LAB FOR ENVIRONMENTAL DESIGN AND SIMULATION (LEDS)

Department of Environmental Architecture

Dr. Bhanuben Nanavati College of Architecture endowed with an excellent infrastructure motivating faculty and a great tradition of empowering women through education for the last 122 years under the MKSSS Trust.Department of Environmental Architecture encompasses the entire gamut of environment that we are a part of; both the built and unbuilt. The department offers a two year full time master's programme in Environmental Architecture. The course is designed and detailed as per the norms of Council of Architecture, India, AICTE (All India Council of Technical Education) and Savitribai Phule Pune University.The course aims at sensitizing the professionals to the environmental issues, global as well as site specific, focusing on the design approach, technology and economics to address them. The department is also well equipped with various software and state of the art facility along with a Industry-Academic platform for exchange of ideas and collaborations under the LEDS lab.

LEDS - Lab for Environmental Design and Simulation

LEDS is a state of art research and development lab facility set up at the Department of Environmental Architecture. This lab aims to facilitate strong Industry-Academic tie-ups. The lab facility is accessible to industry partners, research scholars and students. The lab will assist students and researcher in their on-field/off-field research related to Climate data monitoring, Post-occupancy evaluation studies and design based interventions. The lab is equipped high end instruments and software required for carrying out field based studies. Various instruments like Thermal imaging camera, lux meter, 5 in 1 environmental meter, IR thermometer gun, temperature and humidity data loggers, sound meter, anemometer, CO2 meters are available for research studies and are regularly used by students at the institute. The lab is also equipped with the latest building performance simulation software like Arc GIS, Sefaira, IES(Integrated Environmental Solutions) & Design Builder amongst others. These software are used by students right from the early design stage to post-occupancy and retrofit project evaluation. The lab is also equipped with demonstrative models of various sustainable cooling technologies like radiant cooling, structure cooling and direct and indirect evaporative cooling system. These demonstrative live scale models are used as a teaching-learning aid for students of both graduation and post graduation.

LUXMETER

Measuring lighting or the illumination of an environment requires the use of an incident Lux Meter or Foot-candle meter. Lux is the measurement of the overall intensity of light within a space A luxmeter is a device for measuring brightness. It specifically measures the intensity with which the brightness appears to the human eye. We have individual lux meters as well as data logging lux meters.

Unit of measurement - lux

5 IN 1 ENVIRONMENTAL METER

A 5 in 1 instrument measures 5 environmental parameters- illumination, sound, humidity, temperature and wind velocity.
1. **Anemometer** uses a low-friction ball bearing mounted wheel design for high accuracy.
2. **Humidity sensor** uses a high precision humidity sensor for fast response time.
3. **Light sensor** uses a photodiode and colour correction filter light sensor; spectrum meets C.I.E. photopic.
4. **Thermometer** uses standard temperature measurement sensor for ambient air temperature
5. **Sound meter** meets IEC 61672 class 2 with "A" frequency weighting and "Fast" time response.

LAZER PM 2.5M

A PM2.5 laser dust sensor is a digital universal particle concentration sensor，it can be used to obtain the number of suspended particulate matter in a unit volume of air within 0.3 to 10 microns, namely the concentration of particulate matter, and output with a digital interface also can output quality data of per particle.

Units of Measurement
particulate matter 2.5 (PM2.5)

THERMO HYGROMETER & DATA LOGGERS

Thermo hygrometer are useful for measurement of humidity. It has sensors which measure humidity of the air and temperature of the air. The lab is equipped with many such thermo hygrometer which also have data logging facility to monitor and evaluate real time long period data in spaces.

Unit of measurement -
Temperature - C or F
Relative Humidity - %

ANEMOMETER

An anemometer is a device used for measuring the speed of wind and is also a common weather station instrument. The instruments gives the wind speed in m/s or km/hr.

The instrument is commonly used to find out the wind speed on site and also while carrying our research studies based on Indoor Environmental Quality in terms of fresh air availability and speed.

