

## Training Program on Innovative Construction Technologies & Thermal Comfort in Affordable Housing



### RACHNA: Three-day Training of Trainers Program at CEPT University

Date: 09, 10 and 11 January 2022

Venue: Net Zero Energy Building, CEPT University, Ahmedabad

The “Training of Trainers” program will help the participating professionals in developing skills to become capable of conducting future training on thermal comfort in affordable housing. The program will familiarize them with teaching pedagogy and a larger database on the subject. It will also educate the participants on possible methods of evaluation for the subject. Upon successful completion, the participants will be recognized as certified trainers for thermal comfort in affordable housing.

The session plan for Training of Trainers is as follows:

Table 1: Agenda for three-day “Training of Trainers” module; Day 1

<b>Day 1 ( 09 January 2022, Monday): Thermal Comfort; Buildings and Comfort *All names of the presenters/faculty are placeholders</b>		
11h00 – 11h05	<b>Welcome address and introduction to RACHNA Project</b>	<b>Dr. Rajan Rawal</b>
11h05– 11h15	<b>Session 1: Overview of ‘Training of Trainers’ Workshop and Introduction of Trainers</b>	<b>Dr. Rajan Rawal</b>
11h15 – 12h00 (45 min)	<b>Session 2 (Technical): Importance of Thermal Comfort</b> <i>This session will guide trainers in establishing the importance of thermal comfort. It will discuss the connections between comfort, physiology, health, and productivity. It will provide overarching guidance about the ways and means to achieve comfort in buildings. Additionally, it will discuss factors affecting thermal comfort and the implications of thermal comfort provision on energy consumption and economics.</i>	<b>Dr. Rajan Rawal</b>
12h00 – 12h15	<b>QA &amp; Student Exercise Formation</b>	

12h15 – 12h45 (30 min)	<b>Session 3 (Technical): Building Physics and its relationship with Thermal comfort</b>  <i>This session will deal with building envelope, their heat transfer mechanism, and their effect on thermal comfort. Each heat transfer mode will be discussed in detail with its associated</i>	<b>Dr. Yash Shukla</b>
	<i>building elements. The chapter also will discuss climate context in detail and the impact of building elements on comfort. The session will also deal with selected case studies that demonstrate the correlation between envelope thermal performance, HVAC energy consumption and thermal comfort.</i>	
12h45 – 13h00	<b>QA &amp; Student Exercise Formation</b>	
13h00 – 14h00	<b>Lunch Break</b>	
14h00 – 15h00 (60 min)	<b>Session 4 (Technical): Research Methodology of Building Climate Science</b>  <i>This session will familiarize the potential trainers with methodologies of conducting research relating to outdoor climate, buildings and their internal environment or climates. The session will aid potential trainers in developing understanding</i>	<b>Dr. Minu Agarwal</b>
15h00 – 15h15	<b>QA</b>	
15h15 – 15h30	<b>Health Break</b>	
15h30 – 16h30 (60 min)	<b>Session 5 (Technical): Gaps in Simulated and Actual Building Performance</b>  <i>This session will highlight the gaps between the estimated and actual performance of the whole building. The relevance and need for closing this gap will be highlighted along with pathways for bringing intended and actual performance closer.</i>	<b>Dr. Minu Agarwal</b>
16h30 – 16h45	<b>QA</b>	
16h45 – 17h00	<b>Session 6: Day 1 Concluding remarks</b>	<b>Dr. Rajan Rawal</b>

Table 2: Agenda for three- day "Training of Trainers" module; Day 2

**Day 2 (10 January 2022, Tuesday): Affordable Housing; Energy and Comfort** \*all names of the presenters/faculty are placeholders

10h00 – 10h05	<b>Session 7: Introduction &amp; Overview to Day 2</b>	<b>Dr. Rajan Rawal</b>
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10h05 – 10h50 (45 min)	<b>Session 8 (Technical): Affordable Housing Passive Design Strategies</b> <i>This session will equip potential trainers with passive design strategies and their importance. The same will be reinforced with simulation-based research results. The session will provide insights into the site-level design decisions as well as building-level design decisions. It will further provide a comparative understanding of appropriate orientation, and use of building mass to reduce radiative heat gains in warm climates, it will guide fenestration design, location, and shading design appropriate for affordable housing. The use of appropriate ventilation for comfort and well-being also will be covered in this session. The session will also provide selected case studies that have adopted best practice approaches at the site and at the building level to implement passive design strategies.</i>	Dr. Rajan Rawal
10h50 – 11h00	<b>QA &amp; Student Exercise Formation</b>	
11h00 – 11h45 (45 min)	<b>Session 9 (Technical): Building Materials and Methods of Construction for Affordable Housing</b> <i>This session will start with an overview of affordable walling, roofing and fenestration materials and technologies. It will further detail the appropriateness of materials and methods of the construction for housing and their applicability in various housing typologies. The session further enhances the understanding of the participant to adopt materials and methods according to the climate context. The focus would also be given to alternative construction technologies, low embodied carbon materials, availability of material locally, and its economics. The session will also provide selected case studies that have adopted best practice approaches at the building level with construction technologies and materials.</i>	Dr. Yash Shukla
11h45 – 11h55	<b>QA &amp; Student Exercise Formation</b>	
11h55 – 12h05	<b>Health Break</b>	
12h05 – 12h50 (45 min)	<b>Session 10 (Technical): Building Codes, Affordable Housing and Thermal Comfort</b> <i>This session will provide an understanding of the provision of various thermal comfort-related clauses in the National Building Code, Eco Niwas Samhita, and various guidelines provided by the government. It also will provide insights into the</i>	Dr. Yash Shukla

