

DETERMINANTS OF SLEEP QUALITY AMONG FEMALE UNIVERSITY STUDENTS IN HOSTEL SETTINGS: A CROSS-SECTIONAL STUDY

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CANDIDATE'S DECLARATION

I POONAM KUMARI hereby certify that the work which is being presented in the thesis entitled Determinants of sleep quality among female university students in hostel settings : A cross- sectional study in partial fulfillment of the requirements for the award of the Degree of Master of Technology, submitted in the Department of Environmental Sciences & Engineering, Delhi Technological University is an authentic record of my own work carried out during the period from Aug-2024 to May-2026 under the supervision of Dr. Rajeev Kumar Mishra.

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CERTIFICATE

Certified that **Poonam Kumari** (24/ENE/10) has carried out their research work presented in this thesis entitled “**Determinants of sleep quality among female university students in hostel settings: A cross- sectional study**” for the award of Master of Technology from Department of Environmental Science & Engineering, Delhi Technological University, Delhi, under my supervision. The thesis embodies results of original work, and studies are carried out by the student herself and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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ABSTRACT

Sleep quality plays a significant role in influencing physical health, mental well-being, and academic performance among university students. Transitioning into hostel life during university years exposes students to various environmental and lifestyle factors, such as reduced physical activity, academic stress, and altered dietary habits, all of which contribute to poor sleep quality. However, the role of accommodation-related factors such as air-conditioned (AC) versus non-air-conditioned (Non-AC) rooms, ventilation, thermal comfort, occupancy type, and available personal space remains largely unexplored.

A cross-sectional study was conducted among 271 female students aged 17 to 35 years residing in different hostel settings at Delhi Technological University. Data were collected using a structured questionnaire incorporating components of the Pittsburgh Sleep Quality Index (PSQI) to assess the prevalence of poor sleep quality and identify its key determinants. The findings revealed that 88.2% of students experienced poor sleep quality (PSQI > 5). Factors such as high stress levels, caffeine consumption, irregular sleep–wake patterns, poor self-rated health, and type of residence were found to negatively influence sleep quality.

Notably, poor sleep quality was more prevalent among students residing in Non-AC hostels, primarily due to environmental disturbances such as noise, poor ventilation, and thermal discomfort, resulting in higher PSQI scores compared to those living in AC hostels. With respect to lifestyle factors, 15.1% of students reported frequent use of eye masks while sleeping, 46.5% engaged in physical activity less than two days per week, and 17.2% reported regular caffeine consumption after 5 PM. However, caffeine intake and eye mask usage showed a relatively weaker association with sleep quality compared to environmental conditions and physical activity levels.

Overall, the findings highlight that female students residing in hostels are at considerable risk of poor sleep quality, primarily due to environmental factors such as thermal discomfort in Non-AC hostels, inadequate ventilation, and external disturbances.

Keywords: AC vs Non-AC, Female Students, Hostel Environment, Physical Activity, PSQI, Sleep Quality, Thermal Comfort, Ventilation.

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List of Symbols, Abbreviations and Nomenclature

S.No.	Abbreviation	Description
1.	AC	Air Conditioner
2.	DTU	Delhi Technological University
3.	NON- AC	Non-Air Conditioner
4.	PSQI	Pittsburgh Sleep Quality Index
5.	SNH	Sister Nivedita Hostel
6.	VLB	Virangana Lakshmi Bai (Hostel)

S.No.	Symbols	Description
1.	β_0	Base line of PSQI
2.	β_1 to β_7	Regression Coefficient
3.	C_1	Subjective Sleep Quality
4.	C_2	Sleep Latency
5.	C_3	Sleep Duration
6.	C_4	Habitual Sleep Efficiency
7.	C_5	Sleep Disturbance
8.	C_6	Use of Sleeping Medication / Aids
9.	C_7	Daytime Dysfunction
10.	ϵ	Error

CHAPTER 1

INTRODUCTION

Indoor air quality is a vital concern especially in the residential areas, as well as educational hub areas like universities, boarding school and hostels where young adults are pursuing their higher level education. the students spend their day breathing the air which may be harmful for their health. The environment affects their academic and social schedules, by poor sleep quality. Hence, it is very important to highlight the needs for improving air quality rather than relying on just natural ventilation like old days. The Sleep is a basic biological function that is crucial to physical health, cognitive function and emotional well-being. Good sleep is essential for learning, memory and academic achievement in university students but many students have altered their sleep habits when they go to college, especially if they live in a dormitory and the environment, their lifestyle, and their studies have a significant impact on their sleep. The psychological stress, physiological conditions and social factors make the female students to be more vulnerable to sleep disturbances especially. Hostel life presents unique challenges that can have a major impact on the quality of sleep. Shared rooms, noise and disruption of the environment, restricted personal space, and erratic daily schedules can disrupt sleep continuity and length. As well as the above mentioned factors which are normally studied, environmental factors like ventilation, thermal comfort and type of the accommodation (AC or Non-AC hostel) also have a significant impact on sleep quality. However, these factors are relatively under explored and especially in the context of Indian Universities. The current study is conducted among the female students staying in hostel at Delhi Technological University with the objective to study the determinants of sleep quality with particular concern towards the environment (thermal comfort, ventilation, accommodation type) and lifestyle/psychological factors.

1.1 Background of the Study

The quality of sleep has emerged as a research priority, because sleep is directly related to health, productivity and quality of life. As a University student, it is easy to fall into the habit of having an irregular sleep schedule. Academic assignments, social events, and evening snacking and staying up late on screens and caffeine can all be contributing factors. These are all factors that interfere with a person's sleep and cause poor sleep. Over the past few years, there has been an increasing understanding of how environmental factors influence sleep. Thermal comfort, which is in satisfaction with the surrounding thermal environment, has been recognized as one of the important factors affecting sleep. The students who live in Non-AC hostel may be exposed to high temperatures and lack of ventilation and discomfort, especially during warm seasons. These can contribute to problems with getting to sleep or staying asleep and lower the quality of sleep. On the other hand, it is a fact that temperature controlled through AC can be beneficial for better sleep.

1.2 Problem Statement

Although there is growing awareness about sleep problems among college students, many female hostel dwellers still have poor sleep quality. Previous studies have concentrated on behavioural and psychological factors but research on accommodation-related factors (AC/Non-AC living conditions, ventilation and thermal comfort) is limited. This is especially so in the Indian context, where the hostel facilities are inconsistent, and the environment can have a major effect on the students' health. Therefore, there is a need to systematically investigate how environmental conditions, in combination with lifestyle and psychological factors, influence sleep quality among female university students residing in hostels.

1.3 Objectives of the study

The main objective of this research is to investigate the relationship between environmental conditions and sleep quality among university hostel students. Sleep is an essential part of human health and plays a major role in physical well-being, mental health, academic performance, concentration, and daily functioning. However, many students living in hostels experience poor sleep quality due to several environmental and lifestyle-related factors. Therefore, this study aims to identify and analyze the environmental determinants that influence students' sleep quality in hostel buildings. Another important objective of the research is to assess the sleep quality of students using the Pittsburgh Sleep Quality Index (PSQI), a standardized questionnaire widely used for evaluating sleep patterns and sleep-related problems. Through the PSQI analysis, the study intends to identify the prevalence of poor sleep quality among hostel students and examine its association with indoor environmental conditions. Additionally, the research seeks to understand students' perceptions and experiences regarding their hostel environment. By collecting questionnaire-based responses from students, the study attempts to identify common environmental complaints such as stuffy air, excessive heat, poor ventilation, noise disturbance, and discomfort during sleeping hours. Understanding these perceptions can help in developing strategies for healthier and more comfortable hostel living conditions.

The study also aims to compare thermal comfort and sleep quality between air-conditioned (AC) and non-air-conditioned (non-AC) hostel buildings. This comparison will help determine whether different thermal environments influence students' comfort, sleep satisfaction, and overall well-being. Since students spend a significant amount of time inside hostel rooms, maintaining a healthy indoor environment is important for improving their academic performance and quality of life. The broader objective of the study is to contribute to the field of indoor environmental quality and sustainable hostel design by providing evidence-based findings related to sleep quality and environmental comfort. The results of this research may help architects, planners, hostel administrators, and policymakers improve hostel infrastructure and indoor environmental conditions for students. Improved indoor environments can promote better sleep, better health, increased productivity, and enhanced academic performance among university students.

The overall objectives of the study is

- I. To analyze the quality of sleep in Ac and Non-Ac hostels using the Pittsburgh Sleep Quality Index.
- II. To identify the key factors that influence the sleep pattern in Ac and Non-Ac hostels.
- III. To evaluate different conditions and examine the evidence-based findings.

1.4 Significance of the Study

The present study is related to the under-researched aspects of the effects of environmental factors on sleep quality. The study can be used to provide new insights on the role of hostel infrastructure on student's well-being, with the variables such as thermal comfort, ventilation, type of accommodation etc. The outcome of the study is relevant and applicable in the University administration and policy makers because it indicated a need for the betterment of the hostels to provide better sleep and healthiness to the students. Furthermore, the study adds to the academic literature by combining the behavioral, psychological and environmental approach to provide a comprehensive understanding of sleep quality of the female university student.

1.5 Scope of the Study

The study is limited to female students residing in hostel facilities at Delhi Technological University. It focuses on assessing sleep quality using the Pittsburgh Sleep Quality Index (PSQI) and examining its association with selected lifestyle, psychological, and environmental factors. The study considers variables such as stress, caffeine consumption, physical activity, sleep patterns, thermal comfort, ventilation, and accommodation type. However, it does not include male students or non-hostel residents, and therefore the findings may not be generalized to all student populations.

CHAPTER 2

LITERATURE REVIEW

Sleep quality in university students has been recognized as an important factor for physical health, cognitive functioning and psychological well-being. In recent decades, researchers have been interested in determining the multiple factors that impact sleep in student populations. These can be grouped into behavioural, psychological and environmental determinants. Researchers have been able to compare sleep quality across different populations with the use of standardized instruments like the Pittsburgh Sleep Quality Index (PSQI) created by [Daniel J. Buysse et al. \(1989\)](#).

2.1 Sleep Quality Among University Students

There is a large body of literature that shows that poor sleep quality is very common among University students. Multiple studies across different countries have shown that more than half of students are not getting adequate or good sleep. According to Kaur (2018) a significant proportion of Indian students are sleep deprived and it is attributed to erratic sleep patterns and lifestyle. Similarly, [Amjad and Younas \(2020\)](#) found that University students are frequently experiencing sleep issues, which negatively affect their performance and functioning. This is not a unique situation, as evidenced by the findings in this study, sleep issues are more common amongst students. The transition from home to hostel makes it more difficult to sleep as well. Students can have trouble adjusting to new places, new schoolwork and new expectations, and new friends, all of which may impact sleep. Hostels lack a fixed schedule, giving residents greater freedom, which can disrupt their sleep-wake cycles and lead to poor sleep quality.

2.2 Psychological Determinants of Sleep Quality

Stress, anxiety and depression are defined as psychological stressors and were cited as an important cause of sleep problems in University students. Academic stress, examination stress, and personal concerns can have a significant impact on sleep, including the duration of sleep onset and the amount of sleep. The results of [Yin et al. \(2022\)](#) showed that perceived stress was significantly positively associated with poor sleep quality, indicating that the higher students' perceived stress, the more likely their sleep quality is poor. Moreover, [Amjad and Younas \(2020\)](#) also pointed out that sleep quality is significantly associated with mental disorders such as anxiety and depression. This can be a two-way street, with disruptive sleep quality highlighting psychological problems and psychological problems disrupting sleep quality. The results highlight the need to consider the importance of mental health within interventions focused on sleep quality, and addressing mental health as part of interventions aimed at improving sleep quality.

2.3 Factors that influence sleep quality in lifestyle

Lifestyle behaviors are one of the important variables that affect the sleep behavior of university students. The use of electronic devices, especially at night, has been one of the most important factors. When it comes to sleep, blue light from screens has been shown to inhibit melatonin production and disrupt the sleep-wake cycle ([Hale & Guan, 2015](#)). Also, disturbances in the sleep cycle due to irregular sleep schedules, late-night activities, etc., can disrupt sleep. Caffeine is another lifestyle factor that can have an impact on sleep. [Clark and Landolt \(2017\)](#) found that caffeine intake, especially in the evening, may make individuals feel more awake, making it more difficult to fall and stay asleep, and may reduce sleep efficiency. However, exercise has been shown to be beneficial for sleep. Exercise can also help to improve sleep quality by promoting a more balanced sleep-wake cycle and decreasing stress levels [Vasconcelos et al., 2024](#). However, there are many students who do not have high levels of physical activity which results in low levels of sleep.

2.4 Environmental Determinants: Hostel Living Conditions

Environmental factors have become increasingly recognized as significant sleep quality determinants, especially in the home environment like hostels. Sleep patterns are affected by noise, lighting, room occupancy, and indoor environmental qualities. [Addya et al. \(2025\)](#) mentioned that environmental factors such as indoor noise pollution and overcrowding are major factors affecting sleep disturbances. One of the most common issues in a hostel setting is the sharing of space with other people, as their different schedules and activities can cause some disruption. Ambient noise from the surrounding area adds to the issue and causes poor sleep efficiency and fragmented sleep. These results indicate the importance of environmental factors to be taken into account when discussing students' sleep quality.