Unit of measurement - m/sec; Knots/min; Km/hr

BLACK BALL THERMOMETER

The Black Ball Thermometer is used for measuring radiant temperature. Based on the black body principle, it consists of one sphere, which is equipped with a liquid expansion thermometer, Pt 100 or thermo couple temperature probe . It's an accurate, reliable and user-friendly instrument. It is widely used to measure radiant temperature for human thermal comfort in indoor spaces.
Unit of measurement - C

INFRARED THERMOMETER

An infrared thermometer is a thermometer which infers temperature from a portion of the thermal radiation sometimes called blackbody radiation emitted by the object being measured.By knowing the amount of infrared energy emitted by the object and its emissivity, the object's temperature can often be determined within a certain range of its actual temperature. These infrared thermometers are used to measure the surface temperature of building components like walls, roofs, furniture etc.

Unit of measurement -
Temperature - C or F

SOUND MEASUREMENT

A sound level meter is used for acoustic measurements. The diaphragm of the microphone responds to changes in air pressure caused by sound waves.Sound level meters are commonly used in noise pollution studies for the qualification of different kinds of noise, especially for industrial and environmental.

At the department the sound meters used to carry out studies of noise levels in hospitals, during celebrations and for site analysis studies.

Units of Measurement -Decibels (DB)

THERMAL CONDUCTIVITY METER

The U-value is the most important value for proving the heat loss of a building. With the thermohygrometer and compatible accessories from the U-value set, the u-value of any material section is possible. The thermohygrometer clubbed with this instrument also allows for simultaneous readings of humidity and temperature.

Units of Measurement -W/m2 C

THERMAL IMAGING CAMERA

A thermographic camera (also called an infrared camera or thermal imaging camera) is a device that forms an image using infrared radiation, similar to a common camera that forms an image using visible light.

Instead of the 400-700 nanometer range of the visible light camera, infrared cameras operate in wavelengths as long as 14,000 nm. Their use is called thermography. Thermography finds many uses. For example, building construction technicians can see heat leaks to improve the efficiencies of cooling or heating air-conditioning, ghe camera can help sense the body temperature of humans sitting in a space and how they respond to the same in terms of thermal comfort, etc

WEATHER STATION

Weather monitoring station measure wind speed, wind direction, outdoor and indoor temperatures, outdoor and indoor humidity, barometric pressure, rainfall, and UV or solar radiation. The weather station will be used as a demonstrative setup at the institute to introduce students to the various measuring instruments for weather parameters. The weather station is a data logger equipment which will record timely data of the weather parameters that can be used for research purpose.

CO₂ MONITOR

CO2 sensor is an instrument for the measurement of carbon dioxide levels in an indoor space. Measuring carbon dioxide is an important aspect while studying and monitoring indoor air quality. The lab also is equipped with a LED sensor based CO2 meter which sends an alarm when the CO2 levels increases about set limit and signals the requirement of fresh air in the space.

Units of Measurement
parts -per-million (ppm)

CLAMP METER

A clamp meter is an electrical tester that combines a basic digital multimeter with a current sensor. Clamp meter measure AC current, AC and DC voltage, resistance, continuity, DC current, capacitance, temperature, frequency.

SOLAR METER

Solar meters allow for the display of real-time solar radiation data. It is ideally used to measure PV energy production. Solar meters can refer to pyranometers, which are used to measure solar radiation flux density (W/m2), or devices used to measure the kWh production from a PV system.

LOW ENERGY COOLING TECHNOLOGIES

fAIR CONDITIONING under its unique program aims to deeply integrate sustainability and efficiency into architectural and HVAC- engineering higher education curricula. As part of this they have setup scale up models of various low energy cooling technologies as learning aids for students of architecture and engineering colleges.

STRUCTURE COOLING
&
RADIANT COOLING

Structure/ Radiant cooling systems typically use chilled water running in pipes in thermal contact with the surface. The circulating water only needs to be 2-4°C below the desired indoor air temperature.Heat is removed by the water flowing in the hydronic circuit once the heat from different sources in the space is absorbed by the actively cooled surface

INDIRECT-DIRECT EVAPORATING COOLING SYSTEM

With indirect/direct evaporative cooling, the primary air stream is cooled first with indirect evaporative cooling and then cooled further with direct evaporative cooling.
This scale model was presented by ate- HMX.

