fAIR CONDITIONING

With the support of:

SHAKTI SUSTAINABLE ENERGY FOUNDATION

REPUBLIC AND STATE OF GENEVA

POST TENEBRAS LUX

OAK FOUNDATION

THOUGHTFUL COOLING

Cooling Interiors Efficiently and Sustainably
Certificate Program for BE students

WORKSHOP AGENDA

Date

29 August – 2 September 2016

Venue

Sinhgad College of Engineering
S. No. 44/1, Vadgaon Budruk,
Off. Sinhgad Road,
Pune, Maharashtra 411041

Day 1: Timing: 10.00 am to 6.00 pm		
Number	**Time**	**Title**
1.1	10.00 am – 10.20 am	**Warming Up** **Trainer: Vivek Gilani**
1.2	10.20 am – 11.00 am	**Group Debate: Position mapping and articulation towards understanding of Climate Change** **Moderators: Milkesh Potdar, Nitin Pasricha, Shreya Mundhra** Moderators initiate discussions towards student perceptions and understanding of the term Climate Change and if it is really happening? Personal and group viewpoints emphasized to get students involved in the broader concern of climate change. Moderators are to divide students into three groups: Group 1 - that believes Climate Change is happening and the arguments to support their stand; Group 2 - that supports the fact that climate change is a naysayer's dream; and lastly, Group 3 - that feels there needs to be a development for the greater good and impact from climate change is justifiable for the developing nations.
1.3	11.00 am – 11.30 am	**Do The Math & The Story of Solutions** **Moderator: Nitin Pasricha** Are fossil fuels greater than us? can we emit 565 more gigatons of carbon dioxide and stay below 2°C of warming? Exploring the idea on how we can move our economy in a more sustainable and just direction, starting with orienting ourselves toward a new goal.
1.4	11.30 am – 11.45 am	**Introduction to Integrative Design – 'Performance by Design': A short video prepared by the Rocky Mountain Institute** **Moderator: Nitin Pasricha** Trainer showcases a documentary on High Performance by Integrative Design, the first instalment in the High Performance Building Series to provide an in-depth analysis as to the integrative design process. The film includes examples of how design teams collaborate in new ways to integrate high-performance design elements, such as daylighting, energy efficiency and renewable energy, for optimal performance. Trainer initiates charrette discussions and see the design process unfold on projects such as the Empire State Building retrofit, Missouri Department of

		Natural Resources, Phipps Conservancy, the Desert Living Centre, Willow School and Chicago Botanic Gardens.
1.5	11.45 am – 1.00 pm	**Climate Justice and the Built Space: an Introduction to Fairconditioning** **Trainer: Vivek Gilani** **Session Jockey: Nitin Pasricha** The trainer introduces the Fairconditioning Program, focusing on the Academic Curricula Integration project (ACIP). The trainer additionally elucidates the relationship between the existing problems with our Built Space and Climate Change, further underpinning the guiding principles of the overarching program, and the underlying reasons for devising this specific intervention. The trainer will further highlight upon the realm of curricula integration as viewed by the Program's Executive Board and Board of Advisors.
Break 1	*1.00 pm – 1.45 pm*	*Fuel Up (Lunch, Walk, Breathe)*
1.6	1.45 pm – 2.00 pm	**Workshop Objectives and Participant Expectations** **Trainer: Vivek Gilani** **Session Jockey: Nitin Pasricha** The trainer presents the overarching workshop structure, content, activities and objectives. The trainer further highlights key takeaways - all in the context of embedding efficiency and sustainability within the existing concepts, so as to bridge the gap between knowledge and action and improve the cooling design skills and software simulation skills.
1.7	2.00 pm – 2.30 pm	**Group Debate: Personal position recalibration in the context of new knowledge about Climate Change** **Moderators: Milkesh Potdar, Nitin Pasricha, Shreya Mundhra and Vivek Gilani** A follow up from the previous ice-breaker, the trainer aims to initiate a dialogue between students after having shared the facts and figures relating to climate change. The aim of this session to see if there is any change in viewpoint and stance of students on climate change.