2.5 Thermal Comfort and Sleep Quality

Thermal comfort is an important, under researched determinant of sleep. It is the state of the person's satisfaction with the ambient temperature environment. [Fergus Nicol and Michael Humphreys \(2002\)](#) developed an adaptive thermal comfort model that assumes humans can adjust to a variety of temperatures, but will lose thermal comfort at extreme temperatures and these conditions will have a negative effect on sleep. [Okamoto-Mizuno and Mizuno \(2012\)](#) showed that higher indoor temperatures have been associated with higher sleep fragmentation, lower rapid eye movement (REM) sleep and lower sleep efficiency. Likewise, [Cao et al. \(2012\)](#) reported that the sleep efficiency and duration are strongly affected by thermal discomfort. The results indicate that the optimal thermal environment is a precondition for a good night's sleep.

2.6 AC vs Non-AC Accommodation and Ventilation

The difference between air-conditioned (AC) and non-air-conditioned (Non-AC) environments is especially significant in climates that are warm. Maintaining thermal comfort during sleep is crucial for a good night's rest, and air-conditioned spaces can help achieve this by controlling temperature and humidity levels. Non-AC environments, on the other hand, may be exposed to warmer climate, inadequate ventilation and discomfort, particularly in summer. Inadequate ventilation also contributes to thermal discomfort, as it decreases air flow and increases humidity. [Cao et al. \(2012\)](#) pointed out that poor ventilation has a harmful impact on the indoor air quality and causes discomfort and sleep disturbances. It is, therefore, more likely that the students living in Non-AC hostels will have sleep disturbances because of thermal stress and poor air circulation. Although it is important, the effect of the AC and Non-AC accommodation on sleep quality is not well investigated in the literature, especially in the Indian university hostels.

2.7 Research Gap

Although extensive research has been conducted on sleep quality among university students, most studies have focused primarily on behavioral and psychological factors. There is limited research examining the role of environmental determinants, particularly thermal comfort, ventilation, and type of accommodation, in influencing sleep quality. Furthermore, few studies have specifically focused on female students residing in hostel settings within the Indian context.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study area description

The present study was carried out in two selected hostel buildings of the Delhi Technological University campus namely Virangana Lakshmibai Hostel (VLB) and Sister Nivedita Hostel (SNH) located inside the campus of DTU in Delhi, India. VLB Hostel is an air-conditioned (AC) hostel, while SNH is selected as the non-air-conditioned (Non-AC) hostel. These hostels were chosen to compare the indoor environmental quality, thermal comfort conditions, and sleep quality of students living in different thermal environments. The comparison between AC and non-AC hostels helps in understanding how indoor temperature and comfort conditions influence students' sleeping patterns and overall well-being.

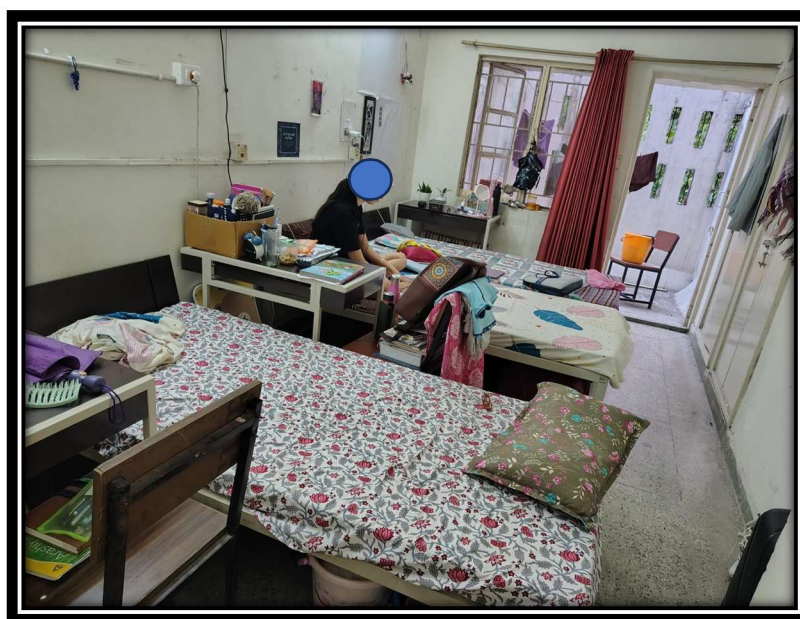


Fig.3.1: Inside view of Non-AC Hostel (SNH)



Fig.3.2: Outer view of Non-AC Hostel (SNH)

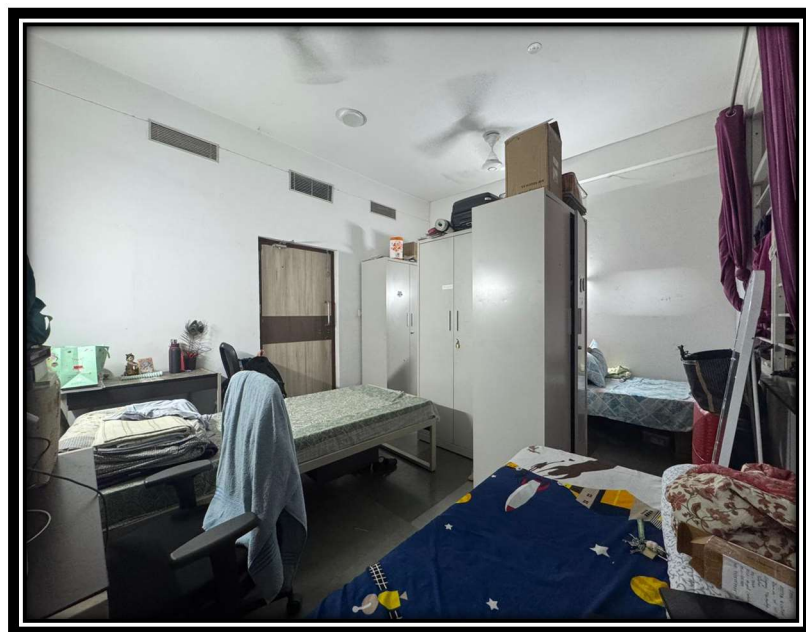


Fig.3.3: Inside view of AC Hostel (VLB)



Fig.3.4: Outer view of AC Hostel (VLB)

Table3.1: Properties of surveyed AC and Non-AC hostels

Name of Hostel	AC/ Non-AC	No. of Floors	Volume	Occupancy	Ventilation
Virangana Lakshmibai Hostel (VLB)	AC	12	58.96	3	2 ceiling fans, 3 AC vents, 1 vent
Sister Nivedita Hostel (SNH)	Non-AC	3	43.25	3	2 ceiling fans, 1 vent

Table 3.1 shows the properties of surveyed AC and Non-AC hostels. The selected hostels accommodate students from different academic programs, educational backgrounds, and age groups. Students residing in these hostels experience different indoor environmental conditions depending upon factors such as room occupancy, ventilation, temperature, humidity, lighting, air movement, and noise levels. Since students spend most of their time inside hostel rooms for studying, resting, and sleeping, the quality of the indoor environment becomes an important factor affecting their health and comfort. The study area was selected because university hostels represent a unique

indoor environment where students live in shared and enclosed spaces with varying environmental conditions. Hostel life often includes academic stress, irregular sleeping schedules, prolonged screen exposure, social interaction, and lifestyle-related habits, all of which may affect sleep quality. Therefore, studying sleep quality in hostel environments is essential for understanding the combined impact of environmental and behavioral factors on students' health and academic performance. This study area is important because limited research has been conducted on the relationship between indoor environmental quality and sleep quality among university hostel students in India.

3.2 Pittsburgh Sleep Quality Index (PSQI)

The methodology used in this research work is cross sectional study to investigate determinant of sleep quality in female university students residing in hostel. The study includes analysis of data collected from 271 female students through questionnaire using Google Form. It mainly includes seven parameters of Pittsburgh Sleep Quality Index with a liberty of modification being done along with other behavioural, psychological and surrounding environmental factors affecting the sleep quality of students. Apart from those role of accommodation type- Air conditioned (AC) and Non- Air Conditioned (Non-AC) have been one of the focal point where it majorly affects Noise disturbances, Air Stuffiness / Poor Ventilations, Purity of room air, Thermal discomfort of the students. The demography of targeted population were in the age range from 17-35 years, Gender-female, and students enrolled in undergraduate, postgraduate or Ph.D. programmes of Delhi Technological University who were residing in two different hostels- VLB (AC Hostel) and SNH (Non-AC Hostel) of same university. A total of 271 students participated in the survey questionnaire and suggesting the sample size was deemed to be sufficient for adequate statistical power for meaningful association between sleep quality and its determinants. The selection of the participants was done through convenience sampling because of the ease and the feasibility of the situation in the hostel. Hence, it may not have a wide generalizability. A structured, self-administered questionnaire was used to collect data on demographic, lifestyle behaviours, environmental conditions, and sleep patterns along with parameters of Pittsburgh Sleep Quality Index (PSQI), a widely used and validated instrument developed by [Daniel J. Buysse et al. \(1989\)](#) to measure sleep quality. PSQI assesses several aspects of sleep such as Subjective Sleep Quality, Sleep Latency,

Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of Sleeping Medication / Aids and Daytime Dysfunction. Each component is rated on a scale of 0-3 and the global PSQI score can be from 0-21 (higher scores represent poorer sleep quality). In the current study, people were classified according to the global PSQI score, which is > 5 as poor sleep quality.

The questionnaire also contained variables pertinent to the goals of the study in addition to PSQI components such as Behavioural aspects - Total daily screen time, days of the week exercised, and sleep–wake routine, psychological aspects- self rated health status after moving to hostel and Environmental aspects- Occupancy and accommodation type, Air Quality in room, Mattress comfort, humidity, lack of natural light. Apart from these there were an important part of the study that involved type of accommodation (AC and Non-AC), type of occupancy- single, double or triple bed sharing which were not very much discussed in earlier literatures and were on of the limitations of those studies. Sleep quality was considered as the dependent variable in this study and the outcomes were measured by PSQI global score. Seven independent variables were analysed to arrive at PSQI score of all the 271 students who participated. By incorporating both traditional and environmental determinants, a holistic evaluation of factors affecting sleep quality of hostel residing students was possible.

Seven Independent Variables selected for PSQI Questionnaire are as follows:

1. C1: Subjective Sleep Quality

- a. It is student's own perception of how well they are sleeping.
- b. Survey Question Used: "On a scale of 1-5, how would you rate your overall sleep quality in your current hostel accommodation?"

2. C2: Sleep Latency

- a. It asks about how long it takes for a student to fall asleep, combined with how often they struggle to fall asleep.

- b. Survey Questions Used: "Sleep Latency (minutes to fall asleep)" + Frequency of "Difficulty falling asleep".

3. C3: Sleep Duration

- a. It is total amount of actual sleep the student gets per night.
- b. Survey Question Used: "Actual hours of sleep at night".

4. C4: Habitual Sleep Efficiency

- a. It is percentage of time a student actually spends sleeping while they are in bed. (e.g., Lying in bed for 10 hours but only sleeping for 5 hours is poor efficiency).
- b. Survey Questions Used: Calculated by comparing "Usual bedtime" and "Usual wake-up time" against the actual hours of sleep and latency.

5. C5: Sleep Disturbances

- a. These are things that physically wake the student up or cause them to toss and turn throughout the night.
- b. Survey Questions Used: The severity of "Waking up during the night (insomnia)", "Waking up too early", and "Restless or poor quality sleep".

6. C6: Use of Sleeping Medication / Aids

- a. It is reliance on outside substances or devices to help induce or maintain sleep.
- b. Survey Questions Used: Since direct medication wasn't asked, the frequency of using earplugs/eye masks, reliance on sleep-improving habits, and late-night caffeine consumption were asked.

7. C7: Daytime Dysfunction

- a. It asks about how much the student's poor sleep is negatively impacting their daily life, health, and academic focus the next day.
- b. Survey Questions Used: The severity of "Daytime fatigue/sleepiness" and "Difficulty concentrating".

The data were analysed using statistical software e.g. SPSS. Means and standard deviations, frequency and percentages were used to describe the characteristics of the study population and the distribution of key variables. To investigate relationship between variables, inferential statistical techniques were used. Pearson correlation analysis were used to determine the strength and direction of associations among sleep quality and independent variables. Multiple regression analysis was also performed to determine which factors are most important and how much each factor contributes to sleep quality.

The regression model used in the study can be conceptually represented as follows:
 Sleep Quality (PSQI Score) = $\beta_0 + \beta_1$ (Subjective Sleep Quality) + β_2 (Sleep Latency) + β_3 (Sleep Duration) + β_4 (Habitual Sleep Efficiency) + β_5 (Sleep Disturbances) + β_6 (Use of Sleeping Medication / Aids) + β_7 (Daytime Dysfunction) + ϵ

In this model, β_0 is the intercept, β_1 to β_7 are the regression coefficient of the independent variables and ϵ is the error term. This model can be used to identify which of the factors are most important and which factors are related to sleep quality controlling for other factors.

