Unit 46: The Underpinning Science for the Provision of Human Comfort in Buildings

Unit code: M/600/0296

QCF Level: 3

Credit value: 10

Guided learning hours: 60

Unit aim

This unit is designed to give learners knowledge of the factors that influence human comfort and an understanding of the principles for the provision of electric power. Learners will also develop skills in applying scientific principles to provide a comfortable internal environment and in performing calculations relating to fluids.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes	Assessment criteria
1 Know the factors that influence human comfort	1.1 Describe four physical factors that influence human comfort in the internal environment
	1.2 Describe four personal factors that influence human comfort in the internal environment
	1.3 Describe four methods used to measure factors that affect human comfort
	1.4 Identify acceptable comfort parameters
2 Be able to apply scientific principles to provide a comfortable internal environment	2.1 Describe the scientific principles that underpin heating, ventilation, acoustics and lighting
	2.2 Perform four separate calculations associated with the provision of a comfortable internal environment

3 Understand the generation, transmission and distribution of electrical power	3.1 explain the generation, transmission and distribution of electricity using appropriate principles and practices
4 Be able to perform calculations relating to fluids at rest and in motion	4.1 Differentiate between the properties of fluids at rest and in motion
	4.2 Produce analytical solutions to problems relating to fluids

Unit content

1 Know the factors that influence human comfort

Human comfort in the internal environment: heating and ventilation; acoustics; lighting

Heating and ventilation: physical factors (air temperature, mean radiant temperature, relative humidity, air movement); personal factors eg clothing, age, gender, activity, metabolism; integrated thermal comfort temperatures eg dry resultant, inside environmental, room centre comfort, apparent; methods used to measure each physical factor eg thermometer, globe thermometer, hygrometer, anemometer; acceptable comfort parameters

Acoustics: factors (sound reduction indices, reverberation times, noise criteria indices); sound level meter to measure each factor; acceptable comfort parameters

Lighting: factors (illuminance levels, daylight factors, glare indices); methods used to measure each factor eg light meter, daylight meter; acceptable comfort parameters

2 Be able to apply scientific principles to provide a comfortable internal environment

Heating and ventilation: principles of heat in buildings (U values, thermal bridges, air changes, fabric and ventilation heat losses, heat gains, heat balance); principles of condensation in buildings (sources of water vapour in buildings, structural temperature profiles, dew-point temperature profiles, prediction and prevention of condensation); standard calculations to support the above

Acoustics: principles of sound (standard units, addition and averaging of decibel levels, difference between sound and noise, techniques used to control noise, difference between sound insulation and sound absorption, difference between airborne and impact sound, issues associated with flanking transmission, techniques used to provide adequate sound insulation, sound absorption coefficients, reverberation, actual and optimum reverberation times); standard calculations to support the above

Lighting: principles of illumination (standard units, differences between natural and artificial light, advantages and disadvantages of each, inverse square law of illumination, cosine law of illumination, lumen method of design, daylight factor, components of daylight factor, desktop methods to determine daylight factor, control of glare for both artificial and natural light sources); standard calculations to support the above

3 Understand the techniques used in the construction of superstructures for low-rise domestic and commercial buildings

Principles of superstructure design: principles of design and factors affecting choice of primary and secondary elements (floors, walls, roofs, stairs, windows, doors) Superstructure construction: techniques used for construction of primary and secondary elements (floors, walls, roofs, stairs, windows, and doors); selection of materials; economic implications of methods used; plant and equipment requirements; health and

safety issues; environmental issues; legislative constraints to include the code for sustainable homes

Superstructure finishes: factors affecting the choice of internal and external finishes; types of finish available and methods used in their application; economic implications of methods used; plant requirements; health and safety issues; environmental issues; legislative constraints

4 Understand the generation, transmission and distribution of electrical power

Principles: nature of electricity; relationship between voltage, current, resistance and power; electromagnetic induction; alternating current wave form; power losses during transmission at different voltages; consequent need to transform AC voltages; nature of three-phase supply

Practices: practical generation of alternating current; standard sources of heat energy used to drive generators eg nuclear reaction or combustion of coal, oil or gas; transformation of alternating current; distribution of single-phase and three-phase electricity supplies to buildings

5 Be able to perform calculations relating to fluids at rest and in motion

Fluids at rest: properties (pressure at a given depth equal in all directions, always acts at right angles to any containing surface, magnitude affected by depth but not by volume or shape); standard calculations (actual pressure at a depth, force acting on a retaining wall, position of depth of centre of pressure)

Fluids in motion in pipes and channels: properties (difference between laminar flow and turbulent flow, total energy a constant); principles and uses of flow measurement devices, eg venturimeters, orifices, notches, weirs, Pitot tubes; standard calculations to support the above, eg volume flow rate, continuity equation, Bernoulli's theorem, Chezy formula for self-cleansing flow; D'Arcy formula for loss of head due to friction