1.8	2.30 pm – 3.15 pm	**Building Physics 1 - Forms of Heat applicable in Building Physics, heat transfer, Psychrometrics, climate analysis and solar geometry.** **Trainer: Vivek Gilani** **Session Jockey: Nitin Pasricha** The trainer highlights fundamental concepts of heat transfer in a building, achieving thermal comfort with least amount of energy; controlling convection-radiation-conduction to understand its effect on the building's environment. Trainer further introduces Psychrometry, U and R-values, the analysis of different climates; and shadow masks. The trainer addresses the relationship between buildings and heat, the idea of cooling load and the primary processes that give rise to it, the influence of sensible and latent heat on building design and how the psychrometric chart helps aid the process of building design. The trainer further ensures that cooling load reduction and passive design strategies are given more importance before the different sustainable cooling technologies are explored.
Break 2	*3.15 pm – 3.30 pm*	*Recess for the mind*
1.8	3.30 pm – 4.30 pm	**Building Physics 1 - Forms of Heat applicable in Building Physics, heat transfer, Psychrometrics, climate analysis and solar geometry (cont.)** **Trainer: Vivek Gilani** **Session Jockey: Nitin Pasricha** The trainer highlights fundamental concepts of heat transfer in a building, achieving thermal comfort with least amount of energy; controlling convection-radiation-conduction to understand its effect on the building's environment. Trainer further introduces Psychrometry, U and R-values, the analysis of different climates; and shadow masks. The trainer addresses the relationship between buildings and heat, the idea of cooling load and the primary processes that give rise to it, the influence of sensible and latent heat on building design and how the psychrometric chart helps aid the process of building design. The trainer further ensures that cooling load reduction and passive design strategies are given more importance before the different sustainable cooling technologies are explored.
2.1	4.30 pm – 6.00 pm	**Building Physics 2 - Passive design theory and application** **Trainer: Vivek Gilani** **Session Jockey: Nitin Pasricha** In continuation to day 1, the trainer covers the following

		topics: Passive Building Design, Fundamentals of Solar Geometry and the different ways of reducing heat ingress through design interventions, thermal heat loads on buildings, greenhouse effect and bioclimatic chart. The trainer further provides an understanding of vernacular and climate adaptive design, importance of using local materials. The trainer helps the students in understanding thermal comfort as the goal while recognizing artificial cooling as merely one of the means to achieve it, adaptive comfort criteria and its energy and environmental conservation benefits.
Day 2: Timing: 9.30am to 6.00pm		
2.1	9.30 am – 10.30 am	**Building Physics 2 - Passive design theory and application (cont.)** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra** In continuation to day 1, the trainer covers the following topics: Passive Building Design, Fundamentals of Solar Geometry and the different ways of reducing heat ingress through design interventions, thermal heat loads on buildings, greenhouse effect and bioclimatic chart. The trainer further provides an understanding of vernacular and climate adaptive design, importance of using local materials. The trainer helps the students in understanding thermal comfort as the goal while recognizing artificial cooling as merely one of the means to achieve it, adaptive comfort criteria and its energy and environmental conservation benefits.
2.2	10.30 am – 11.15 am	**Thermal Comfort and Indoor Air Quality - The basic concepts, measurements and standards of thermal comfort and Indoor Air Quality** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra** The trainer elucidates on the following concepts: Thermal comfort and its influencing factors, Solar passive design, Envelope design and its material property, Mode of heat transfer - conduction, convection and radiation. The trainer additionally highlights: adaptive comfort – one size fit all approach, micro climate and how it is affected by landforms, and street width or other external factors.
Break 1	*11.15 am - 11:30 am*	*Recess for the Mind*

2.3	11.30 am - 12:15 pm	**Active Cooling - Efficient HVAC Systems** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra** The trainer brings about the issue of growing Airconditioning demand with regard to building sector growth. Conventional building EPI and Energy efficient building EPI & its effect on electricity consumption is also discussed by the trainer. The trainer ensures that the students are aware of and understand the environmental, spatial and structural implications of using this technology, in comparison the conventional HVAC systems for building design. Further, working of Refrigeration & AC – basics of enthalpy, Coefficient of Performance to evaluate the whole system, introduction to terms like Integrated Part Load Value, Energy Efficiency Ratio and cooling load estimation format – models used for simulation are also covered by the trainer.
2.4	12.15 pm – 1.00 pm	**Natural Refrigerant Air Conditioning** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra** The trainer ensures that the students are aware of and understand the environmental, spatial and structural implications of using this technology, in comparison the conventional HVAC systems for building design. The trainer further ensures that the students realize that these are already commercially available and implementable technologies, further emphasizing that they are sustainable technologies and not alternative technologies. The trainer also covers the environmental benefits of using this technology as it replaces f-gasses, along with the different safety implications and application constraints. This focuses on Unitary and Centralized systems, with a special module on R-290 based refrigerant technology. The trainer also highlights the need to leapfrog to natural refrigerants, which is possible. The session also delves into the issues with usage of carbon dioxide as a natural refrigerant and lack of commercial application examples.
Break 2	*1.00 pm – 1.45 pm*	*Fuel Up (Lunch, Walk, Breathe)*
2.5	1.45 pm – 2.00 pm	**Question – Answers Discussion**
2.6	2.00 pm – 2.45 pm	**Solar Vapour Absorption Machines** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra**