During the study, the ethical issues were taken into account. All the respondents gave informed consent before the data were collected, and participation was voluntary. We attempted to ensure the anonymity and confidentiality of the participants as far as possible and only used the data for academic research. Finally, it is evident from above that methodology used in this study is systematic and comprehensive in examining the

determinant of “Quality of Sleep” in female students residing in university hostels. The study provides a solid framework for assessing sleep behaviour in the real world residential context by combining the factors of lifestyle, psychological, and environmental factors, especially the ones related to thermal comfort and type of accommodation.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Sleep Quality Assessment using PSQI Score

This section presents the discussion and analysis of data collected from 271 female students of Delhi Technological University residing in the hostel through questionnaire. Efforts have been made to convert the qualitative data into quantitative form using the Pittsburgh Sleep Quality Index to analyze sleep quality and the contributing factors. PSQI quantify the sleep quality on the scale of 0 to 21 where a score greater than 5 ($PSQI > 5$) is categorized as poor sleep quality while a score of 5 or less ($PSQI \leq 5$) is categorized as good sleep quality.

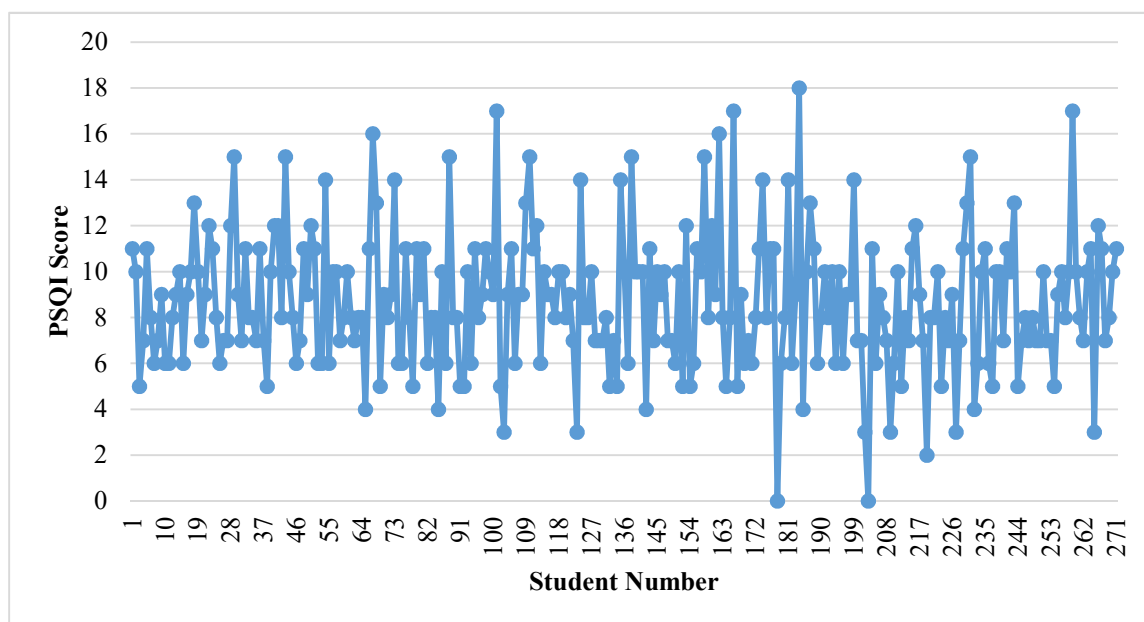


Fig.4.1: Assessment of Sleep Quality among female Students using PSQI Score

The PSQI Score for Students graph (Fig. 4.1) illustrates the distribution of the sleep quality of female students under study. The results indicate that a considerable proportion (nearly 88.2%) of the students have poor sleep quality (PSQI Score > 5). This means that poor sleep are highly prevalent among students residing in hostel. The underlying reasons may be found in factors such as Lifestyle factors- Physical Activity, Higher Screen time and Hostel living conditions- Temperature Discomfort, Poor Ventilation, Noise Disturbances, etc. The findings of the earlier research done by Asmita et al 2025. identified that 70.1% of students had PSQI score greater than 5 which are consistent with the findings of this study and further reinforces the idea that achieving healthy sleep patterns in hostel settings are difficult for students.

4.2 Sleep Quality Rating

A question was included in the questionnaire to rate students their sleep quality on a scale of 1-5. For the ease of analysis, rating of 5 is categorized as good sleep quality while 1-4 are categorized as bad sleep quality. The graph plotted (Fig. 4.2) illustrates the distribution of sleep quality of students as rated by themselves.

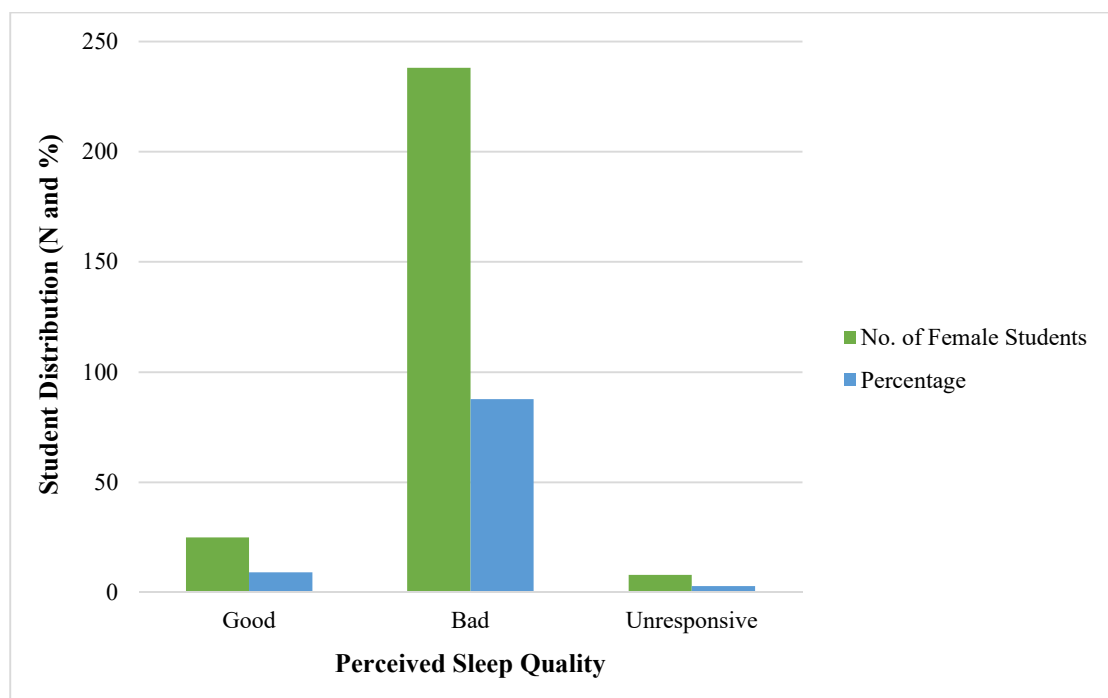


Fig.4.2: Self-rated Sleep Quality of students

On comparing this rating with PSQI score of students, results were found to be consistent. Number of students with PSQI score greater than 5 were in correspondence with number of students who rated themselves in bad sleep quality category (ratings 1-4) whereas PSQI score less than 5 were in correspondence with those who rated themselves in good sleep quality category (rating 5) which is evident from Comparison table for Self-rated sleep quality and PSQI score (Table 4.1).

Table 4.1: Comparison table for Self-rated sleep quality and PSQI score

PSQI	No. of Students	Percentage %	Perceived Sleep Quality	No. of Students	Percentage %
Greater than 5	239	88.1	Bad	238	87.8
Less than 5	32	11.8	Good	25	9.2
			Unresponsive	8	2.9

4.3 Physical Activity and Digital Engagement trend among hostellers

Further analysis of lifestyle factors revealed notable behavioral patterns among the participants. As shown in Fig.4.3, a considerable proportion of students reported low levels of physical activity, with 45.1% engaging in exercise less than two days per week. Similarly, Fig.4.4 illustrates that 40.96% engaging in Screen time of 8 or more hours. Reduced physical activity has been associated with poorer sleep outcomes, as regular exercise plays a key role in regulating circadian rhythms and promoting deeper sleep cycles. Excessive use of mobile phones, laptops, and other electronic devices can delay sleep onset, reduce total sleep duration, and negatively affect overall sleep quality. Exposure to blue light emitted from screens suppresses melatonin secretion and thus disturbing the natural sleep–wake cycle.

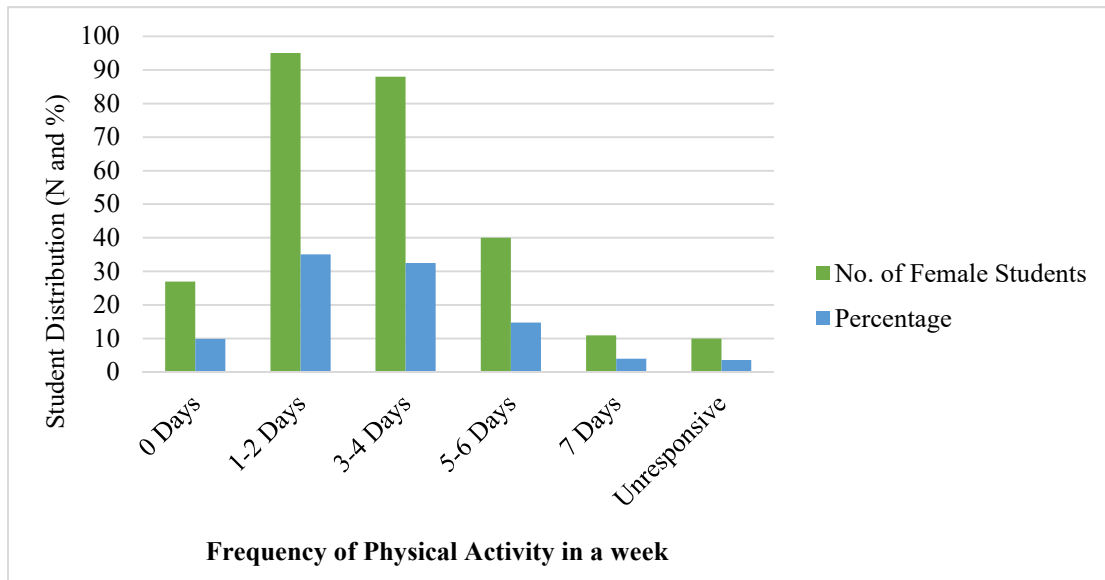


Fig.4.3: Weekly Physical Activity pattern among female students

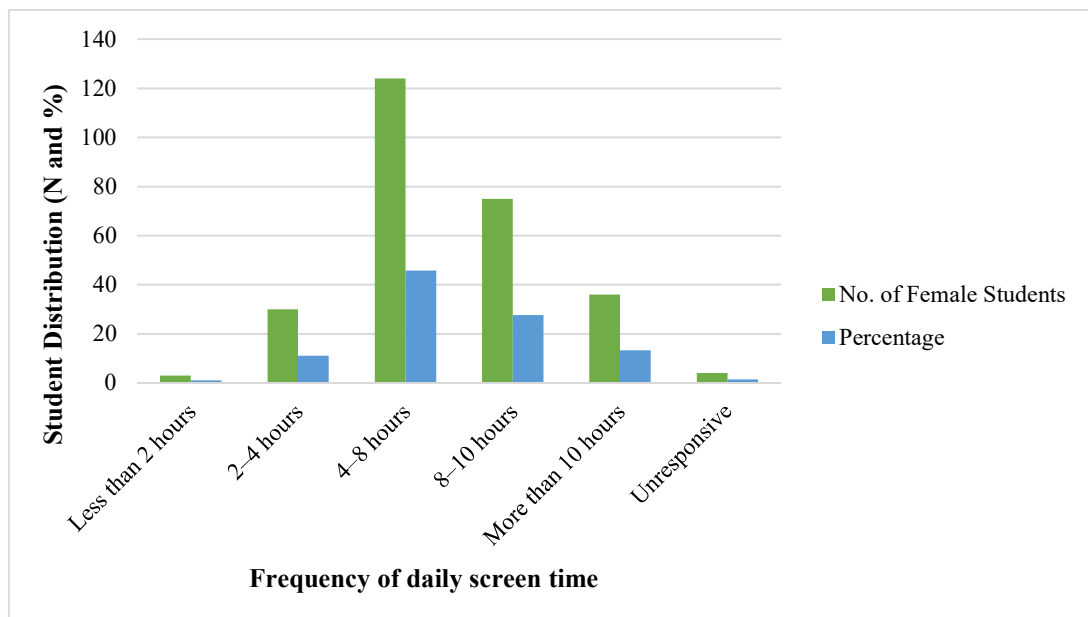


Fig.4.4: Analysis of Daily Digital Screen Interaction among female students

4.5 Effect of Caffeine Consumption on students

Additionally, as shown in Fig.4.5, 17% of students reported regular consumption of caffeine after 5 PM, which is known to delay sleep onset and reduce sleep efficiency. However, this lifestyle factor has demonstrated a relatively weaker association with sleep quality when compared to environmental determinants.