Units of Measurement

parts -per-million (ppm)

C6 Climate Consultant

Climate Consultant is a simple to use, graphic-based computer program that helps architects, builders, contractor, homeowners and students understand their local climate. It uses annual 8760hour EPW format climate data available on the energy plus website for major cities in the world. Climate Consultant translates this raw climate data into dozens of meaningful graphic displays. This tool is a starting point to all environmental design analysis to understand the local climate and how to respond to the same.
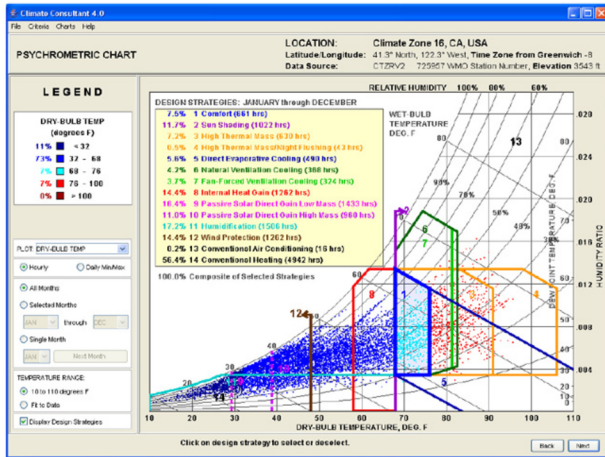
sefaira

Sefaira Architecture is a collaborative, cloud-based software that combines an engaging, easy-to-learn interface with validated industry-standard analysis engines. It equips firms who care about building performance to produce high-performing design concepts from the early design stages
Sefaira is equipped to performance daylight analysis and early design stage energy analysis.

Integrated Environmental Solution
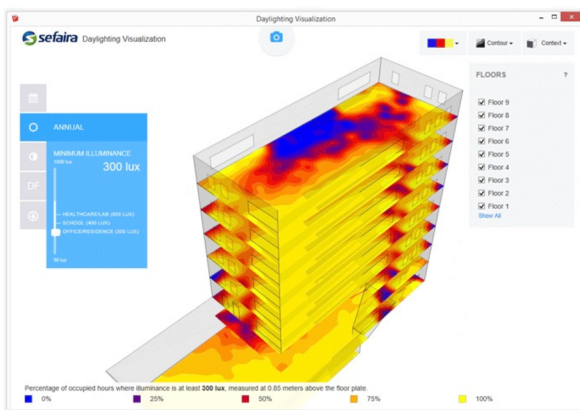
IES helps you deliver ambitious performance goals while seeking opportunities to keep costs appropriate. In fact, as top engineers use advanced IESVE tools you can easily collaborate and exchange models with them as you progress- facilitating an improved integrated and data driven process. IES is a Whole Building Performance simulation software.

DesignBuilder SOFTWARE
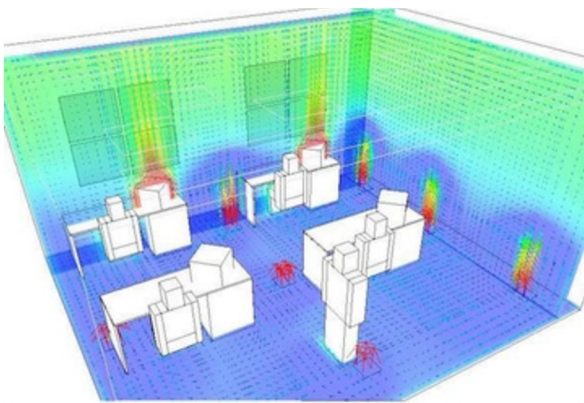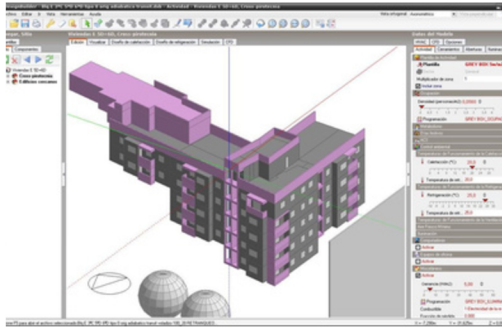
Design Buider provides advanced modelling tools in an easy-to-use interface. This enables the whole design team to use the same software to develop comfortable and energy-efficient building designs from concept through to completion. Design Builder is a whole Building Performance Simulation Software.


eQUEST
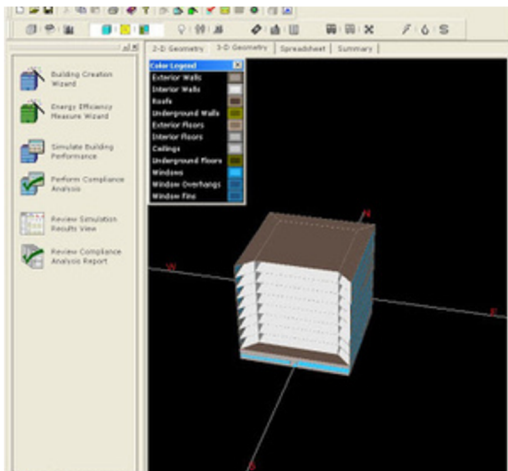
This freeware tool was designed to allow you to perform detailed energy analysis. This is accomplished by building model and energy efficient measure (EEM) wizard and a graphical results display module derived building energy use simulation program.