		The trainer ensures that the students are aware of and understand the environmental, spatial and structural implications of using this technology, in comparison the conventional HVAC systems for building design. The trainer further delves into the fact that these techniques are commercially available and easily implementable, and are 'sustainable' and not alternative technologies. The trainer also presents the environmental benefits of this technology since it avoids vapour compression. Along with the aforementioned points, the trainer explains the climatic constraints of evaporative cooling overcoming them by blending with conventional HVAC systems to still derive energy efficiency and low f-gas benefits.
2.7	2:45 pm - 3.15 pm	**Direct/Indirect Evaporative Cooling** **Trainer: Vrajlal Kanetkar** **Session Jockey: Shreya Mundhra** The trainer ensures that the students are aware of and understand the environmental, spatial and structural implications of using this technology, in comparison the conventional HVAC systems for building design. The trainer further delves into the fact that these techniques are commercially available and easily implementable, and are 'sustainable' and not alternative technologies. The trainer also presents the environmental benefits of this technology since it avoids vapor compression. Along with the aforementioned points, the trainer explains the climatic constraints of evaporative cooling overcoming them by blending with conventional HVAC systems to still derive energy efficiency and low f-gas benefits.
Break 3	*3.15 pm - 3.30 pm*	*Recess for the mind*
2.8	3.30 pm – 4.15 pm	**Structure and Radiant Cooling** **Trainer: Shrikant Kaduskar** **Session Jockey: Shreya Mundhra** The trainer ensures that the students are aware of and understand the environmental, spatial and structural implications of using this technology, in comparison the conventional HVAC systems for building design. The trainer also explains the different types of these cooling techniques, along with their application in different circumstances. The trainer further delves into the fact that these techniques are commercially available and easily implementable, and are 'sustainable' and not alternative technologies. The trainer further explains the environmental benefit of structure and radiant cooling as it reduces vapor compression. The trainer also explains how the partial addressing of cooling load is

		overcome by blending with conventional HVAC systems to derive energy efficiency and low f-gas benefits.
2.9	4.15 pm – 5.15 pm	**Life Cycle – Carbon Foot-printing and economics** **Trainer: Vivek Gilani** **Session Jockey: Shreya Mundhra** The trainer explores the economic rationale behind switching to a carbon free lifestyle, the costs associated with each action of ours, and how much CO2 it releases into the atmosphere. Further, the trainer discusses the life cycle costs of various technologies, payback periods and benefits of using alternative technologies. How to calculate these associated costs and justify the use of these.
2.10	5.15 pm – 5.30 pm	**Question – Answers and Discussion**
Day 3: Timing: 10.00am to 6.00pm		
3.1	10.00 am – 1.00 pm	**Introduction to Energy Modelling: Demonstration of Smart Energy Modelling** **Trainer: Mihir Shah** **Session Jockey: Nitin Pasricha** The trainer introduces to the students a web based tool to calculate HVAC load and further simulate those effects on the building's performance. The trainer explains various capabilities of the Smart Energy software.
Break 1	*1.00 pm – 2.00 pm*	*Lunch Break*
3.2	2.00 pm – 6.00 pm	**Smart Energy Tool - Modelling Sustainable Cooling Technologies** **Trainer: Mihir Shah** **Session Jockey: Nitin Pasricha** The trainer conducts practice sessions with the students on the smart energy tool in a Computer Lab.
Day 4: Timing: 10.00am to 6.00pm		
4.1	10.00 am – 1.30 pm	**Case study detailing:** *Doing heat load calculations and modelling an output that demonstrates sustainable building design incorporating sustainable cooling technologies and techniques* **Trainer: Mihir Shah** **Session Jockey: Nitin Pasricha** In this session, students will be assigned a problem statement and asked to generate heat loads and run

		simulations on the Smart Energy tool. The trainer would showcase the capability of the software, advantages and limitations. Further, need for these software's, basic terminologies, importance of internal load and pay back periods will be discussed. *Student Assessment on simulation of case study using Smart Energy tool applications.*
Break 1	*1.30 pm – 2.15 pm*	*Lunch Break*
4.2	2.15 pm – 3.15 pm	**Review of Simulation results from student's assessments, Discussions and Q&A Session** **Trainer: Mihir Shah** **Session Jockey: Nitin Pasricha**
4.3	3.15 pm – 4.15 pm	**Assessment test conducted by cBalance/Fairconditioning Team** **Moderators: Milkesh Potdar, Nitin Pasricha, Shreya Mundhra**
Day 5: Timing: 10.00am to 6.00pm		
5.1	10.00 am – 2.00 pm	**Site Visit 1: Suzlon One Earth, Hadapsar, Pune**
5.2	3.00 pm – 6.00 pm	**Site Visit 2: IITM, Pashan, Pune**

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