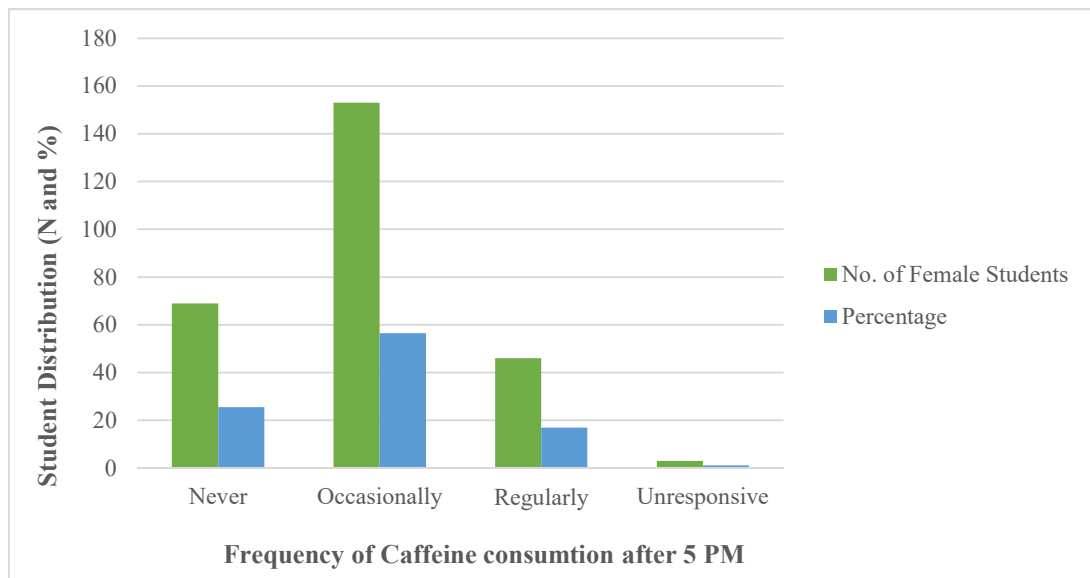


Fig.4.5: Caffeine consumption trend after 5 PM among female students

4.6 Usage of sleep aid among students

The use of sleep aids such as eye masks was reported by 15.1% of participants, indicating attempts to mitigate environmental disturbances during sleep. However, usage of sleep aid has proven to be less impactful among students due to relatively weaker association with sleep quality as compared to the environmental determinants.

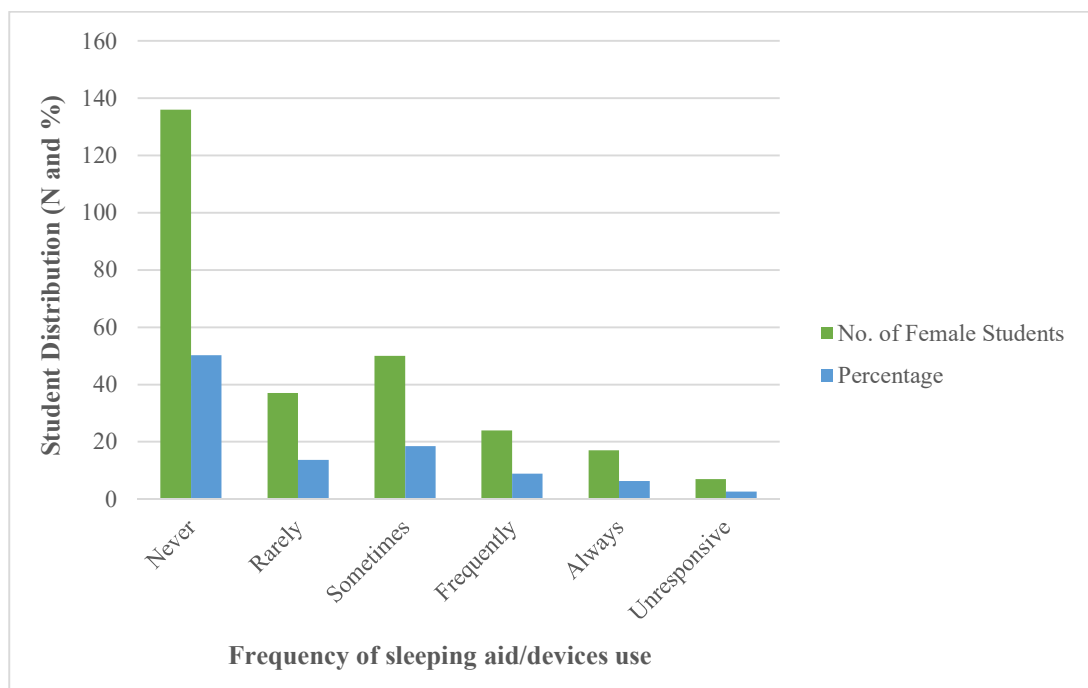


Fig.4.6: Use of sleep aid/devices among female students

A key focus of this study was the examination of environmental determinants, particularly the impact of accommodation type and thermal comfort on sleep quality.

Table 4.2: Comparative analysis of AC and NON-AC Hostel Residents sleep Quality

Accomodation Type	Occupancy	Number Of Students	Mean PSQI Score
AC HOSTEL	Triple	218	8.62
NON-AC HOSTEL	Triple	53	8.93

Table 4.3: Comparison for Thermal Comfort of AC and NON-AC Hostel Residents

THERMAL COMFORT COMPARISON				
Hostel type	Comfortable		Uncomfortable	
AC	55	25.22%	154	70.64%
NON-AC	9	16.98%	43	81.13%

Table 4.3 states that the thermal comfort was relatively better in case of AC residents over Non-AC residents and table 4.2 states that the Non-AC residents have a slightly worse (higher) average PSQI score, both groups are still scoring well above the clinical threshold of 5. This suggests that while temperature control (AC) helps slightly, there are other major environmental factors (like noise, light) driving the poor sleep quality across the board.

4.7 Parameters affecting Room environment

Another question was included in the questionnaire to rate students their hostel room's environment. Three parameters- Humidity, Air Quality & Concentration and

Natural Light were point of interest. Each Parameter was to be responded using five different scales- Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. The graph plotted (Fig. 4.7) illustrates the room's physical environmental based on the response. It was found that close to 18% students felt that rooms are consistently humid and lacks sufficient natural light. Further, 34.31% students felt that air quality of room affects the concentration level. Increased humidity levels may be associated with waking up during the night and waking up too early and unable to go back to sleep. Additionally, parameter- Air quality of room affects concentration level may compromise academic performances of students. However, these factors needs to be studied separately and are limitations of this study.

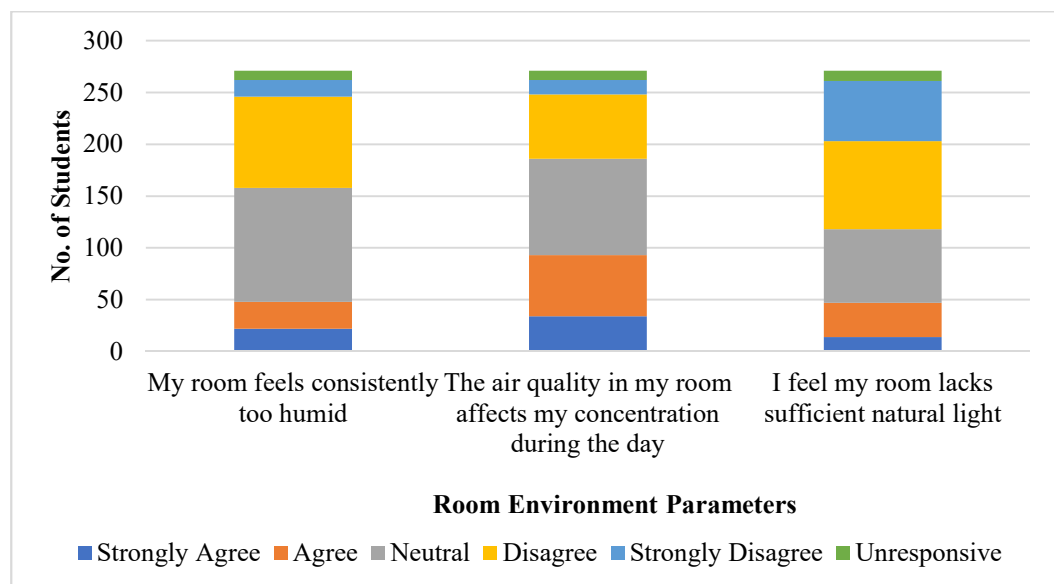


Fig.4.7: Room Environment as felt by students

4.8 Analysis of Natural Environmental factors affecting sleep quality

The factors affecting sleep quality which were to be rated on the three parameters- Temperature Discomfort, Light Exposure and Perceived Air Stiffness/Poor Ventilation on the scale of five- Very Significantly, Significantly, Moderately, Slightly and Not at All. The graph representing factors affecting sleep quality (Fig.4.8) demonstrates that environmental disturbances such as temperature discomfort, light exposure and poor ventilation are among the most influential determinants of poor sleep quality.

It was found that 72.69% students claimed temperature discomfort regardless of room being AC or NON-AC which may be due to lack of control over temperature regulation which is controlled centrally by hostel administration; 50.92% students mentioned light exposure as a factor and 56.83% students mentioned poor ventilation as a factor which adversely affect sleep quality.

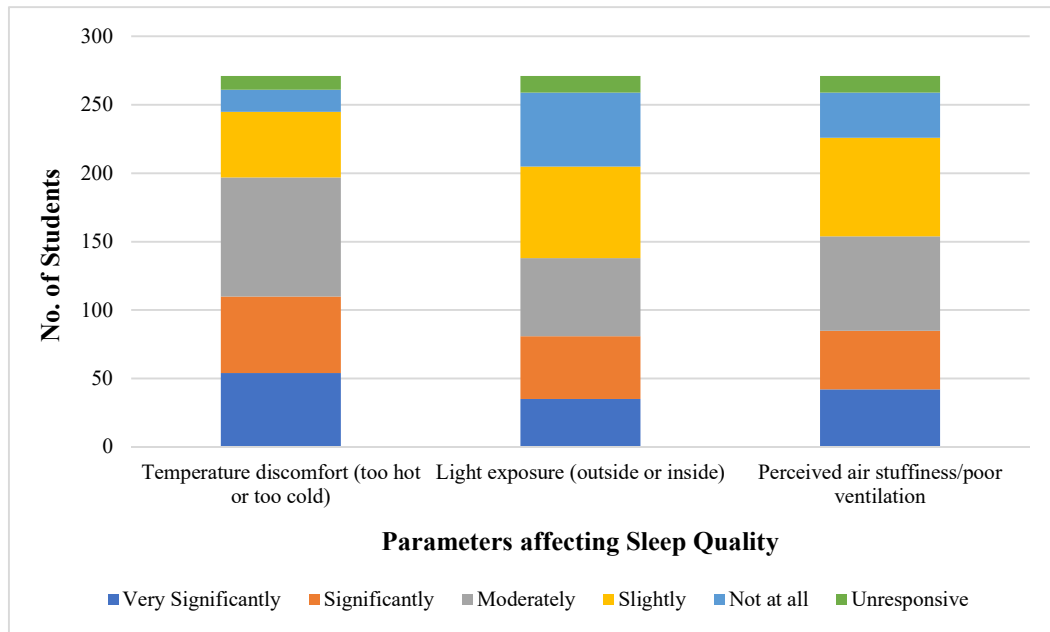


Fig.4.8: Factor affecting Sleep Quality of students

Table 4.4: Comparison for Poor Ventilation of AC and NON-AC Hostel Residents

PERCEIVED POOR VENTILATION			
Hostel type	No. of Students (Poor Ventilation)	Total No. of Students	Percentage of Students
AC	118	218	54.13%
NON-AC	36	53	67.92%

4.9 Interference of Environmental factors on sleep quality

Fig.4.9 reflects students' views on the importance of environmental factors for good-quality sleep. More than 50% students who participated considered all four factors- Temperature, Noise control, Light level, and Air Quality/Ventilation as very important to achieve a good sleep.

Of these variables, Room temperature and noise control seem to be the most pronounced. Students residing in shared accommodations reported more frequent disturbances due to noise and differences in sleep schedules among roommates. Students recognized that stable temperatures and less environmental disturbances are important for uninterrupted sleep. The results support the idea that environmental changes may have greater potential to improve the sleep quality of hostel residents than individual coping strategies.

