

AAH301-CLIMATE AND BUILT ENVIRONMENT

UNIT I CLIMATE AND HUMAN COMFORT

S.No	PART A-MCQs	Ans
1	Climate is defined as the _____ weather conditions of a place. a)Daily b)Weekly c)Long-term average d) Hourly	c
2	Which factor mainly determines the climate of a place? a)Latitude b)Longitude only c)Population density d) Building height	a
3	Which climatic element measures the amount of moisture in air? a)Rainfall b)Temperature c)Humidity d)Wind speed	c
4	Solar radiation mainly affects the _____. a)Air pressure b)Temperature c)Humidity d)Wind direction	b
5	Which instrument is used to measure humidity? a)Barometer b) Hygrometer c) Thermometer d) Anemometer	b
6	Which instrument measures wind speed? a) Hygrometer b) Rain gauge c) Anemometer d) Thermometer	c
7	Rainfall is measured using a _____. a) Thermometer b) Rain gauge c) Hygrometer d) Barometer	b
8	Climate directly influences the _____ of buildings. a) Colour only b) Structural design only c) Architectural design d) Cost only	c
9	Which climate receives very little rainfall? a) Composite b) Hot-Dry c) Cold d) Warm-Humid	b
10	Chennai is an example of _____ climate. a) Cold b) Warm-Humid c) Hot-Dry d) Mountain	b
11	The normal human body temperature is approximately _____. a) 35°C b) 36°C c) 37°C d) 40°C	c
12	Heat loss through sweating is called _____. a) Radiation b) Evaporation c) Conduction d) Reflection	b
13	Which climatic factor most affects evaporation from the human body? a) Humidity b) Latitude c) Altitude d) Soil type	a
14	Effective temperature is an index combining _____. a) Temperature and humidity b) Rainfall only c) Wind only d) Pressure only	a
15	Air movement increases heat loss by _____. a) Convection b) Radiation c) Reflection d) Absorption	a
16	High humidity generally makes people feel _____. a) Cooler b) Shorter c) Lighter d) Warmer	d
17	Mahony Tables are mainly used for _____. a) Soil testing b) Climate-responsive building design c) Structural analysis d) Cost estimation	b
18	Which of the following is recommended for hot-dry climates? a) Large windows b) Thick walls c) Glass roofs d) Open courtyards without shade	b
19	In warm-humid climates, buildings should provide _____. a) Minimum ventilation b) No windows c) Maximum cross ventilation d) Thick concrete roofs only	c
20	Which climate requires compact building forms to reduce heat loss? a) Warm-Humid b) Hot-Dry c) Composite d) Cold	d

21	The main objective of climate-responsive building design is to _____. a) Increase construction cost b) Improve thermal comfort with minimum energy use c) Reduce building height d) Increase window area only	b
Analytical MCQs		
22	A town located at an altitude of 2,000 m experiences lower temperatures than a nearby coastal city. The primary climatic factor responsible is: a) Latitude b) Humidity c) Altitude d) Wind speed	c
23	Which combination of climatic elements is most important when designing naturally ventilated buildings? a) Rainfall and vegetation b) Wind direction and temperature c) Soil type and geology d) Latitude and longitude	b
24	Which climatic classification is characterized by high temperatures and high humidity throughout the year? a) Hot-humid b) Cold c) Temperate d) Composite	a
25	Effective Temperature (ET) combines the effects of: a) Wind and rainfall only b) Temperature, humidity and air movement c) Rainfall and altitude d) Latitude and longitude	b
26	According to climatic design principles, buildings in hot-humid climates should have: a) Flat roofs with black finish b) Large shaded openings c) Thick masonry walls only d) Underground rooms	b
27	A school building is proposed in Chennai, where temperatures are high and humidity is also high. Which design strategy is most appropriate? a) Thick stone walls with small windows b) Dark-colored roofs c) Underground classrooms d) Large shaded windows with cross ventilation	d
28	An architect observes that occupants feel uncomfortable despite an air temperature of 27°C because humidity is 90%. What is the most likely reason? a) Excessive radiation loss b) Low metabolic rate c) Reduced evaporation of sweat d) Increased conduction	c
29	Two cities are at the same latitude, but one is located in the mountains and the other at sea level. Which city will generally have the lower average temperature? a) Sea-level city b) Mountain city c) Both the same d) Cannot be determined	b
30	A building achieves thermal comfort without mechanical cooling by maintaining heat balance between occupants and the environment. This principle is known as: a) Structural equilibrium b) Human heat balance c) Climatic zoning d) Environmental impact	b