	<p><i>implementation of policy. The participants will be able to comprehend the process of implementing the code at the local level. It will discuss the programming of code implementation, the economics of it as well as the benefits of the codes. Further, this section will outline the codes implemented internationally through voluntary market-based systems, government bylaws, provisions in ISO, and ASHRAE standards.</i></p>	
12h50 – 13h00	<b>QA &amp; Student Exercise Formation</b>	
13h00 – 14h00	<b>Lunch Break</b>	
14h00 – 14h45 (45 min)	<p><b>Session 11 (Technical): Application of Thermal Comfort in Affordable Housing- A Suite of Case Studies</b></p> <p><i>This session will bring salient features of the projects that have demonstrated approaches to achieving thermal comfort in affordable housing. This session will include the projects that were conceived using integrated design practices. The case studies in this session will highlight more than one aspect of the project that meets the objective of affordability and comfort. The on-site performance of the housing also will be included to help the participants understand the methods of field performances</i></p>	<b>Dr. Rajan Rawal</b>
14h45 – 15h00	<b>QA &amp; Student Exercise Formation</b>	
15h00 – 15h45 (45 min)	<p><b>Session 12 (Technical): Cooling Technologies and Comfort, the introduction of affordable advanced technologies</b></p> <p><i>This session will establish the relationship between cooling technologies and comfort. It will elaborate on affordable cooling technologies, their performance, applicability in various climates, and their operations. The potential trainers will be able to train officials in choosing best suited low and/or no-cost technologies for cooling.</i></p>	<b>Dr. Rajan Rawal</b>
15h45 – 16h00	<b>Questions and Answers</b>	
16h00 – 18h00 (120 min)	<p><b>Session 13 (Technical, Hands-on): Teaching Methods and Pedagogical Approach + Tour of the facility</b></p> <p><i>This session will introduce the potential trainers to the teaching methods for multiple topics related to building science like building physics, thermal comfort, and housing. It will provide guidance for content development on these topics. Simultaneously, a visit to the testing facilities will provide a holistic picture. The participants will be capable of providing knowledge about direction and progress in research within the field to the officials.</i></p>	<b>Dr. Rajan Rawal</b>

Table 3: Agenda for three-day "Training of Trainers" module; Day 3

Day 3 (11 January 2022, Wednesday): Codes and Standards; Cooling and Comfort		
10h00 – 10h05	Session 14: Introduction & Overview to Day 3	Dr. Rajan Rawal
10h05 – 11h30 (55 min)	<b>Session 15 (Technical, Hands-on): Measurement and Evaluation of Thermal Comfort</b> <i>This hands-on session will demonstrate experiments to measure thermal comfort in an indoor environment. Simulation-based and field study-based measurement methods will also be illustrated. Potential trainers will be familiarized with statistical analysis methods to translate data into relevant observations and conclusions.</i>	Dr. Yash Shukla
11h30 – 11h45	QA & Student Exercise Formation	
11h45 – 13h00 (75 min)	<b>Session 16 (Technical): Embodied and Operational Energy</b> <i>In this session, potential trainers will be introduced to the relevance of considering embodied and operational energy in the context of affordable housing. The interdependencies of both will be highlighted through various examples. The session will also briefly include the environmental implications of both embodied and operational energy of buildings.</i>	Dr. Rajan Rawal
13h00 – 13h30	QA & Student Exercise Formation	
13h30 – 14h30	Lunch Break	
14h30 – 15h30	<b>Session 17: Development of exercises by potential trainers and their evaluation. Discussion on Building Science Teaching, Research and Development</b> <i>Participants will be briefed about exercise development for various topics. They will be grouped and assigned topics to develop exercises for their evaluation.</i>	Dr. Rajan Rawal
15h30 – 16h15	Session 18: Concluding Remarks, Certificate Distribution	CEPT-CRDF + GIZ

### How to reach CEPT Campus and NZEB?

#### Directions to reach Venue

1. Access the North Gate/ South Gate of the CEPT University Campus from University Road.





2. Walk to the Net Zero Energy Building from North or South Gates on highlighted path.

1 North Gate of CEPT  
Campus

3 Reach the edge of  
the building

4 Walk along the  
edge of the building

5 Net Zero Energy  
Building (NZEB)

2 South Gate of CEPT  
Campus



3. View from Spot 3 from north end





4. Walk along the building and turn left to access steps to the basement.



Kindly Note: The mask is mandatory in the training. Thank you.