Radiance VISUAL ANALYTICS
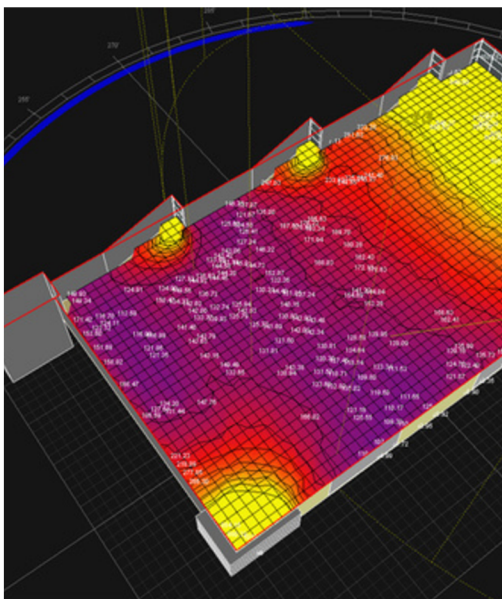
RADIANCE was designed as a lighting analysis and visualisation aid to Lighting designer, Architects and Lighting engineers for usage in a simulated built environment. RADIANCE accurately calculates the radiance (radiometric equivalent of luminance) in an illuminated space.It is commonly used to analyse and predict light levels and for visualisation prior to construction.

DIALux 4.10
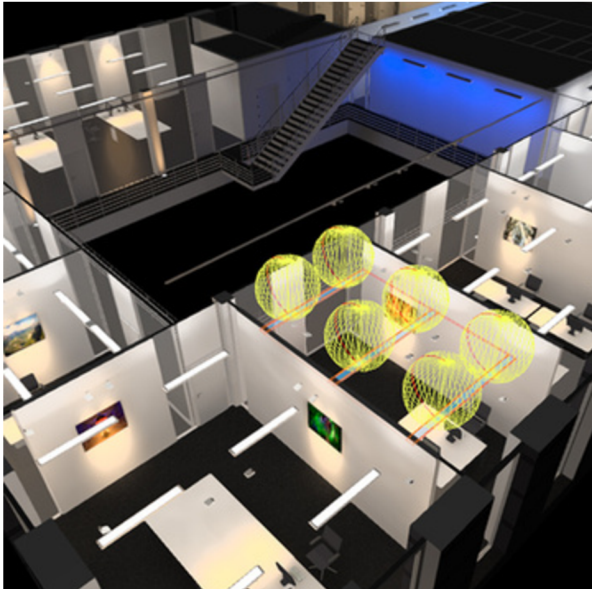
This is primarily a lighting based simulation software used for artifical indoor and exterior lighting analysis. You can plan and design using the electronic luminaire catalogues of the world's leading luminaire manufacturers. Superimpose on the CAD data of other architectural programmes and create our own lighting design.
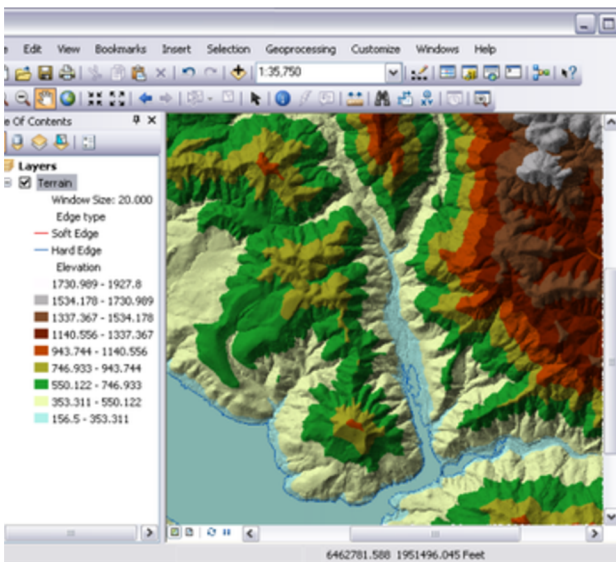

ArcGIS is a planning enabaled tool used for mapping various regional and urban level parameters for styudying the spatial and physical extend along with regional level study can be done w.r.t. environmental and landscape mapping.