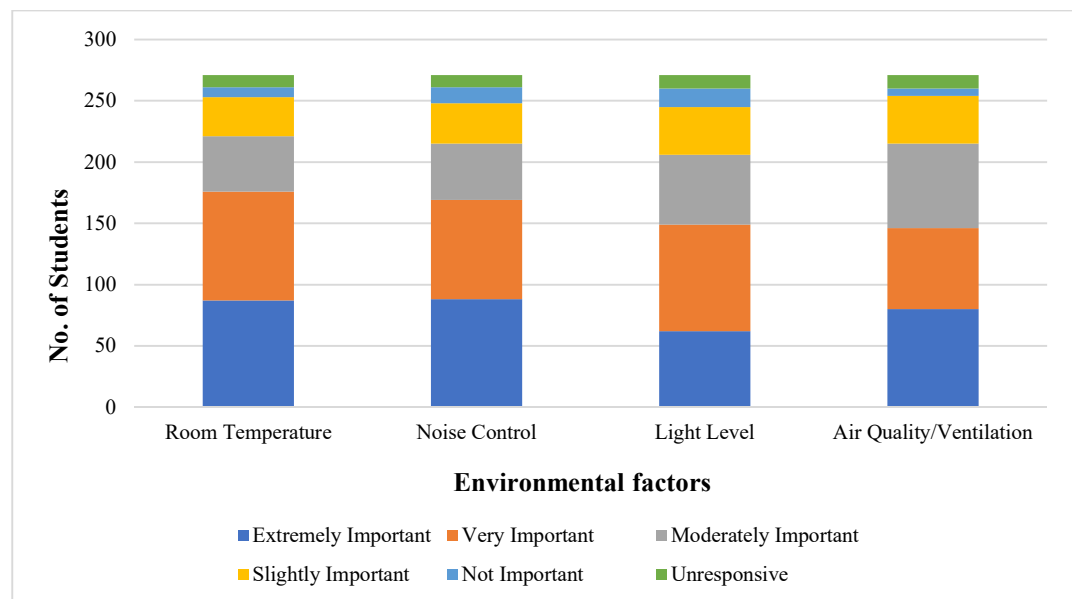


Fig.4.9: Importance of environmental factors for good sleep quality

Noise disturbances from surrounding hostel activities and external environments were frequently reported as causes of difficulty falling asleep and restless or poor-quality sleep. These conditions were more common in Non-AC hostel rooms than in AC hostel rooms, which may be due to open doors and windows for better ventilation and

temperature control. These findings suggest that hostel infrastructure and environmental management significantly influence students' sleep outcomes.

Table 4.5 shows the comparison of sleep disturbances among AC and Non-AC hostel residents. In all four categories- Difficulty falling asleep, waking up during the night (insomnia), waking up too early and unable to go back to sleep, and restless or poor quality sleep; Non-AC residents were more affected than AC residents.

Table 4.5: Sleep Disturbance Comparison of AC and NON-AC Hostel Residents

SLEEP DISTURBANCE COMPARISON								
Hostel Type	Difficulty falling asleep		Waking up during the night (insomnia)		Waking up too early and unable to go back to sleep		Restless or poor quality sleep	
AC	136	62.39%	71	32.57%	84	38.53%	130	59.63%
NON-AC	39	73.58%	25	47.17%	23	43.39%	33	62.26%

4.10 Severity of Sleep Disturbance

The Severity of Sleep Disturbances graph (Fig. 4.10) displays the frequency and intensity of students' sleep disturbances in four categories: Difficulty falling asleep, waking up during the night (insomnia), waking up too early and unable to go back to sleep, and Restless or poor-quality sleep.

As seen in the graph, a high number (more than 60%) of students are having difficulty falling asleep and experiencing restless or poor-quality sleep, and 35% are waking up during the night (insomnia) and waking up too early, unable to go back to sleep. All these findings suggest that large proportions of students are experiencing moderate to severe sleep disturbances, which may negatively affect concentration, academic performance, and mental health. It also suggests that poor sleep quality spans a wide range, including shorter sleep, sleep discontinuity, and reduced sleep efficiency.

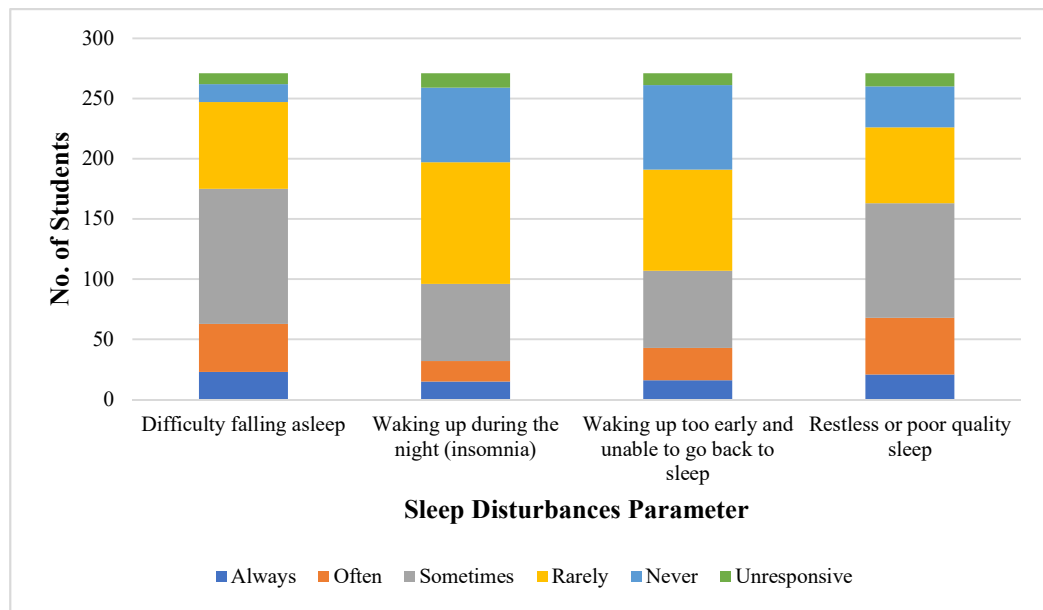


Fig.4.10: Severity of Sleep Disturbances among students

Overall, the results of the study demonstrate that while lifestyle and psychological factors do influence sleep quality, environmental determinants, particularly Thermal comfort, noise, and ventilation, play a more dominant role among female hostel students. The relatively weaker associations with factors such as caffeine consumption and eye mask use suggest that individual coping mechanisms may not be sufficient to counteract the impact of unfavorable environmental conditions.

The findings of this study provide important insights into the role of hostel infrastructure and living conditions in shaping sleep quality. The higher prevalence of poor sleep among students residing in Non-AC hostels underscores the need to improve thermal comfort, noise reduction, and ventilation. These results emphasize that interventions to improve sleep quality should not be limited to behavioral modifications but should also address structural and environmental factors in hostel settings.

CHAPTER 5

CONCLUSION, FUTURE SCOPE AND SOCIAL IMPACT

5.1 Conclusion

The present study investigated the determinants of sleep quality among girl students residing in hostels at Delhi Technological University using the Pittsburgh Sleep Quality Index (PSQI). Results indicate that the prevalence of poor sleep quality (PSQI score > 5) is very high (88.19%) among participants. This is an important concern as sleep deprivation has various implications on students' physical health, emotional well-being, and academic performance. The study reveals that the sleep quality of hostel-residing girl students is influenced by Lifestyle and Environmental Factors. Lifestyle factors such as low physical activity, prolonged screen time, irregular sleep schedules, and evening caffeine consumption contribute significantly to disturbed sleep patterns. However, environmental factors such as thermal discomfort, noise disturbances, poor ventilation, inadequate air quality, humidity, and excessive light exposure turn out to be comparatively stronger contributors to poor sleep quality.

One of the significant contributions of this study is on the aspects related to type of accommodation- Air-conditioned (AC) Hostel and Non-Air-conditioned (Non-AC) Hostel. The results show that Non-AC hostel residents scored a higher PSQI score, indicating poor sleep quality, compared to AC Hostel residents. This could be because of higher thermal discomfort, ventilation and environmental disturbances (such as noise). The second critical environmental determinant that was identified was ventilation. Poor ventilation was associated with discomfort, poor air quality, and high humidity, all of which negatively affected sleep. Moreover, differing sleep schedules in shared accommodation and external environmental disturbances also contributed to sleep disruption and reduced sleep efficiency. The results also suggest that individual coping

mechanisms, such as using eye masks, earplugs, etc., may not be sufficient to overcome the adverse effects of poor hostel environments. Therefore, improving sleep quality among university students requires both lifestyle modifications as well as institutional attention toward better hostel design and environmental management.

The results of this study give an extensive knowledge about the factors that affect sleep quality among girl students living in hostels, emphasizing the importance of the behavioural and environmental determinants. The findings indicate that problems are multidimensional and provide valuable insights for hostel administration and policymakers for targeted interventions, resulting in a healthier, more supportive environment for university.

5.2 Future Scope

Although the present study provides meaningful insights into sleep quality among hostel residing female students, several areas remain open for further research.

- The study was limited to girl students from a single university in one geographical region and used convenience sampling. Future studies may include students of both genders from multiple universities from different geographical regions to improve the generalizability of the findings.
- The present research was cross-sectional in nature, thus giving insights into sleep patterns only at a single point in time (during the onset of summer). Longitudinal studies may help in understanding seasonal variations, long-term sleep behaviour, and changes in sleep quality with change in academic years.
- The study primarily focused on self-reported questionnaire responses. Future studies may incorporate objective techniques sleep assessment such as smart wearables, actigraphy or polysomnography for more accurate evaluation of sleep patterns.
- Environmental factors such as room temperature, humidity, ventilation rate, noise levels, and indoor air quality were assessed subjectively based on perception of students. Future research may include direct measurements of environmental

factors using monitoring instruments such as thermometer, hygrometer, anemometer, decibel meter, etc. to establish stronger correlations between environmental conditions and sleep quality.

- Future work may also focus on architectural and infrastructural design of hostel buildings, which may also include occupancy and positioning of rooms, including room occupancy, arrangement and positioning of furniture and other items in rooms, lighting design, acoustic insulation, and natural ventilation systems, to develop student-friendly residential environments.

5.3 Social Impact

Sleep is a fundamental component of physical health, mental well-being, and academic productivity. The findings of this study hold important social significance, particularly in the context of university students residing in hostels. Poor sleep quality among students can negatively affect concentration, memory, emotional stability, decision-making ability, and overall academic performance. Chronic sleep deprivation may also increase the risk of stress, anxiety, depression, and other long-term health complications. Therefore, addressing sleep related issues are essential for promoting healthier and more productive students. This study emphasizes that sleep quality is not only an individual responsibility but also strongly influenced by the residential environment provided by educational institutions. The findings may encourage universities and hostel administrations to prioritize student well-being by improving hostel infrastructures. The research may also contributes through raising awareness among students regarding healthy lifestyle practices such as reducing excessive screen time, engaging in physical exercises, and reducing caffeine consumption during evening and further late hours. Thus, the study not only contributes to academic literature on sleep quality but also provides practical implications for creating healthier educational and residential environments that support the holistic development of students.

5.4 Contribution to United Nations Sustainable Development Goals (SDGs)

1. SDG 3: Good Health and Well-Being

- Identifies key environmental, lifestyle, and psychological factors affecting sleep quality among university students.
- Highlights the impact of poor sleep quality on physical health, mental well-being, and daily functioning.
- Provides recommendations for improving sleep health through better hostel environments and healthy lifestyle practices.
- Supports the promotion of student well-being and prevention of sleep-related health issues.

2. SDG 4: Quality Education

- Examines factors that influence sleep quality, which is closely associated with concentration, memory, learning ability, and academic performance.
- Emphasizes the importance of healthy sleep for improving educational outcomes and student productivity.
- Provides evidence that can help educational institutions create supportive learning and residential environments.

3. SDG 11: Sustainable Cities and Communities

- Highlights the importance of thermal comfort, ventilation, indoor air quality, and noise control in residential environments.
- Provides recommendations for improving hostel infrastructure and living conditions.
- Contributes to the development of healthier, safer, and more sustainable student accommodation facilities.

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APPENDIX-I

Questionnaire used for PSQI Score Evaluation

Exploring the Environmental Determinants of Sleep Quality

1. Academic Program

Mark only one oval.

☐ Ph.D.

☐ UG

☐ Master's

2. Department

3. Sex

4. Age (years)

5. Weight (kg)

6. Height (cm)

7. Hostel Name (Hall No.)

8. Floor Level

9. Room Occupancy

Mark oval.

☐ TRIPLE**10. Appliances used in the room during summer***Check all that apply.*

- ☐ Ceiling fan
- ☐ Standing fan
- ☐ Cooler
- ☐ Air conditioner

11. Ventilation Habits

Mark only one oval.

☐ Window(s) open☐ Door(s) open**12. Ventilation Habits LIGHTS ON**

Mark only one oval.

☐ Regularly☐ Occasionally☐ Option☐ Never**13. Room Vents (provisions above doors)**

Mark only one oval.

☐ Yes, I do have and open regularly

- ☐ Yes, I do have and open occasionally
- ☐ Yes, I do have and do nothing with them
- ☐ I do not have any of them
- ☐ Never

14. Is free space available in the room?

Mark only one oval.