PART B

Q.No	Descriptive Questions
1	Explain the relationship between climate and civilization. Discuss how climate influences human settlements, culture, agriculture, and architecture.
2	Explain the components of climate and their significance in building design.
3	Explain the various modes of heat loss from the human body.
4	What is Effective Temperature (ET)? Explain its significance in thermal comfort.
Analytical Descriptive Questions	
5	Analyze how climate has influenced the development of human civilization and architectural styles.

UNIT II **SOLAR SHADING DEVICES**

S.No	PART A -MCQs	Answer
1	The sun rises in the _____ and sets in the _____. a) North, South b) South, North c) East, West d) West, East	c
2	The position of the sun in the sky is determined by: a) Solar altitude and solar azimuth angles b) Latitude and longitude only c) Wind direction and humidity d) Rainfall and temperature	a
3	A sun path diagram is used to: a) Measure rainfall b) Predict wind direction c) Show the apparent movement of the sun throughout the year d) Measure humidity	c
4	The overhead sun occurs when: a) Solar altitude is 45° b) Solar altitude is 90° c) Solar azimuth is 90° d) Declination is 0°	b
5	Chennai experiences the overhead sun: a) Once a year b) Twice a year c) Three times a year d) Never	b
6	Solar shading devices are mainly used to: a) Increase heat gain b) Prevent rainfall c) Increase daylight only d) Reduce unwanted solar radiation entering buildings	d
7	Which factor does not affect the sun's position? a) Latitude b) Time of day c) Day of the year d) Building height	d
8	The longest shadow during the day occurs: a) At noon b) At midnight c) In the early morning and late evening d) During sunset only	c
9	On the Equinox (March 21 and September 23), the sun rises approximately in the: a) North b) East c) South d) West	b
10	Which of the following locations receives the overhead sun twice every year? a) Arctic Circle b) Tropic of Capricorn c) Equator d) North Pole	c
11	Shadow angle calculations are useful for: a) Water supply design b) Designing effective shading devices c) Soil testing d) Traffic planning	b
12	The shadow angle used in shading design is measured between: a) The wall and the roof b) The sun's rays and the building surface c) The foundation and the wall d) Two walls	b
13	The Vertical Shadow Angle (VSA) is measured: a) In a vertical plane perpendicular to the wall b) In a horizontal plane only c) Along the floor d) Along the ceiling	a
14	Which direction receives the strongest afternoon solar radiation? a) North b) South c) East d) West	d
15	Which tool is commonly used by architects to design effective shading? a) Psychrometric Chart b) Sun Path Diagram c) Bar Chart d) Wind Rose only	b
16	Buildings in hot climates require: a) Maximum solar heat gain b) Effective solar shading c) Thick snow insulation d) No ventilation	b
17	The sun's path is longest during: a) Summer Solstice b) Winter Solstice c) Autumn Equinox d) Spring Equinox	a
18	Which shading device is most suitable for high-angle summer sun? a) Vertical fins b) Louvers facing downward only c) Horizontal overhangs d) Curtains only	c
19	The sun path changes throughout the year because of: a) Earth's magnetic field b) Wind movement	d

