

unit : I

Thermal Applications

Two mark questions

1. Define heat Conduction

Conduction is the process of transmission of heat from one point to another through substance without the actual of the particles of the substance.

2. Define coefficient of thermal conductivity and mention its unit.

It is defined as the quantity of heat conducted per second normally across unit area of cross-section per unit temperature difference per unit length of the material.

Its unit is $\text{Wm}^{-1}\text{K}^{-1}$

3. Derive the unit in which thermal conductivity is measured.

$$k = \frac{Qx}{A(\theta_1 - \theta_2)l}$$

$$k = \frac{\text{joule} \times \text{metre}}{(\text{metre})^2 \times \text{kelvin} \times \text{second}}$$

$$= \frac{\text{joule}}{\text{second} \times \text{metre} \times \text{kelvin}}$$

$$= \frac{\text{watt}}{\text{metre} \times \text{kelvin}}$$

$$= \text{Wm}^{-1}\text{K}^{-1}$$

4. What is thermal resistance?

The thermal resistance of a body is a measure of its opposition to the flow of heat through it.

5. Write down an expression for the amount of heat conducted through a compound media of two layers.

$$Q = \frac{A(\theta_1 - \theta_2)}{\frac{x_1}{k_1} + \frac{x_2}{k_2}}$$

A - Area of the cross section

θ_1 - Temperature at the outer face of the material at hot end.

θ_2 - Temperature at the outer face of the material at cold end.

x_1 - thickness of the material at hot end

x_2 - thickness of the material at cold end

k_1 - thermal conductivity of the material at hot end.

k_2 - thermal conductivity of the material at cold end.

6. Mention the methods to determine thermal conductivity of good and bad conductors.

Seele's method - for good conductors like metallic rod

Forbe's method - for determining the absolute conductivity of metals

Lee's disc method - for poor conductors

Radial flow method - for bad conductors.

7. What are three modes of transferring heat?

- Conduction
- Convection
- Radiation

8. Define convection

It is the process in which heat is transmitted from one place to another by the actual motion of the heated particles.

9. Define radiation.

It is the process in which heat is transmitted from one place to the other directly, without the agency of any material medium.

10. Define fenestration

It is defined as any opening or arrangement of openings in a building.

12. What are the various fenestration systems?

There are various fenestration systems like glazing, windows, curtain walls, sloped glazing and exterior doors.

13. What are the three main components of fenestration?
- i) Glazing
 - ii) Framing
 - iii) Shading devices and/or screens.

14. What is the total heat transfer through fenestration?
The heat gain through fenestration consists of two main components.

• Q_{thermal} = heat transfer between indoor and outdoor air.

This is positive or negative depending on temperature.

• Q_{solar} = heat transfer from solar radiation

This is always a positive number.

The total heat transfer through fenestration

$$Q_{\text{total}} = Q_{\text{thermal}} + Q_{\text{solar}}$$

15. Mention a few methods of thermal insulation

- use of materials with low conductivity
- Thickness of walls and roofs
- Provision of air spaces
- Heat insulation by orientation
- Thermal insulation by shading
- Providing sufficient height of ceiling.

16. What is thermal performance of buildings?

It refers to the process of modeling the energy transfer between building and its surroundings.

17. What is thermal comfort?

It is the condition of mind that expresses satisfaction with the thermal environment and it is assessed by subjective evaluation. It is the occupants' satisfaction with the surrounding thermal conditions.

18. What is the need for shading devices?

Well-designed sun control and shading devices can dramatically reduce building peak heat gain and cooling requirements. These devices also improve the natural lighting quality of building interiors.

19. How are shading devices classified?

- i) Internal shading devices
- ii) External shading devices.

20. What is central heating?

A central heating system provides warmth to the whole interior of a building or portion of a building from one point to multiple rooms.

unit : II

Ventilation and Refrigeration

Two mark questions

1. What is Ventilation ?

The term ventilation is used to mean the free passage of clean air in a structure. In other words, the removal of all vitiated air from a building and its replacement with fresh air is known as ventilation.

2. What are the factors affecting ventilation?

- i) Air changes
- ii) Humidity
- iii) Quality of air
- iv) Temperature
- v) use of building.