- ☐ Yes, it is congested
- ☐ Yes, a little bit
- ☐ No, not at all

15. Caffeine consumption (tea/coffee) after 5 PM

Mark only one oval.

- ☐ Regularly
- ☐ Occasionally
- ☐ Never

16. Total daily screen time (phone/laptop/computer)

Mark only one oval.

- ☐ Less than 2 hours
- ☐ 2–4 hours
- ☐ 4–8 hours
- ☐ 8–10 hours
- ☐ More than 10 hours

17. Usual bedtime

18. Latency (Minutes to fall sleep)

19. Usual wake-up time

20. Actual hours of sleep at night

21. Air purifier using in room

Mark only one oval.

☐ yes

☐ No
22. How would you rate the general air quality inside your room?*Mark only one oval.*

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

23. To what extent do the following factors in your room affect your sleep quality?*Mark only one oval per row.*

	Not at all	Slightly	Moderately	Significantly	Very significantly
Noise level (from outside or inside the hostel)	☐	☐	☐	☐	☐
Temperature discomfort (too hot or too cold)	☐	☐	☐	☐	☐
Light exposure (from outside)	☐	☐	☐	☐	☐

or inside the
room)

Perceived air
stiffness/poor
ventilation

☐☐☐☐☐

24. On a scale of 1 -5, how would you rate your overall sleep quality in your current hostel accommodation?

1

2

3

4

5



25. Please rate the severity of the following sleep disturbances you experience in your hostel room:

Mark only one oval per row.

Never

Rarely

Sometimes

Often

Always

Difficulty falling
asleep

☐☐☐☐☐

Waking up
during the
night
(insomnia)

☐☐☐☐☐

Waking up too
early and
unable to go
back to sleep

☐☐☐☐☐

Restless or
poor quality
sleep

☐☐☐☐☐

26. How frequently do you use earplugs or an eye mask while sleeping?
Mark only one oval.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Frequently
- ☐ Always

27. Please rate the importance of the following environmental factors for achieving good sleep quality:
Mark only one oval per row.

	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important
Room Temperature	☐	☐	☐	☐	☐
Noise Control	☐	☐	☐	☐	☐
Light Level	☐	☐	☐	☐	☐
Air Quality/Ventilation	☐	☐	☐	☐	☐

28. On average, how many days per week do you engage in moderate to vigorous physical activity?

Mark only one oval.

- ☐ 0 days
- ☐ 1 -2 days
- ☐ 3-4 days
- ☐ 5-6 days
- ☐ 7 days

29. What is the typical noise source that most frequently disturbs your sleep?

Check all that apply.

- ☐ Noise from outside the hostel (traffic, construction)
- ☐ Noise from adjacent rooms/corridor (talking, doors closing)
- ☐ Noise from in-room appliances (fan, cooler)
- ☐ Noise from room-mate(s)
- ☐ Internal body sounds/snoring Other
- ☐ (please specify)

30. How would you rate the frequency of noise disturbance affecting your sleep?

Mark only one oval.

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

31. Do you use any specific device or habit to track or improve your sleep quality?

Check all that apply.

- ☐ Sleep tracking app/device (e.g., smartwatch)
- ☐ Meditation/Relaxation techniques before bed
- ☐ Sleep mask/Earplugs
- ☐ No specific device/habit

32. How would you rate the perceived comfort of your mattress/sleeping surface?

Mark only one oval.

1	2	3	4	5
☐	☐	☐	☐	☐

- 33.** Please rate how strongly you agree with the following statements regarding your hostel room's environment:

Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My room feels consistently too humid.	☐	☐	☐	☐	☐
The air quality in my room affects my concentration during the day.	☐	☐	☐	☐	☐
I feel my room lacks sufficient natural light.	☐	☐	☐	☐	☐

- 34.** On a typical night, how often do you wake up fully (not just stir) due to a perceived environmental factor (e.g., noise, temperature)?

Mark only one oval.

- ☐ Never
- ☐ Less than once per week
- ☐ 1 -3 times per week
- ☐ 4-6 times per week
- ☐ Every night

- 35.** Please rate the severity of the following potential health issues you've experienced since moving into the hostel:

Mark only one oval per row.

	Never	Rarely	Sometimes	Often	Very Often
Headaches/Migraines	☐	☐	☐	☐	☐
Respiratory discomfort (e.g., coughing, congestion)	☐	☐	☐	☐	☐
Daytime fatigue/sleepiness	☐	☐	☐	☐	☐
Difficulty concentrating	☐	☐	☐	☐	☐

APPENDIX-II

PSQI SCORE CALCULATION

Table II.1: PSQI score calculation using seven parameters used in questionnaire

Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
13-03-26 12:23	Female	Masters	11	2	1	0	1	2	2	3
13-03-26 12:33	Female	Masters	10	2	1	1	1	1	1	3
13-03-26 12:48	Female	Masters	5	2	1			1	1	0
13-03-26 13:01	Female	Masters	7	2	1	0	0	1	0	3
13-03-26 13:53	Female	Masters	11	2	1	0	0	2	3	3
16-03-26 20:05	Female	Masters	8	2	1	0		1	3	1
16-03-26 20:18	Female	Masters	6	1	1	0	0	1	1	2
18-03-26 21:00	Female	Masters	7	2	1	1	1	1	0	1
18-03-26 22:23	Female	Masters	9	2	1	0	3	1	0	2
18-03-26 22:26	Female	Masters	6	3	2	0	0	0	1	0
18-03-26 22:29	Female	Masters	6		1	0	0	3	1	1
18-03-26 22:30	Female	Masters	8	2	2	0	1	1	0	2
18-03-26 22:31	Female	Masters	9	1	3	0	0	2	1	2
18-03-26 22:33	Female	Masters	10	2	1	1	0	1	2	3
18-03-26 22:35	Female	Masters	6	1	1			1	2	1
18-03-26 22:36	Female	Masters	9	1	1	0	0	2	2	3
18-03-26 22:36	Female	Masters	10	2	2	0	1	1	3	1
18-03-26 22:37	Female	Masters	13	2	3	0	0	2	3	3
18-03-26 22:39	Female	UG	10	2	1	0	0	1	3	3
18-03-26 22:40	Female	UG	7	0	2	0	3	0	2	0
18-03-26 22:42	Female	Masters	9	1	2	1	1	1	1	2
18-03-26 22:42	Female	Masters	12	2	2	0	2	2	1	3
18-03-26 22:43	Female	UG	11	1	1	1	1	1	3	3
18-03-26 22:45	Female	Masters	8	1	1	1	0	1	1	3
18-03-26 22:52	Female	Masters	6	0	1	1	0	1	1	2
18-03-26 22:53	Female	UG	7	2	1	0	0	1	1	2
18-03-26 23:46	Female	Masters	7	1	1	0	0	1	1	3
03-04-26 22:53	Female	UG	12	1	2	0	0	3	3	3
03-04-26 22:57	Female	UzG	15	3	3	1	1	2	2	3
03-04-26 22:57	Female	UG	9	1	1	2	1	1	1	2

Continued on Page 43

Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
03-04-26 23:17	Female	Masters	7	0	1	0	0	1	3	2
03-04-26 23:21	Female	UG	11	2	3	1	1	2	1	1
03-04-26 23:21	Female	Masters	8	1	1	0		2	1	3
03-04-26 23:22	Female	Masters	8	2	1	0	0	1	1	3
03-04-26 23:23	Female	UG	7	1	1	2	2	0	1	0
03-04-26 23:24	Female	UG	11	1	2	2		1	3	2
03-04-26 23:25	Female	Masters	7	1	1	0	1	1	1	2
04-04-26 17:22	Female	Masters	5	1	1	0	0	1	1	1
08-04-26 15:11	Female	Masters	10	1	1	0	0	2	3	3
08-04-26 15:13	Female	Masters	12	2	2	1	0	3	1	3
08-04-26 16:03	Female	Masters	12	2	1	1	1	2	2	3
08-04-26 16:12	Female	Masters	8	2	1	0	0	1	1	3
08-04-26 22:20	Female	Masters	15	3	3	1		3	2	3
08-04-26 23:04	Female	UG	10	2	1	1	0	1	3	2
08-04-26 23:05	Female	UG	8	2	1			1	3	1
08-04-26 23:05	Female	UG	6	1	1	0	0	1	0	3
08-04-26 23:07	Female	UG	7	1	1	0	0	1	1	3
08-04-26 23:07	Female	UG	11	2	1	1	0	2	3	2
08-04-26 23:09	Female	UG	9	2	1	1	1	1	0	3
08-04-26 23:09	Female	UG	12	2	2			3	2	3
08-04-26 23:11	Female	UG	11	1	1	1	2	2	1	3
08-04-26 23:12	Female	UG	6	2	0	0	0	0	1	3
08-04-26 23:16	Female	UG	6	1	1	0	0	1	1	2
08-04-26 23:16	Female	UG	14	2	2	1		3	3	3
08-04-26 23:17	Female	Masters	6	1	1	0	1	1	1	1
08-04-26 23:18	Female	UG	10	3	3	0	0	2	0	2
08-04-26 23:19	Female	UG	10	2	1	2	1	1	1	2
08-04-26 23:20	Female	UG	7	2	1	0	0	0	1	3
08-04-26 23:21	Female	UG	8	1	1	0	0	2	1	3
08-04-26 23:24	Female	UG	10	1	2	1	0	1	3	2
08-04-26 23:27	Female	UG	8	1	1	0	0	2	1	3
08-04-26 23:31	Female	UG	7	1	1			1	1	3
08-04-26 23:33	Female	UG	8	1	1	1	0	1	1	3
09-04-26 0:14	Female	UG	8	1	1	0	0	1	3	2
09-04-26 23:07	Female	Masters	4		1	0	0	0	3	0
09-04-26 23:15	Female	UG	11	3	1	0	0	1	3	3
09-04-26 23:16	Female	UG	16	3	3	1	1	3	2	3
09-04-26 23:16	Female	UG	13	2	2	1	1	2	2	3
09-04-26 23:17	Female	UG	5	2	0			0	3	0
09-04-26 23:17	Female	UG	9	1	1	1	1	1	1	3
09-04-26 23:19	Female	UG	8	2	1	0	0	1	3	1
09-04-26 23:21	Female	UG	9	3	1	1	2	1	1	0

Continued on Page 44

Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
09-04-26 23:21	Female	UG	14	3	2	0	1	2	3	3
09-04-26 23:25	Female	UG	6	1	1	0		1	1	2
09-04-26 23:27	Female	UG	6	2	0	1	0	0	1	2
09-04-26 23:34	Female	UG	11	2	1	1	0	1	3	3
09-04-26 23:38	Female	UG	8	0	0	2	2	0	1	3
09-04-26 23:39	Female	UG	5	0	1	1	0	1	0	2
09-04-26 23:40	Female	UG	11	2	1	0	3	1	1	3
09-04-26 23:40	Female	UG	9	2	1	0	0	1	3	2
09-04-26 23:41	Female	UG	11	3	3	0	1	1	0	3
09-04-26 23:41	Female	UG	6	1	1	0	0	1	2	1
09-04-26 23:48	Female	UG	8	0	1	2	0	1	1	3
10-04-26 9:05	Female		8	1	1	0	0	1	3	2
10-04-26 23:04	Female	UG	4	3	1	0	0	0	0	0
10-04-26 23:05	Female	UG	10	1	1	1	1	1	3	2
10-04-26 23:05	Female	UG	6	1	1	0	0	1	1	2
10-04-26 23:10	Female	UG	15	2	2	1	3	1	3	3
10-04-26 23:16	Female	UG	8	2	1	1	0	0	1	3
10-04-26 23:16	Female	UG	8	2	2	0	0	0	1	3
10-04-26 23:16	Female	UG	5	2	0	0	1	1	1	0
10-04-26 23:16	Female	UG	5	1	1	0	0	0	0	3
10-04-26 23:23	Female	UG	10	2	1	0	1	2	3	1
10-04-26 23:24	Female	UG	6	1	1	0	0	1	1	2
10-04-26 23:25	Female	UG	11	2	2	0	1	2	1	3
10-04-26 23:27	Female	UG	8	1	1	1	0	0	2	3
10-04-26 23:27	Female	UG	9	1	1	2		2	3	0
10-04-26 23:28	Female	UG	11	1	1	2	1	2	1	3
10-04-26 23:28	Female	UG	10	2	1	1	1	2	0	3
10-04-26 23:35	Female	UG	9	2	2	0	0	1	1	3
10-04-26 23:38	Female	UG	17	2	2	1	3	3	3	3
10-04-26 23:48	Female	UG	5	0	0	0	0	0	3	2
10-04-26 23:49	Female	UG	3	0	1	0	1	0	1	0
10-04-26 23:53	Female	UG	9	1	1	0	0	1	3	3
10-04-26 23:54	Female	UG	11	1	2	0	3	1	1	3
10-04-26 23:54	Female	UG	6		1	0	0	0	3	2
10-04-26 23:57	Female	UG	9	1	2	0	1	1	2	2
11-04-26 1:57	Female	UG	9	2	0	0		1	3	3
11-04-26 23:21	Female	UG	13	2	2	1	1	3	1	3
11-04-26 23:23	Female	UG	15	3	3	0	2	2	2	3
11-04-26 23:25	Female	Masters	11	1	1	1	3	1	2	2
11-04-26 23:25	Female	Masters	12	0	3	1	1	3	1	3
11-04-26 23:26	Female	Masters	6	2	1	1		1	1	0
11-04-26 23:28	Female	UG	10	2	1	1	0	2	1	3