	c) Moon's orbit d) Earth's axial tilt and revolution around the Sun	
20	The main objective of studying the sun's movement in building design is to: a) Increase construction cost b) Improve thermal comfort and energy efficiency c) Increase building height d) Reduce ventilation	b
21	In tropical climates, proper solar shading helps to: a) Increase artificial lighting demand b) Reduce indoor heat gain and improve occupant comfort c) Increase building weight d) Increase air pollution	b
	Analytical MCQs	
22	A building in Chennai (13°N latitude) has its south-facing windows receiving direct sunlight during winter afternoons. Which shading device is most effective? a) Vertical fins only b) Horizontal overhangs only c) Combination of horizontal overhangs and vertical fins d) No shading is required	c
23	A classroom faces east. Which period is most critical for designing shading devices? a) Afternoon only b) Early morning c) Midnight d) Noon during winter	b
24	During the overhead sun period, the shadow cast by a vertical pole is: a) Long and directed north b) Long and directed south c) Nearly zero or extremely short d) Equal to the pole height	c
25	If the solar altitude angle increases from 30° to 70°, the shadow length of a building will: a) Increase significantly b) Remain unchanged c) Decrease significantly d) Become twice the building height	c
26	A building designer ignores shadow angle calculations while designing an office building. The most likely consequence is: a) Reduced structural strength b) Poor daylight and increased solar heat gain c) Better ventilation d) Improved acoustics	b
27	Vertical fins are generally preferred for: a) South-facing walls in tropical regions b) East- and west-facing walls receiving low-angle sunlight c) Roof shading only d) North-facing walls	b
28	A sun path diagram indicates that the sun's altitude is highest on June 21 in the Northern Hemisphere. This information helps architects: a) Select foundation depth b) Design effective roof overhangs c) Determine concrete mix d) Calculate earthquake loads	b
29	An architect wants to reduce cooling load in a tropical building. Which design decision is most appropriate after studying the sun path diagram? a) Provide shading devices based on seasonal solar angles. b) Increase west-facing glazing without shading. c) Remove roof insulation. d) Increase window area on all sides equally.	a
30	Why is knowledge of the movement of the sun important in sustainable building design? a) It determines concrete strength. b) It helps optimize daylight, thermal comfort, and energy efficiency. c) It predicts earthquakes. d) It improves water supply systems.	b

PART B

Q.No	Descriptive Questions
1	Explain the apparent movement of the sun and its significance in building design.
2	Explain shadow angles and their importance in shading design.
3	Explain how solar angles influence building orientation and window design.
4	Explain the importance of studying the movement of the sun in sustainable architecture.
	Analytical Descriptive Questions
5	Explain how knowledge of solar geometry helps civil engineers in planning and designing buildings.

HEAT FLOW THROUGH BUILDING ENVELOPE CONCEPTS

S.No	PART A -MCQs	Ans
1	Heat transfer through a solid material mainly occurs by: a) Convection b) Radiation c) Conduction d) Evaporation	c
2	Thermal conductivity is defined as: a) Resistance to heat flow b) Ability of a material to conduct heat c) Heat stored in a material d) Heat lost by radiation	b
3	The SI unit of thermal conductivity is: a) W/m ² K b) W/mK c) J/kgK d) m ² K/W	b
4	Thermal resistivity is the: a) Reciprocal of thermal conductivity b) Product of conductivity and temperature c) Heat capacity of a material d) Rate of heat transfer	a
5	A material with high thermal conductivity is: a) Cork b) Wood c) Copper d) Glass wool	c
6	The SI unit of specific heat is: a) W/mK b) J/kgK c) W/m ² K d) J/m ³	b
7	Thermal resistance is expressed in: a) W/mK b) m ² K/W c) J/kgK d) W/K ²	b
8	Thermal capacity depends on: a) Density only b) Conductivity only c) Mass and specific heat d) Surface area only	c
9	Air cavities in walls primarily act as: a) Heat generators b) Reflectors only c) Conductors d) Thermal insulators	d
10	The U-value represents: a) Thermal resistance b) Overall heat transfer coefficient c) Heat storage capacity d) Solar radiation intensity	b
11	The SI unit of U-value is: a) W/mK b) W/m ² K c) J/kgK d) m ² K/W	b
12	A lower U-value indicates: a) Higher heat transfer b) Poor insulation c) Better insulation d) High thermal conductivity	c
13	Buildings in hot climates benefit from: a) High time lag b) Low time lag c) No insulation d) Thin walls only	a
14	Which building material provides a higher time lag? a) Glass b) Concrete c) Aluminum sheet d) Plastic	b
15	The building envelope primarily separates: a) Interior and exterior environments b) Foundation and soil c) Roof and wall d) Building and road	a
16	Which type of glass reduces solar heat gain? a) Clear glass b) Frosted glass only c) Plain glass d) Low-E glass	d
17	Double-glazed glass improves: a) Sound only b) Thermal insulation c) Structural strength only d) Fire resistance only	b
18	Which glass has a reflective coating to reduce heat gain? a) Reflective glass b) Float glass c) Wired glass d) Acrylic glass	a
19	Laminated glass consists of: a) One glass sheet only b) Plastic only c) Two or more glass sheets bonded with an interlayer d) Fiberglass only	c
20	Which property helps a wall resist heat flow?	