3. What are the types of ventilation?

- i) Natural ventilation
- ii) Mechanical or artificial ventilation

4. What are the methods of artificial ventilation?

- i) Exhaust system
- ii) Supply system
- iii) Combination of exhaust and supply systems
- iv) Plenum process
- v) Air conditioning

5. What is air conditioning?

It is defined as the process of controlling and maintaining the properties of air like temperature, humidity, purity, direction of flow etc, in a closed space.

6. What is the principle of air conditioning?

An air conditioner continuously draws the air from an indoor and cools it by the refrigeration principles and discharges it back into the same indoor space.

7. What is a window air conditioner?

Window air conditioner is also known as room air conditioner.

- It is designed to condition the air in a single room or a large scale.

- It is called a window air conditioner because it is usually installed in a window.

8. What are the components of a window air conditioner?

i) Compressor

vi) Fan

ii) Condenser

vii) Thermostat

iii) Air filter

iv) Evaporator

v) Motor

9. What are the advantages of the window air conditioner?

- For each unit an individual temperature control device is provided.
- For air distribution, ducts are not required.

10. What are the disadvantages of the window air conditioner?

- The unit is installed outside the wall.
- This unit has a fixed air quantity.

11. What is packaged air conditioner?

Packaged air conditioner is a self-contained unit primarily for floor mounting, designed to provide conditioned air to the space to be conditioned.

12. What is chilled plant water?

Chilled water is extensively used as a secondary refrigerant in a larger commercial, institutional and industrial premises to make cooling available over a large area.

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13. What is a cooling load?

It is defined as the total heat required to be removed from the space in order to bring it to the desired temperature by air conditioning and refrigerating equipment.

14. What are the different air conditioning systems?

- i) Central Air Conditioning
- ii) Split Air Conditioner
- iii) Window Air Conditioner
- iv) Portable Air Conditioner
- v) Hybrid Air Conditioner.

15. What are the common causes of AC fire?

- i) Failing to keep cleaned properly
- ii) Storing flammable materials near the AC system.
- iii) Faulty parts and equipment.

unit - III

Acoustics and Lightning Design

Two mark questions

1. Enumerate the ways in which sound is classified?

Sound is classified on the basis of frequency

i) Infrasonics (frequency less than 20 Hz)

ii) Audible Sound (frequency in between 20 Hz and 20,000 Hz)

iii) Ultrasonics (frequency greater than 20 Hz)

2. Define absorption coefficient of a material.

What is its unit?

The absorption coefficient of a material is defined as the ratio of sound energy absorbed by its surface to that of the total sound energy incident on the surface.

The unit of absorption coefficient is open window unit (O.W.U)

3. What are the acoustical factors to be considered while we construct any buildings?

- Reverberation time
- Loudness
- Echelon effect
- Focussing
- Resonance
- Echoes
- Noises

4. Mention any four sound absorbing materials
Carpets, glass, wool, hair, furniture also wood
foam materials, audience.

5. What is noise? How is it classified?
Unwanted sound reaching our ears is called
the noise.

There are three types of noises.

- Inside noise
- Airborne noise
- Structure borne noise

6. What are sound absorbing materials?

The special materials used to increase the
absorption of sound waves or to reduce the reflection
of sound waves in a room or hall are known as
sound absorbing materials.

7. What are the requirements of a good acoustical
material.

- It should be easily available at a reasonable
cost.
- It should be fire resistant.
- It should have high coefficient of absorption.
- It should have sufficient structural strength.

8. What are the types of sound absorbing material?

- Porous absorbers
- Resonant absorbing or panel
absorbers
- Cavity resonators
- Composite types of absorbers.

9. What are the main actions which causes impact of noise in multistoreyed buildings?

- Speech privacy
- Background noise
- Sound masking
- Orientation of buildings.

10. What is visual field glare?

Glare is difficulty of seeing in the presence of bright light such as sunlight or artificial light. Because of this some cars include mirrors with automatic anti-glare functions.

11. What are types of glare?

- i) Direct glare
- ii) Reflected glare
- iii) Disability
- iv) Discomfort glare
- v) Straback glare.