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Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
11-04-26 23:31	Female	UG	9	2	2	0	0	1	1	3
11-04-26 23:31	Female	UG	9	1	1	1	1	1	1	3
11-04-26 23:36	Female	UG	8	2	1	0	0	1	1	3
11-04-26 23:38	Female	UG	10	1	1	1	1	1	2	3
11-04-26 23:38	Female	UG	10	2	1	0	0	2	3	2
11-04-26 23:38	Female	UG	8	1	2	0	0	1	1	3
11-04-26 23:39	Female	UG	9	2	1	1	0	2	1	2
11-04-26 23:41	Female	UG	7	2	1	0	0	1	3	0
11-04-26 23:43	Female	UG	3	0	1			1	0	1
11-04-26 23:45	Female	UG	14	2	2	1	3	2	1	3
11-04-26 23:46	Female	UG	8	2	0	1	0	1	1	3
12-04-26 0:52	Female	UG	8	1	1	1	1	1	1	2
12-04-26 20:27	Female	Masters	10	1	2	0	0	2	2	3
12-04-26 21:46	Female	Masters	7	2	1	0	0	2	0	2
12-04-26 21:50	Female	Masters	7	1	1	0	0	1	2	2
12-04-26 22:00	Female	Masters	7	1	1	1	0	0	1	3
12-04-26 23:12	Female	Masters	8	1	1	0	0	2	1	3
12-04-26 23:15	Female	Masters	5	0	1	0	1	1	1	1
12-04-26 23:16	Female	Masters	7	2	1	1	1	1	1	0
12-04-26 23:20	Female	Masters	5	0	1	0	0	1	0	3
12-04-26 23:21	Female	Masters	14	3	2	1	1	3	1	3
12-04-26 23:24	Female	Masters	10	2	1	0	1	1	2	3
12-04-26 23:24	Female	UG	6	0	1	0	1	1	3	0
12-04-26 23:25	Female	UG	15	2	2	2	0	3	3	3
12-04-26 23:27	Female	UG	10	2	1	1	3	1	0	2
12-04-26 23:27	Female	UG	10	1	2	0	0	1	3	3
12-04-26 23:29	Female	UG	10	1	1	1	0	1	3	3
12-04-26 23:29	Female	UG	4	0	0	0	0	0	1	3
12-04-26 23:29	Female	Masters	11	1	2	0	0	3	2	3
12-04-26 23:30	Female	UG	7	2	1	0	0	1	1	2
12-04-26 23:31	Female	UG	10	2	1	1	1	1	1	3
12-04-26 23:32	Female	Masters	9	2	1	2		1	1	2
12-04-26 23:32	Female	UG	10	2	2	0	0	2	1	3
12-04-26 23:33	Female	UG	7	1	1	0	0	1	1	3
12-04-26 23:34	Female	UG	7	1	1	0	0	1	1	3
12-04-26 23:35	Female	UG	6	2	1	0	0	0	1	2
12-04-26 23:36	Female	UG	10	2	1	1	1	1	1	3
12-04-26 23:36	Female	UG	5	1	1	0	0	1	1	1
12-04-26 23:36	Female	Masters	12	2	2	1	1	1	2	3
12-04-26 23:37	Female	Masters	5	1	0	0	0	1	0	3
12-04-26 23:37	Female	UG	6	1	2			1	0	2
12-04-26 23:40	Female	Masters	11	1	2	1	3	1	0	3

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Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
12-04-26 23:41	Female	UG	10	2	1	1	1	1	1	3
12-04-26 23:41	Female	UG	15	2	2	2	1	2	3	3
12-04-26 23:41	Female	UG	8		0	1	1	0	3	3
12-04-26 23:42	Female	UG	12	2	1	1	3	1	1	3
12-04-26 23:45	Female	Masters	9	2	1	0	0	1	3	2
12-04-26 23:46	Female	UG	16	3	3	2	1	3	1	3
12-04-26 23:51	Female	UG	8	2	1	0	0	1	1	3
12-04-26 23:51	Female	UG	5	2	1	1	0	1	0	0
12-04-26 23:52	Female	UG	8	2	1	0	0	1	1	3
12-04-26 23:53	Female	UG	17	3	1	2	3	2	3	3
12-04-26 23:54	Female	UG	5	2	1	0	0	0	1	1
12-04-26 23:56	Female	UG	9	2	2	1	0	1	2	1
12-04-26 23:58	Female	UG	6	2	1	0	0	1	1	1
13-04-26 0:00	Female	UG	7	1	1	1	1	1	0	2
13-04-26 0:00	Female	UG	6	1	1	1	0	1	0	2
13-04-26 0:01	Female	UG	8	1	1	1	0	1	2	2
13-04-26 0:03	Female	UG	11	2	1	0	3	1	1	3
13-04-26 0:07	Female	UG	14	3	2	2	3	1	1	2
13-04-26 0:12	Female	UG	8	2	1	0	0	1	2	2
13-04-26 0:16	Female	UG	11	1	2	1	3	1	1	2
13-04-26 0:25	Female	UG	11	2	1	2	1	2	1	2
13-04-26 0:50	Female		0		0			0	0	0
13-04-26 22:39	Female	UG	6	1	1	0	0	1	3	0
13-04-26 22:40	Female	UG	8	1	1	2	0	1	1	2
13-04-26 22:43	Female	UG	14	3	2	1	0	3	3	2
13-04-26 22:43	Female	UG	6	0	1	0	0	1	1	3
13-04-26 22:45	Female	UG	9	3	1	0		1	3	1
13-04-26 22:45	Female	UG	18	3	3	2	2	2	3	3
13-04-26 22:47	Female	UG	4	0	1	1		1	0	1
13-04-26 22:50	Female	UG	10	2	1	1		1	2	3
13-04-26 22:51	Female	UG	13	2	1	1	1	3	2	3
13-04-26 22:53	Female	UG	11	2	2	1	0	2	1	3
13-04-26 22:55	Female	UG	6	1	1	0	0	1	1	2
13-04-26 22:58	Female	UG	8	2	1	0	1	1	1	2
13-04-26 22:58	Female	UG	10	2	1	0	0	3	1	3
13-04-26 22:59	Female	UG	8	2	1	1		1	1	2
13-04-26 23:01	Female	UG	10	1	1	1	1	2	3	1
13-04-26 23:04	Female	UG	6	1	1	0		1	1	2
13-04-26 23:04	Female	UG	10	2	2	0	0	2	1	3
13-04-26 23:13	Female	UG	6	1	1	0	0	1	1	2
13-04-26 23:17	Female	UG	9	2	1	1	0	1	1	3
13-04-26 23:20	Female	UG	9	3	1	0	0	1	1	3

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Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
14-04-26 10:03	Female	Ph.D.	14	3	2	1	2	2	1	3
14-04-26 10:12	Female	UG	7	2	1	0	0	1	2	1
14-04-26 10:22	Female	Ph.D.	7	2	1	0	0	1	1	2
14-04-26 23:08	Female	UG	3		0			0	3	0
14-04-26 23:09	Female	UG	0	0	0	0	0	0	0	0
14-04-26 23:11	Female	UG	11	2	1	0	3	1	3	1
14-04-26 23:11	Female	UG	6	1	1	1	0	1	1	1
14-04-26 23:20	Female	UG	9	2	1	1	0	1	1	3
14-04-26 23:21	Female	UG	8	2	1	0	0	2	0	3
14-04-26 23:22	Female	UG	7	0	1	2	0	1	1	2
14-04-26 23:22	Female	UG	3	0	1	0	0	0	0	2
14-04-26 23:23	Female	UG	6	1	1	0	0	1	0	3
14-04-26 23:23	Female	UG	10	0	2	2	1	1	1	3
14-04-26 23:24	Female	UG	5	3	0	1	0	0	1	0
14-04-26 23:29	Female	UG	8	1	1	1	0	1	1	3
14-04-26 23:29	Female	UG	7	1	1	0	0	1	1	3
14-04-26 23:29	Female	UG	11	2	1	1	1	1	2	3
14-04-26 23:30	Female	UG	12	2	3	1	0	2	1	3
14-04-26 23:30	Female	UG	9	2	1	1	1	1	1	2
14-04-26 23:33	Female	UG	7	1	1	1	0	1	1	2
14-04-26 23:34	Female	UG	2	0	0	0	1	0	1	0
14-04-26 23:34	Female	UG	8	2	2	1	1	1	0	1
14-04-26 23:34	Female	UG	8	1	1	1	1	1	1	2
14-04-26 23:36	Female	UG	10	1	1	1	0	1	3	3
14-04-26 23:37	Female	UG	5	1	1	1	1	0	1	0
14-04-26 23:37	Female	UG	8	2	1	1	0	0	1	3
14-04-26 23:38	Female	UG	7	2	2	0	0	1	0	2
14-04-26 23:38	Female	UG	9	0	1	0	0	2	3	3
14-04-26 23:41	Female	UG	3	1	1	0	0	1	0	0
14-04-26 23:44	Female	UG	7	2	0	0	0	0	2	3
14-04-26 23:48	Female	UG	11	1	2	0	3	1	1	3
15-04-26 9:57	Female	Ph.D.	13	3	2	0	0	2	3	3
15-04-26 23:15	Female	UG	15	3	2	0	1	3	3	3
15-04-26 23:16	Female	UG	4	0	1	0	0	1	0	2
15-04-26 23:16	Female	UG	6	1	1	0	0	1	0	3
15-04-26 23:17	Female	UG	10	3	2	0	0	2	2	1
15-04-26 23:17	Female	UG	11	1	2	1	3	1	1	2
15-04-26 23:20	Female	UG	6	1	1	0	0	1	1	2
15-04-26 23:20	Female	UG	5	1	2	0	0	1	0	1
15-04-26 23:22	Female	UG	10	1	1	2	1	1	1	3
15-04-26 23:22	Female	UG	10	2	2	1	1	2	1	1
15-04-26 23:23	Female	UG	7	2	1	0	1	1	1	1

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Time of Data Collection	Gender	Academic Program	PSQI Score	C1	C2	C3	C4	C5	C6	C7
15-04-26 23:24	Female	UG	11	1	2	0	0	2	3	3
15-04-26 23:24	Female	Masters	10	3	2	0	0	1	1	3
15-04-26 23:24	Female	Masters	13	3	2	0	0	2	3	3
15-04-26 23:26	Female	Ph.D.	5	1	1	0	0	1	0	2
15-04-26 23:26	Female	Masters	7	1	1	0	0	1	1	3
15-04-26 23:27	Female	Masters	8	3	2	0		0	0	3
15-04-26 23:27	Female	UG	7	1	2	1	1	1	1	0
15-04-26 23:27	Female	UG	8	1	1	2	1	1	1	1
15-04-26 23:28	Female	UG	7	1	1	0	0	1	1	3
15-04-26 23:28	Female	Masters	7	1	2	0	0	1	1	2
15-04-26 23:28	Female	UG	10	2	1	0	0	1	3	3
15-04-26 23:28	Female	Masters	7	1	1	0	0	1	1	3
15-04-26 23:28	Female	Masters	7	2	1	0	0	1	1	2
15-04-26 23:29	Female	Masters	5		0	0	0	0	3	2
15-04-26 23:30	Female	Masters	9	2	1	0	0	1	3	2
15-04-26 23:30	Female	Masters	10	2	1	0		2	2	3
15-04-26 23:30	Female	UG	8	2	1	0	0	2	1	2
15-04-26 23:33	Female	Masters	10	2	2	0	0	1	3	2
15-04-26 23:34	Female	UG	17	3	3	1	1	3	3	3
15-04-26 23:34	Female	UG	10	3	1	0	0	2	1	3
15-04-26 23:36	Female	UG	8	2	0	1	0	1	1	3
15-04-26 23:36	Female	Masters	7	2	1	0	0	1	0	3
15-04-26 23:37	Female	UG	10	0	2	0	3	2	0	3
15-04-26 23:39	Female	UG	11	2	2	1	1	1	1	3
15-04-26 23:39	Female	UG	3	0	1	0	1	1	0	0
15-04-26 23:39	Female	UG	12	2	1	2	0	1	3	3
15-04-26 23:47	Female	Masters	11	3	1	1	1	1	2	2
15-04-26 23:48	Female	Masters	7	1	1	0	0	1	1	3
16-04-26 0:00	Female	Ph.D.	8	2	1	0	0	2	1	2
16-04-26 0:12	Female	Masters	10	3	2	1	0	1	1	2
16-04-26 1:46	Female	Ph.D.	11	3	2	0	0	2	1	3