	a) High U-value b) High thermal resistance c) High conductivity d) Low thickness	b
21	Which material is commonly used as thermal insulation? a) Steel b) Glass wool c) Copper d) Aluminum	b
Analytical MCQs		
22	A brick wall has high thermal resistance. What is the primary advantage of this property in a hot climate? a) Faster heat transfer indoors b) Reduced heat flow into the building c) Increased indoor humidity d) Increased solar radiation	b
23	If two walls have equal thickness, the wall with lower thermal conductivity will: a) Transfer more heat b) Transfer less heat c) Have higher density d) Store less heat	b
24	Thermal resistivity is the: a) Product of conductivity and density b) Ratio of heat flow to temperature c) Sum of conductivity and resistance d) Reciprocal of thermal conductivity	a
25	Time lag is: a) Delay between outdoor and indoor peak temperatures b) Time required for heat generation c) Time required to cool the room d) Duration of solar radiation	a
26	Decrement factor indicates: a) Reduction in heat flow amplitude b) Increase in conductivity c) Wall thickness d) Solar radiation intensity	b
27	Increasing wall thickness generally: a) Increases thermal resistance b) Reduces thermal resistance c) Increases conductivity d) Decreases time lag	a
28	Which combination provides the best indoor thermal comfort? a) High U-value and low time lag b) Low U-value and high time lag c) High conductivity and low resistance d) Thin walls and clear glass	b
29	Why are insulated glass units (IGUs) preferred in modern buildings? a) They increase solar heat gain. b) They reduce energy consumption. c) They eliminate daylight. d) They reduce structural strength.	b
30	An architect wants to reduce heat entering a building in summer while allowing daylight. The best choice is: a) Single clear glass b) Thin aluminum panel c) Double-glazed Low-E reflective glass d) Steel sheet	c

PART B

Q.No	Descriptive Questions
1	Explain the relationship between climate and civilization. How has climate influenced the development of human civilization?
2	Explain the factors that determine the climate of a place.
3	Explain the components of climate and their significance in building design.
4	Explain the climatic classification for building designers in tropical regions.
Analytical Descriptive Questions	
5	Explain human thermal comfort and the factors affecting it.

UNIT IV

INDO ARYAN STYLE

S.No	PART A -MCQs	Ans
1	Which instrument is used to measure wind speed? a) Thermometer b) Hygrometer c) Anemometer d) Barometer	c
2	The direction of wind is mainly influenced by: a) Rainfall b) Temperature difference and pressure gradient c) Humidity only d) Soil type	b
3	Hills and mountains affect wind by: a) Stopping all wind completely b) Changing its speed and direction c) Reducing humidity only d) Increasing rainfall only	b
4	Buildings should be oriented to: a) Block all wind b) Avoid sunlight completely c) Face west only d) Maximize beneficial natural ventilation	d
5	Good natural ventilation requires: a) Openings on opposite walls b) One window only c) Thick walls only d) Small rooms	a
6	Cross ventilation occurs when: a) Air enters and exits through opposite openings b) Air enters through the roof c) Air moves underground d) Air enters through doors only	a
7	The main purpose of ventilation is to: a) Increase indoor humidity b) Remove stale air c) Block sunlight d) Reduce building height	b
8	Fans improve thermal comfort mainly through: a) Evaporation of sweat b) Heating the room c) Reducing pressure d) Increasing rainfall	a
9	Which fan is commonly used in residential buildings? a) Exhaust fan b) Ceiling fan c) Industrial fan d) Blower	b
10	Stack effect occurs because of: a) Difference in wind speed b) Temperature difference between indoor and outdoor air c) Rainfall d) Humidity	b
11	Warm air in stack effect tends to: a) Move downward b) Remain stationary c) Rise upward d) Move sideways only	c
12	Stack effect is stronger in: a) Short buildings b) Open fields c) Underground buildings d) Tall buildings	d
13	Which feature improves stack ventilation? a) Chimney b) Basement c) Balcony d) Porch	a
14	The Venturi effect causes: a) Increase in air velocity b) Increase in humidity c) Decrease in rainfall d) Increase in temperature	a
15	Courtyards help buildings by: a) Blocking all air movement b) Preventing daylight c) Increasing indoor pollution d) Improving natural ventilation	d
16	Which of the following creates thermally induced air currents? a) Temperature difference b) Rainfall c) Earthquake d) Soil erosion	a
17	Air movement inside buildings improves: a) Indoor air quality b) Noise pollution c) Dust accumulation d) Structural load	a
18	Windbreaks such as trees are used to: a) Increase wind speed b) Stop sunlight completely c) Reduce excessive wind speed d) Increase humidity	c
19	Which opening is most effective for hot air to escape? a) Low-level window b) Roof ventilator c) Basement vent d) Floor opening	b
20	Which climatic design feature enhances passive cooling?	

