. See Figure 6

2.3.1 Baseline calculations

An attempt has been made to work out Baseline calculations for Water consumption based on the National benchmark set forth on per capita basis (for domestic/flushing use) & on the basis of species-wise population of various Trees /plants (for irrigation).

The campus population is tabulated below for the said calculation that follow in the next pages

Table 3 Campus Population

Category	Details		
	Students	Male	1606
		Female	844
Total Population category wise	Faculty	Male	62
		Female	48
	Non toophing staff	Male	10
	Non-teaching staff	Female	55
	Visitors		20 per day





Figure 6 Rain water harvesting facility (Top) & Collection Tank (below)



a) Consumption for Domestic use

Domestic water demand is calculated based on a per capita requirement of 45 litres per day per person for Academic institutions as specified in Indian Standard IS 1172 and tabulated in Table 4.



Table 4 Per Capita consumption of Domestic Water

Total Campus strength considering 85% student attendance	2251
Therefore per day consumption (Kilo Litres), which is met by 300 KL storage capacity	94.5 KL

b) Consumption for Flushing water based on Fixtures used & Full /Part time occupancy

Based on appraisal guideline 7.1.2 of GRIHA Manual for existing buildings & catalogue details for existing Plumbing Fixtures, consumption for Flushing has been estimated for use by the full /part time occupants as shown in Tables 5 & 6 below.

Occupants	Female	Male	Part time occupancy with 85% attendance			
			Female	Male		
Faculty	48	62	41	53		
Students	844	1606	717	1365		
Tech & Admn staff	10	55	9	47		
Visitors -~ 20 per day	5	15	5	15		
Total strength	907	1738	772	1480		

Table 5 Full time /Part time Occupancy Table*

* Full time occupancy is taken as Zero since there is no hostel or staff quarters

Table 6 Calculated consumption based on use of installed Fixtures

		Flow rate		Daily use					2
Fixture	Model used	in Litres	Duration					Calculated consumption	
		per flush		Full time		Part time			
Tixture		(LPF)		equivalent		occupant			
		Also see E	No of	Female	Male	Female	Male	Female	Male
		below	Flush						
Urinal -Gents	Metropole	6	1		2		0.4		3551
Water Closet- Gents	Flush valve 40 mm				1		0.1		888
Water Closet- Ladies & differently abled				1		0.5		2315	
		in Litres							12.2
		per							
		minute	in						
		(LPM)	Seconds						
Faucet /Taps -Gents	Jaguar				4		0.5		3092
	make	16.72	15						
	PRS-CHR-	10.72	15					1613	
Faucet /Taps -Ladies	031			4		0.5			
						Sub Total ir	n Litres	3928	7531
						Grand Tota	al in KL	-	L1



c) Consumption of Irrigation Water

Based on appraisal guideline 7.1.4 of GRIHA Manual for existing building &other references as cited in Table 7 below, estimates for Irrigation water requirement (LPD) has been worked out for various Plant species of the campus.

Species	Approx. Area m2	Plant factor	Evapo- transpiration rate (mm/day) for New Delhi	Irrigation efficiency	Water requirement In Litres per day (LPD)= Plant factor * Evapotranspiration <u>rate × Canopy area *1000</u> Irrigation system efficiency				
Tree*	1100	0*	3.88	0.5	0*				
Shrub	700	0.4	3.88	0.75	1,450				
Lawn	3500	1	3.88	0.75	18,107				
	Total				19,557				
					ie 19.6 KL				

Table 7 Calculation of Irrigation Water Requirement

*Trees need very little or no supplemental water & hence Plant factor is taken as Zero for LPD calculations & therefore it is encouraged to plant more trees specially the Xerophyte & Native variety

As with other services, demand for irrigation is also met directly with Municipal supply through the Rainwater harvesting Tank of matching capacity.

From the foregoing it appears that Water intake as well as the distribution and consumption pattern is under control & accordingly the overall Water balance as shown in Figure 7 indicates the supply and demand side of the water is in order.

However, the opportunity exists for better Water conservation, management & control by implementing the recommended action points listed under Chapter 3 of this report



Figure 7 Supply & Demand Flow chart



2.4 Waste Management

- a) E-Waste An e-waste collection and awareness drive was carried out by Prakriti in association with Chintan Environmental Research and Action Group. It collected 20 kgs of e-waste. There is a designated e-waste basket for environment-friendly disposal of ewaste.
- b) Solid waste management Separate colored dustbins are stationed at designated locations etc. so that the segregation of solid waste into dry and wet categories is ensured at the time of individual members.

The garden waste is composted and converted into manure which is used in the gardens. The non-biodegradable plastic waste is used by the students of the Eco-club and the leftover is disposed off through the *Kabadiwala*.

c) **Waste Paper Recycling** - There is a paper recycling unit in the college that recycles the paper waste generated in the college campus

d) **Hazardous Waste**: As DCAC is not a science college no significant hazardous waste is produced

2.5 Transportation & Carbon footprint

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to the burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions

In addition to the water, waste, energy and biodiversity audits, carbon footprint can also be determined based on the amount of carbon emissions created.

One pertinent aspect is to consider the distance and method travelled between home and college every day. It undertakes the measure of the bulk of carbon dioxide equivalents exhaled by the organization through which the carbon accounting is done. It is necessary to know how much the organization is contributing towards sustainable development& is therefore essential that any environmentally responsible institution examine its carbon footprint.