APPENDIX-III

QUESTIONNAIRE RESPONSE TABLE

Table III.1: Room Conditions as felt by students

Room Conditions	My room feels consistently too humid	The air quality in my room affects my concentration during the day	I feel my room lacks sufficient natural light
Strongly Agree	22	34	14
Agree	26	59	33
Neutral	110	93	71
Disagree	88	62	85
Strongly Disagree	16	14	58
Unresponsive	9	9	10

Table III.2: Factor affecting Sleep Quality of students

Factors Affecting Sleep Quality	Temperature discomfort (too hot or too cold)	Light exposure (outside or inside)	Perceived air stuffiness/poor ventilation
Very Significantly	54	35	42
Significantly	56	46	43
Moderately	87	57	69
Slightly	48	67	72
Not at all	16	54	33
Unresponsive	10	12	12

Table III.3: Importance of environmental factors for good sleep quality

Importance of environmental factors for good sleep quality	Room Temperature	Noise Control	Light Level	Air Quality/ Ventilation
Extremely Important	87	88	62	80
Very Important	89	81	87	66
Moderately Important	45	46	57	69
Slightly Important	32	33	39	39
Not Important	8	13	15	6
Unresponsive	10	10	11	11

Table III.4: Severity of Sleep Disturbances

Severity of Sleep Disturbances	Difficulty falling asleep	Waking up during the night (insomnia)	Waking up too early and unable to go back to sleep	Restless or poor quality sleep
Always	23	15	16	21
Often	40	17	27	47
Sometimes	112	64	64	95
Rarely	72	101	84	63
Never	15	62	70	34
Unresponsive	9	12	10	11

LIST OF PUBLICATIONS AND THEIR PROOFS

1. International Conference on Recent Advances in Multidisciplinary Engineering (ICRAME-2026) held on 01-02 April 2026



Low-Carbon Cement Manufacturing Using Green Hydrogen: A Case Study of Dalmia Cement, Karnataka, India

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Abstract: To reduce CO₂ emissions, this study assesses the use of green hydrogen as a fuel substitute in a cement factory with a daily output capacity of 4400 tonnes. Hydrogen consumption, thermal energy replacement, and possible emission reductions were evaluated by analysing scenarios with 50–100% hydrogen substitution. According to the findings, total CO₂ emissions can be reduced by 43% when coal combustion emissions are eliminated, and calcination emissions remain unchanged. While theoretically possible, hydrogen-based cement manufacturing is currently expensive, with CO₂ abatement costs of about USD 120 per tonne of CO₂, primarily due to electricity and electrolyser expenses, according to a techno-economic study. Significant environmental gains are accompanied by higher water and land requirements, according to sustainability studies. The research indicates that green hydrogen is a promising option for decarbonising cement, particularly when paired with CCUS and other low-carbon technologies.

Exposure to Inhalable, Thoracic and Alveolar Particles among Commuters Using Different Transport Modes in Delhi

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Abstract: The transport sector is one of the major sources of air pollution and serious health risks in Delhi, and atmospheric pollutant concentrations are consistently above national standards. In a city like Delhi. Real-time monitoring was carried out to determine the personal exposure of particulate number concentrations (PNC), inhalable, thoracic and alveolar particles in the two urban routes in Rohini (Delhi technological university DTU-Rithala and DTU-Badli). It was monitored using a portable aerosol spectrometer installed on four commuting modes (two-wheeler scooter, electric rickshaw, auto-rickshaw, car with open windows) during morning (08–10h), afternoon (12–14h) and evening (16–18h) periods. In all modes, the peak of PNC is during commute times. As an example, Badli corridor cars have reached a peak of about 1.1×10^6 particles/cm³ in the afternoon (Up direction) during the day, and scooty and auto are high in the morning (about $8 - 9 \times 10^5$ µg/m³). At Rithala, scooty PNC in the up direction fell practically to zero in the afternoon (a very unexpected fact). The two-wheelers had the highest concentration of inhalable PM in the afternoon (~100 µg/m³) which was about two times higher than what was observed in the morning. The two-wheeler mode showed the highest exposures (~350 µg/m³ inhalable in afternoon) and the second at auto-rickshaw and open-window car and lower values at the morning or evening. Thoracic and alveolar fractions had the same modal ranking but significantly lower absolute values of two-wheeler; (e.g. afternoon thoracic = 5080 µg/m³, alveolar = 1015 µg/m³). Our results support the fact that the modes of open-air commuting: walking and cycling, as well as the periods of high traffic exposures, significantly contribute to the rise in particulate exposure. This study suggests that commuters and the government prefer the less-polluting transportation or away-peak travel that can help lessen the amount of inhalation doses.

CNN-Transformer Framework for Failure-Aware Remaining Useful Life Prediction of Turbofan Engines

Abhishek Dwivedi^{1*}

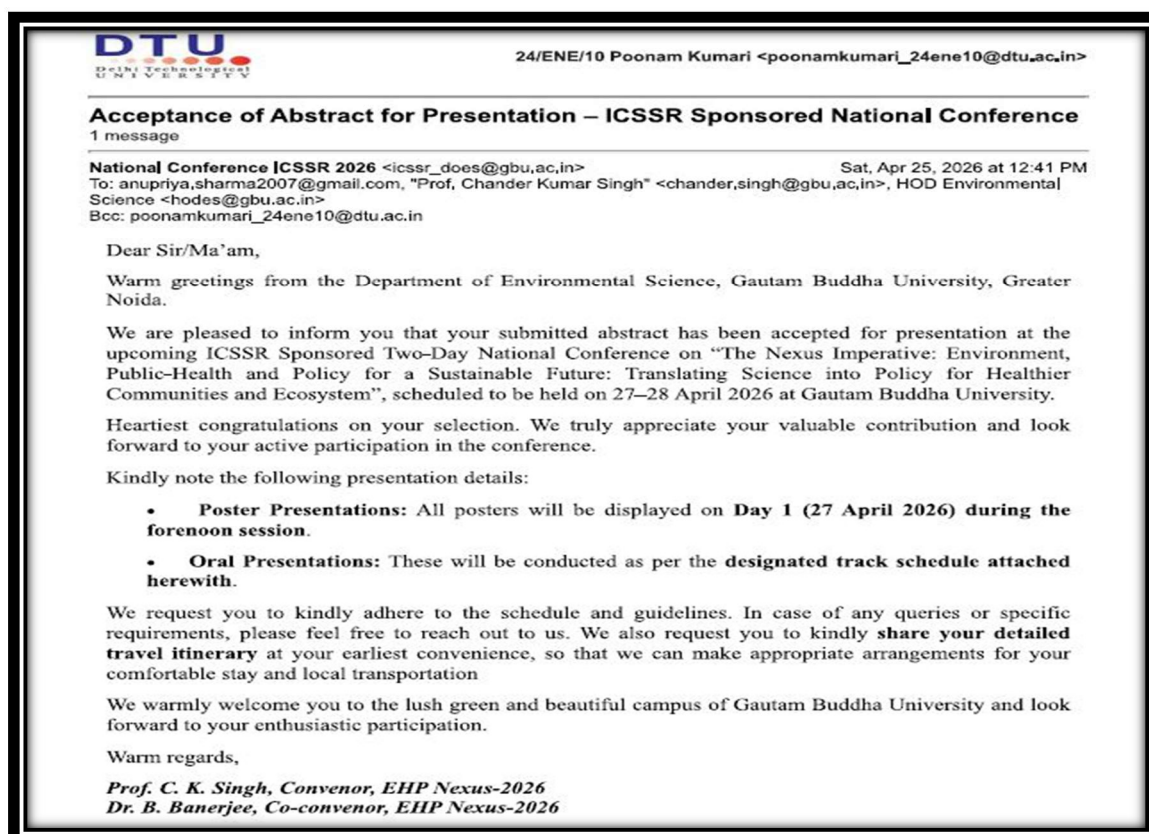
¹ Chhatrapati Shahu Ji Maharaj University, India

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Abstract: Accurate estimates of the remaining useful life (RUL) are essential for ensuring reliable operational safety in safety-critical systems. In this study, a failure-aware CNN-Transformer hybrid framework is proposed that utilizes safety-critical time series sensor data to predict RULs. Convolutional layers are utilized to extract local temporal patterns and inter-sensor correlations, and the Transformer encoder models long-range degradation trends throughout the lifespan of (multiple) operating cycles to capture long-range dependencies of degradation. The CNN-Transformer architecture employs an asymmetric loss function to properly penalize the model for making unsafe estimates of future RULs by explicitly marginalizing the estimated over mine RUL estimates. RUL predictions generated by the proposed framework were evaluated using the publicly available NASA C-MAPSS benchmark datasets. The results clearly demonstrate that the architecture can produce accurate and reliable RUL estimates during prediction/testing experiments, with an overall prediction root mean square error (RMSE) of 17.48 cycles and precise control of prediction overestimation risk. In addition, the predicted RUL and true RUL trajectories were found to closely match in terms of the end-of-life condition. The analysis of the predicted RUL via SmoothGrad shows that this proposed RUL method significantly enhances the user's (maintainer's) understanding of sensor and



2. Acceptance of Abstract for Presentation – ICSSR Sponsored National Conference



3. Acceptance of Abstract for Asia Pacific SDG & Sustainability Summit 2026

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Monika Sharma <sharma.monika1646@gmail.com>

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Dear Researcher,

We are delighted to inform you that your abstract has received approval from the Scientific Review Committee. It has been selected for an **Oral Presentation** at the forthcoming **Asia Pacific SDG & Sustainability Summit 2026**, a flagship international conference and awards forum organized by the Environment and Social Development Association (ESDA), Delhi, in collaboration with esteemed institutions including Dr. Bhim Rao Ambedkar College, University of Delhi, Villa College, Maldives and Tribhuvan University, Kathmandu, Nepal. The summit is scheduled to be held from **June 20-22, 2026, in hybrid mode** at the prestigious India International Centre, New Delhi (India).

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undersigned.
Regards

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—
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Associate Professor & Faculty In-Charge
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Department of Environmental Science and Engineering
Delhi Technological University
Delhi-110042

Contact No. 8800486298

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RESUME

B.Tech	<i>Civil Engineering from SIT, Siliguri</i>				
M.Tech (ongoing)	<i>Environmental Engineering at DTU, Delhi</i>				
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PREVIOUS ACADEMIC RECORD					
Examination Passed	Board/University		Year of Passing	Percentage/GPA	
X	Bihar State Examination Board		2013	67.20	
XII	Bihar State Examination Board		2015	69.20	
Graduation (B.Tech)	Siliguri Institute of Technology		2019	7.20	
Post Graduation (M.Tech)	Delhi Technological University		2026	6.53 (upto 3 rd Semester)	

TRAINING / EXCURSION / INTERNSHIP		
Places / Organization Visited	Period	Nature of Job
Project Implementation Unit, Gulzarbagh (Bihar State Road Development Corporation Ltd)	30 days (16 th June to 15 th July 2018)	Summer Internship Trainee
Water Resource training at NHPC, Teesta valley, Singtam, Sikkim	30 days (29 th July to 28 th August 2017)	Summer Internship Trainee
Ground Water Management & Rain Water Harvesting to Recharge Ground Water at DTU under Ministry of Jal Shakti, GOI	27.09.2024	One day “Tier III training course” at DTU
Environmental Impact Assessment training at Rian Enviro Private Limited, Patna	44 Days (05 th February to 20 th March 2025)	Semester Break Internship Training
Field Visit from DTU to Sadhera Limestone Mine, Madhya Pradesh with Team Perfect	10 Days (02 nd May to 12 th May 2025)	Excursion
ANY OTHER INFORMATION		
<u>ACHIEVEMENTS & ACCOLADES:</u> • Runner UP in Technovision 2017 – the Tech-fest of SIT Siliguri • Participated in Bridge design event of Workshop module at Techniche– the annual Techno-Management fest of IIT Guwahati in 2017 • Participated in Basic Auto CAD training at SIT in 2017 • Participated in fashion show at INSVAGANZA 2018- Annual cultural Fest cum Fete <u>SKILLS AND INTERESTS:</u> • Technical Skills: AutoCAD, StadPro, C, C++ • Advance Diploma in Computer Education • Software skills: Microsoft Word, Excel, PowerPoint		

EXTRA-CURRICULAR ACTIVITIES:

- Member of Badminton club in SIT
- Member of NSS at SIT

PROJECTS:

- At SIT Siliguri – A comparative study of Seismic performance of base isolated and fixed base RC frame structure.
- At DTU – A Comparative Analysis of Air Pollution Exposure Across Commuting Modes for College Students.

CONFERENCE AND SEMINARS:

- Participated in One-Day Seminar on “Recent Trends in Material-Research” at SIT in 2015
- Participated in SAMERPAN – SUSTAINABLE ACTION & MOBILITY FOR EMISSION REDUCTION & PROMOTING AWARENESS NATIONWIDE on 26th November 2024
- Participated in Annual Students’ Convention PRASTUTI IDEATHON – 2025 on 22nd March 2025

WORK EXPERIENCES:

- Worked as Product Manager at Byju’s