	a) Courtyard b) Thick carpet c) False ceiling only d) Basement	a
21	Air movement inside a building depends mainly on: Wall colour b) Size and location of openings c) Floor finish d) Roof material only	b
Analytical MCQs		
22	A building is located on a hilltop where strong winds are common. Which design strategy best reduces excessive wind pressure? a) Increase window size on windward side b) Use windbreaks and landscaping c) Build without setbacks d) Increase building height	b
23	A building surrounded by tall structures receives poor natural ventilation because: a) Wind speed increases b) Solar radiation increases c) Wind shadow is created d) Air density decreases	c
24	Which topographical feature usually increases wind speed? a) Dense forest b) Narrow mountain pass c) Large lake d) Open courtyard	b
25	During daytime near the coast, air moves from sea toward land because: a) Land cools faster b) Ocean pressure becomes higher permanently c) Sea heats faster d) Land heats faster	d
26	The primary objective of climate-responsive building design is to: a) Increase energy consumption b) Improve occupant comfort using natural resources c) Reduce building life d) Eliminate ventilation	b
27	Why are opposite openings provided in naturally ventilated buildings? a) To improve cross ventilation b) To reduce air movement c) To increase humidity d) To reduce daylight	a
28	Which design feature minimizes wind turbulence around buildings? a) Sharp building corners b) Rounded building edges c) Very tall compound walls d) No openings	b
29	Why are ceiling fans effective even when air temperature remains unchanged? a) They reduce humidity b) They increase air movement and evaporation from the skin c) They lower atmospheric pressure d) They produce cool air	b
30	An architect wants to maximize natural ventilation in a tropical building. Which combination is the best? a) Small windows, thick walls, no courtyard b) Opposite openings, courtyard, proper orientation to prevailing wind c) Fully sealed building d) Windows on one side only	c

PART B

Q.No	Descriptive Questions
1	Explain air currents around buildings and the factors affecting them.
2	Explain air movement through buildings and the principles of natural ventilation.
3	Explain the stack effect and its application in building design.
4	Explain the importance of courtyards in climate-responsive building design.
Analytical Descriptive Questions	
5	Discuss passive design strategies for improving natural ventilation in buildings.