This topic is left open and could be taken up in a future study with more data.

2.6 Green Practices in Education

Contemporary subjects, which are very much relevant to imparting education on Green practices are offered by the college in various semesters under General Elective (GE), Value addition course (VAC) and Skill enhancement course(SEC), such as:

- Green technologies
- Prospecting E-Waste for Sustainability
- Developing Sustainability Plans for A Business
- Swatch Bharat
- Environmental Auditing



CHAPTER 3

RECOMMENDATIONS



3.1 Recommendations based on Audit findings

Based on the foregoing observations, we suggest following action points in the short, mid & long-term perspectives in order to move toward greater environmental sustainability & achieve good ratings under the GRIHA rating system for enhanced corporate, academic & social responsibility image among peers.

The recommendations have been grouped under the following categories so that delegation & /or assignment of responsibilities to the concerned team for implementation is clearly identifiable with respect to each focus area

- A) Related to Policymaking
- B) Related to Water management
- C) Related to the well-being of occupants

A) Policy making

i. In order to streamline the ongoing good practices & to provide a more dedicated focus & direction for the continuation of the collaborative effort, it is imperative that the <u>Green /environment policy</u> must be finalized, issued & displayed prominently on the Campus and also posted on the website at the earliest possible opportunity.

B) Related to Water Management

The following measures are suggested to improve the efficiency of the existing Water management system by adopting efficient fixtures and by systematic monitoring of the consumption pattern at suitable points on the supply as well as on the demand side.

- i. Automatic Sensor Taps /Faucets are recommended to be installed in all the Washrooms /Toilets of the college so as to minimize wasteful use of water. These fixtures work on the principle of timing & distance & therefore they also provide a very safe, hygienic contactless way of use
- ii. Low Flow Fixtures: The Flushing water consumption can be optimized from the baseline calculations shown in 2.3.1 (b) by <u>using low flow fixtures</u> as per Makes/ models suggested below
 - Metropole makes Flush valve 40 mm in size with a flow of 3 LPF (Liters per flush)



- Faucet /Tap with the flow of 6 LPM (Liters per minute)
- Faucets/ Taps with Automatic switch off after 10-12 sec
- *iii.* **Garden Sprinklers:** The use of Multi –point sprinklers & flooding techniques are recommended to improve irrigation efficiency & help in Water conservation
- *iv.* **Installation of Water meters**: Water Meters are like scientific mirrors to show the exact water consumption at each service or point of operation. The help to quantify correct use & identify any misuse or unnecessary wastages.

It is recommended to install Water meters at an accessible location on the Supply side (Municipal & Bore well) & on the Demand side (Flushing & Domestic). The Water diagram shown in Fig 7 can be updated to indicate Water meter location & regular monitoring can help to understand the usage pattern more closely complying with the principle of "What gets measured gets managed"

- v. Leak detection: Regular inspection of Water Tanks & connected piping is recommended to identify if any water is leaking through the threaded/ bolted joint &/or through likely pin holes on rusted pipes
- vi. Sewage Water Treatment/ Recycling,

Currently, there is no recycling of Wastewater and neither there is any provision for the treatment of Sewage. It is recommended to install a facility for sewage treatment /recycle facility so that the treated wastewater can be reused for flushing and irrigation & thereby helping in Water conservation

C) Related to well-being of occupants

Consider implementation of following good practices to ensure the well-being of occupants of the campus

- i. **Indoor plants** are commonly used for their aesthetic benefits but they also have a vital role in reducing airborne Pollution. The right choice of plants can be an excellent way of improving indoor air quality and general health. Local landscape contractor may be deployed for the supply and rotation of these plants.
- *Water quality testing*: Testing of incoming water supply at least on quarterly basis is a good practice & recommended for the well-being of the campus occupants.





Annexure 1:

Events in pictures – organised by Prakriti-The Eco club, NSS & the Green committee

Figure 8 Announcement -Play 4 Eco- online gaming



Presents our winning players

Crossword: Veeresh Pratap Singh Word Search: Srishti Gupta Skribbl/Word Search: Harshit Sehrawat

Many many congratulations!







Figure 9 Cleanliness drive at the Ridge Forest







Figure 10-Winning entries- Poster competition



Figure 11 – Cleanliness drive by NSS





Figure 12- Webinar organised by Dept. of Environmental studies & Green committee



Department of Environmental Studies and Green Committee in association Prakriti and IQAC, Delhi College of Arts & Commerce (University of Delhi)



webinar

On the Topic Life on Earth: an outcome of interactions and its evolution

Resource Persons:



Dr. Pratap Srivastava, Department of Botany, University of Allahabad, Prayagraj

Patron Prof. Rajiv Chopra, Principal Dr. Srikant Pandey, Convener, IQAC Pyarimohan Maharana

Department of Environmental Studies Rahul Bhadouria

Date and Time: 21 January, 2023; 12.00 noon **Online platform:** Google meet

Green Committee Dr. Rahul Bhadouria (Environmental Studies) Dr. Pyarimohan Maharana (Environmental Studies) Ms. Poonam Rani (Library) Dr. Neha Jingala (Journalism) Dr. Mamta Kumari (Computer Science)