AUTODESK
FLOW DESIGN
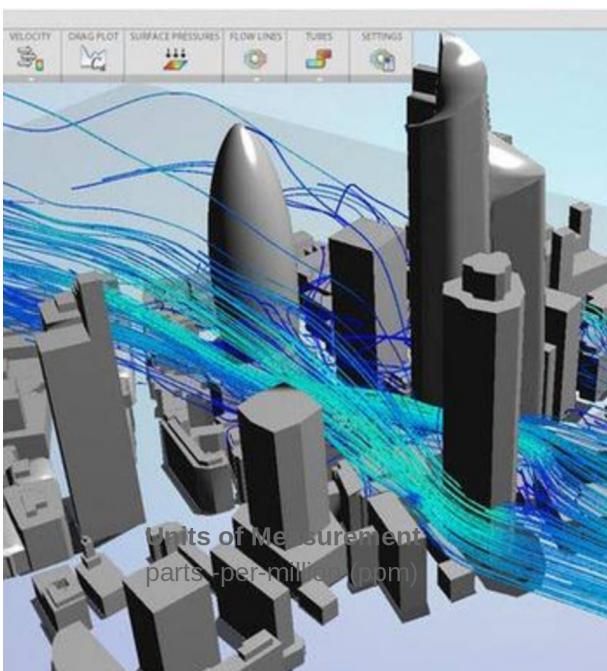
Flow Design is virtual wind tunnel software. It models airflow around design concepts to help test ideas early in the development cycle.It models wind behavior around an exterior and provides an understanding of where there may be risks of elevated wind speeds or where there may be stagnant areas that affect air quality or comfort.

EXPERIMENT DONE IN LAB
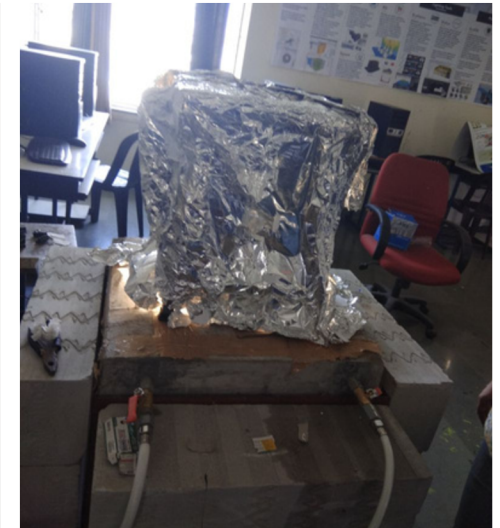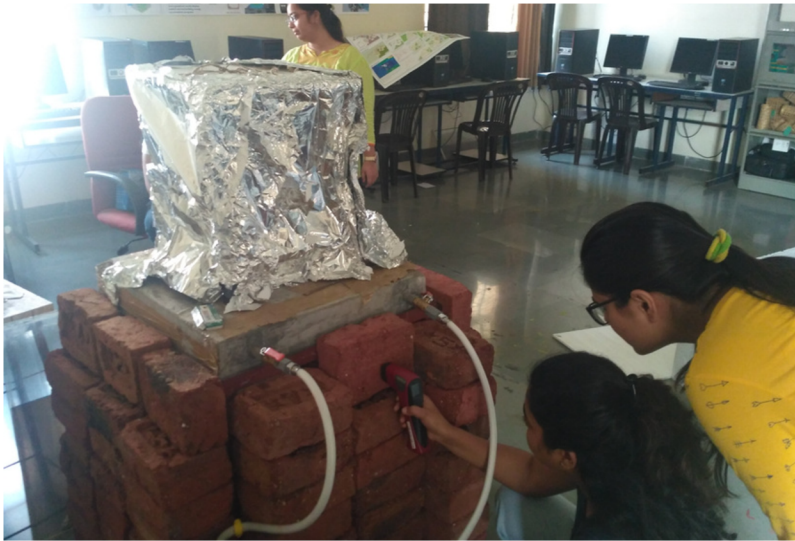
Studies done using Instruments

1. M.Arch(E.A.) 1st Year Students- Daylight Studies in various institutes of the MKSSS's campus for daylight; Study done using lux meter.