UNIT V

INDO ISLAMIC AND WORLD ISLAMIC ARCHITECTURE

S.No	PART A -MCQs	Ans
1.	The primary design objective in a warm humid climate is to: a) Maximize heat gain b) Reduce ventilation c) Promote natural ventilation and shading d) Increase thermal mass	c
2.	In hot and dry climates, buildings should generally have: a) Large glass facades b) Thick walls with high thermal mass c) Large openings on all sides d) Lightweight construction only	b
3.	Which roofing material is most suitable for reducing heat gain in hot climates? a) Dark asphalt b) Reflective cool roof c) Black metal sheet d) Dark concrete roof	b
4.	In cold climates, the building should be designed to: a) Maximize heat loss b) Avoid insulation c) Increase ventilation throughout the day d) Maximize solar heat gain	d
5.	Which window orientation provides maximum winter solar gain in India? a) North b) South c) East d) West	b
6.	Which of the following helps reduce indoor temperature naturally? a) Reflective roofing b) Dark roof paint c) Black walls d) Glass roof without shading	a
7.	Which landscape element helps cool the surrounding environment? a) Concrete pavement b) Water bodies and vegetation c) Asphalt roads d) Metal fencing	b
8.	Climate-responsive design mainly aims to: a) Increase energy consumption b) Improve indoor comfort using natural resources c) Eliminate natural lighting d) Increase artificial cooling	b
9.	Which organization developed the LEED rating system? a) GRIHA Council b) US Green Building Council (USGBC) c) BRE Global India d) TERI	b
10.	LEED stands for: a) Leadership in Energy and Environmental Design b) Low Energy Environmental Design c) Leadership for Eco Engineering Design d) Local Environmental Energy Development	a
11.	GRIHA is India's: a) Water conservation policy b) Pollution control act c) Solar energy mission d) National green building rating system	d
12.	Which parameter is evaluated in all major green building rating systems? a) Energy efficiency b) Color of walls c) Furniture design d) Brand of materials	b
13.	Which rating system was introduced first? a) LEED b) GRIHA c) BREEAM d) EDGE	c
14.	BREEAM stands for: a) Building Research Establishment Environmental Assessment Method b) Building Resource Energy Assessment Method c) Basic Renewable Environmental Assessment Model d) Building Rating for Energy Efficiency Assessment Method	a
15.	Which renewable energy source is most commonly integrated into green buildings? a) Coal b) Solar photovoltaic panels c) Diesel generators d) Natural gas boilers	b
16.	Day lighting primarily helps in: a) Increasing electricity consumption b) Reducing artificial lighting demand c) Increasing indoor temperature only d) Eliminating windows	b
17.	Which Indian building is a well-known example of a GRIHA-rated green building? a) Rashtrapati Bhavan (certain complexes) b) Taj Mahal c) India Gate d) Charminar	a
18.	Which of the following is a LEED-certified iconic building?	a

	a) Empire State Building (after green retrofit) b) Eiffel Tower c) Leaning Tower of Pisa d) Big Ben	
19.	Which feature is commonly found in green buildings? a) Efficient HVAC systems b) Excessive artificial lighting c) Poor insulation d) No waste management system	a
20.	The main objective of climate-responsive architecture is to: a) Increase construction cost b) Reduce environmental impact and improve occupant comfort c) Increase dependence on air conditioning d) Use only imported materials	b
21.	GRIHA is India's: a) Water conservation policy b) National green building rating system c) Solar energy mission d) Pollution control act	b
	Analytical MCQs	
22	BREEAM originated in: a) USA b) India c) UK d) Australia	c
23	Rainwater harvesting contributes mainly to: a) Water Efficiency b) Indoor Air Quality c) Structural Design d) Fire Protection	a
24	Green roofs primarily help in: a) Increasing heat gain b) Reducing storm water runoff and cooling buildings c) Increasing electricity use d) Reducing daylight	b
25	Which climate benefits from compact building forms? a) Warm humid b) Cold climate c) Coastal climate d) Tropical climate	b
26	Wind towers are commonly used in: a) Hot and dry climates b) Cold climates c) Mountain regions d) Humid climates	a
27	Which renewable energy source is commonly integrated into green buildings? a) Diesel generator b) Gas boiler c) Coal furnace d) Solar PV	d
28	Which building rating system was developed in India? a) LEED b) BREEAM c) GRIHA d) WELL	c
29	Day lighting reduces: a) Cooling b) Artificial lighting energy c) Rainwater use d) Structural load	b
30	A building with minimum energy consumption is called: a) Smart Building b) Passive Building c) Industrial Building d) Temporary Building	b

PART B

Q.No	Descriptive Questions
1	Explain the design strategies for buildings in Warm Humid and Hot Humid Climates.
2	Discuss the design strategies suitable for Hot and Dry Climates.
3	Explain the design principles for Cold Climate Buildings.
4	Explain Climate Responsive Building Design with suitable examples.
	Analytical Descriptive Questions
5	Describe the importance of Climate Responsive Design and Green Building Concepts in Sustainable Development.