



when compared to the night and a maximum difference of 7°C was found between sites. Amirtham et al (2009) investigated the land cover changes due to urbanization in the city of Chennai from 1991 to 2000 and found a significant increase in hot spots in the city mainly attributed to the increase in the urban built up. Rose (2010) found the existence of UHI in Chennai city through the study of historic climate records from meteorological stations and also found a statistically significant increasing trend in the discomfort due to urbanization.

Thermal comfort indices combine two or more parameters into a single factor. Spagolo and de Dear (2003) found the outdoor thermal comfort index OUT SET\* in the subtropical Sydney as 26.2°C and that of the indoor SET\* as 24°C. Taib (2010) in the assessment of thermal comfort parameters in landscape gardens in high rise buildings identified significant variation in air temperature, humidity, wind speed and radiation; but the survey on users perception revealed differences only in lighting level and wind speed. Also the behavioural adaptations of users in urban open spaces in Taiwan revealed that the attendance in urban parks was influenced by sun and thermal conditions (Lin et al 2013). Yang et al (2013) found that the neutral operative temperature and preferred temperature as 28.7°C and 26.5°C in Singapore. And the study also found that people in outdoors generally have a higher tolerance level to comfort conditions when compared to indoors especially in the tropics. The study also suggested that the combination of lower density spaces with higher building heights would reduce the sky view factor value and the incoming solar radiation thus improving the outdoor thermal comfort.

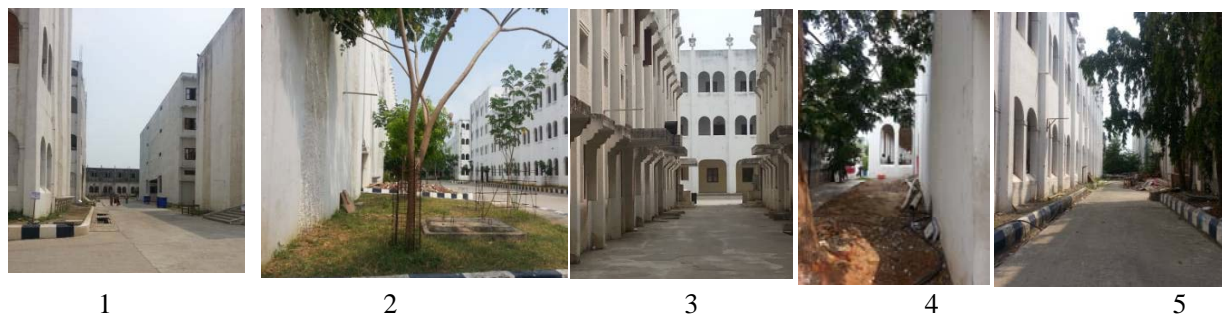
Chennai, a tropical city characterized by high temperatures and humidities, suffers extensively due to the urban heat island effect which affects the outdoor thermal comfort conditions significantly. Therefore, this study aims at the enhancement of outdoor thermal comfort conditions, through urban climate mapping in an institutional campus in Chennai.

## AREA OF STUDY

Sathyabama University is an institutional campus in the suburbs of Chennai experiencing hot humid climate (Figure 1a). The maximum air temperatures during summer (May and June) varies between 38°C and 42°C and the minimum air temperatures during winter (December and January) varies between 18°C and 20°C. The average monthly relative humidity ranges from 63% (June) to 80% (November) and the vapour pressure varies between 22.6hpa and 32hpa. The institution houses several academic blocks of varying street geometry. Five different locations in the campus were selected considering various parameters such as the percentage of vegetation, orientation of streets and canyon geometry (H/W ratio). The thermal properties of the built surfaces were similar in all locations. Figure 1b shows the measurement locations in the campus.



**Figure 1** a) Sathyabama University Campus, Chennai b) Measurement locations in the academic zone



**Figure 2** Images of Measurement locations (1-5)











## APPENDIX 1

### STUDY ON THERMAL COMFORT IN AN INSTITUTIONAL BUILDING

I like your participation in answering this questionnaire based on your thermal comfort, the inputs from this survey helps us to analyze occupants comfort level in this institutional building.

<b>Age:</b>	<b>Sex:</b>	<b>Time:</b>
<b>Clothing:</b>	<b>Are you under Fan:</b>	(Yes/ No/ Partial)

Please Tick ( ) the suitable bubble against the various scales:

1.Orientation of the Location:

North	South	East	West

2.Vegetation Index of the Location:

No vegetation	Sparse Vegetation	Existence of Shrubs	Existence of Trees

3.Thermal Sensation:

Cold	Cool	Slightly cool	Neutral	Slightly warm	Warm	Hot

4.Feeling of Comfort:

Too cool	Comfortably cool	Comfortable	Comfortably warm	Too warm

5.Satisfactory level of temperature in the place:

Very satisfied	Satisfied	Dissatisfied	Very dissatisfied

6.Level of Air movement should be:

Lesser	As it is	More

7.Level of Humidity should be:

Lesser	As it is	More

8.How would you like to be :

Cooler	As it is	Warmer

9.Are the overall conditions acceptable:

Yes	No