2. Bangad Komal - Study And Evaluation Of Thermal Comfort And Occupant Satisfaction In Green Residential Buildings Through Field Studies In Pune; Study done using post occupancy methodology and thermohygrometer.

3. Gaikwad Bhavna- Natural Ventilation And Energy Efficiency In Hospitals Case Of Pune; study done using anenometer and thermo hygrometer.

4. Phalke Snehal- A Post Occupancy Evaluation For Passive Ventilation Systems And Daylight In Warm And Humid Climate : Case CCCR IITm Pune; Study done using the luxmeter and anenomter.

5. Pathare Ankita- Evalution Of The Climatic Performance Of A Vernacular Residence In Pune, Study done using data logger to measure temperature and humidity.

6.Nike Netra- Assessing The Indoor Environmental Quality In Shopping Areas With A Focus On Shopping Arcades, Case Of Pune , India, Study done using 5 in 1 environmental meter to measure, sound,light, temperature and humidity in shopping areas.

Studies done through Simulation Software

1. Chitnis Shrushti- Roof Design For Thermal Performance To Reduce Heat Gain- Study done using IES software

2. Saggam Neha - Evaluating Of Phase Change Materials For Thermal Energy Storage- Study done using the Design Builder software.

3. Gokhale Shruti - Analysis Of Alternatives For Bioclimatic Low Cost Housing Design, Study done using Ecotect Software.

4. Karkhanis Neha- Solar Shading For Low Energy Use And Daylight Quality In Offices In Pune., Study done IES software.

5. Dixit Nidhi - Evaluating Architectural Interventions In Reducing Carbon Footprint Of Dairy Industry, Study done using Gabi LCA software.

6. Nesarikar Pradnya- Study Of Influence Of Land Cover On Urban Heat Islands In Pune Using Remote Sensing, Study done using ArcGIS tool.

7. Studying and Evaluating coastal settlements of Kerela for climate resilience- Study done using Arc GIS tool for mapping climate vulnerability and assessment.

WORKSHOP CONDUCTED

Different software simulation tools and providing skills of the latest software that are used in the industry are taught to the students. Software like Envimet and e-Quest are few of the recent workshops conducted at the lab.

Students from B.Arch and M.Arch participate in these workshops to gain handson experience. These sessions are conducted by experts from various organisations and research institutes.

TEAM

Ar. Namrata Dhamankar- Jadhav
Head, LEDS
Assistant Professor
B.Arch I M.Sc Environmental Design
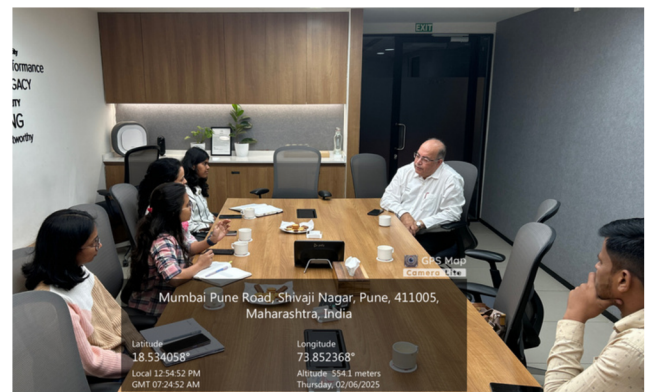
Dr. Sujata Karve
Head of Department, M.Arch(E.A)
B.Arch I M.Planning (Housing) I PhD

Dr.Prajakta Dalal- Kulkarni
Associate Professor
B.Arch I M.Arch Environment I PhD

Dr.Anurag.Kashyap
Principal, BNCA
B.Arch I M.E(Town Planning) I PhD

For enquiries on visits and renting of instruments contact:

Ar. Namrata Dhamankar-Jadhav
m.: +91 9960890814
e: namrata.dhamankar@bnca.ac.in

a.: MKSSS's Dr. Bhanunen Nanavati College of Architecture for Women
BNCA New Campus, Karve Nagar, Pune 411052, India
www.bnca.ac.in   +91- 20-25313303