12. What are the reducing factors of visibility?

- Reduction of brightness of the rest of the scene by constriction of the pupils.
- Reduction in contrast of the rest of the scene by scattering of the bright light within the eye.
- Bloom Surroundings objects in front of glare.
- Reduction in contrast by scattering light in particles in the air.

13. what is daylight?

Daylight or the light of day is the combination of all direct and indirect sunlight during the day time. This includes direct sunlight, diffuse sky radiation and both of these reflected by the earth and terrestrial objects.

14. what is daylight factor?

The daylight factor is defined as

$$DF = \frac{E_i}{E_o} \times 100\%$$

E_i - illuminance due to daylight at a point on the indoors working plane.

E_o - Simultaneous outdoor illuminance on a horizontal plane from an unobstructed hemisphere of overcast sky.

15. what are the forms of artificial sky?

There are two basic forms of artificial sky

i) hemispherical and ii) rectangular.

16. Mention few artificial light sources.

i) Incandescent lamp

ii) Fluorescent tube

iii) Compact fluorescent lamp

iv) Discharge lamps

v) Light Emitting Diode (LED)

unit - IV

New Engineering Materials

Two mark questions

1. What are composite materials ?

Composite materials, are a combination of two or more materials that are different in chemical composition. Composite materials can be a combination of various materials, such as plastics, metals, fibers or ceramics.

2. How are composite materials classified ?

- Fiber - reinforced
- Structural
- Particle - reinforced

3. What is the function of matrix materials ?

In composites, the matrix phase serves important functions. First it binds the reinforcement (fibers) together. It acts as a medium and transmits and distributes the external load to the fibers.

4. What are the type of composites based on the matrix materials ?

- Polymer matrix composites : In this the matrix material is a polymer, reinforced by ceramic.
- Metal matrix composites : In this composite, the matrix is a pure metal or an alloy and the reinforcement is a ceramic phase.

5. What are fibre reinforced plastics and its types ?

- Glass fibre Reinforced Plastics (GFRP)
- Aramid fibre Reinforced Plastics (AFRP)
- Carbon fibre Reinforced Plastics (CFRP)

6. Mention the application of Composites ?

- Commercial aircraft
- Military aircraft
- Missiles
- Space hardware
- Automobile and trucks

7. What are metallic glasses ?

Glass is an amorphous, brittle and transparent solid. The metals are malleable, ductile and exhibit crystalline properties. The metallic glasses have the properties of both metals and glasses.

Metallic glasses are strong, ductile, malleable, opaque and brittle. They have good magnetic properties and high corrosion resistance.

8. What are the types of metallic glasses ?

i) Metal - Metal metallic glasses

Combination of metals

Example :

Metals

Nickel (Ni)

Magnesium (Mg)

Metals

Niobium (Nb)

Zinc (Zn)

ii) Metal - Metalloid metallic glasses

Combinations of metals and metalloids

Example :

Metals

Fe, Co, Ni

Metalloids

B, Si, C, P

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9. What are shape memory alloys?

A group of metallic alloys which shows the ability to return to their original shape or size, when they are subjected to heating or cooling are called shape memory alloys.

10. What are the types of shape memory alloys?

- i) one-way shape memory alloy
- ii) two-way shape memory alloy

11. Give example for shape memory alloys?

- Ni-Ti alloy (Nitinol)
- Cu-Al-Ni alloy

12. Define shape memory effect.

The change in shape of a material at low temperature by loading and regaining of original shape by heating it, is known as shape memory effect.

The shape memory effect occurs in alloys due to the change in their crystalline structure with the change in temperature and stress.

- while loading twinned martensite becomes deformed martensite at low temperature.

- On heating deformed martensite becomes austenite and upon cooling it gets transformed to twinned martensite.

13. What is pseudo elasticity?

Pseudo elasticity occurs in shape memory alloys when it is completely in austenite phase.

Unlike the shape memory effect, pseudo elasticity occurs due to stress induced phase transformation without a change in temperature. The load on the shape memory alloy changes austenite phase into martensite.

14. What are ceramic materials?

Most of the ceramics are compounds of metallic and non-metallic elements. The crystal structure of ceramics is more complex because at least two elements are involved in making a ceramic compound. Ceramics can be used at low as well as high temperatures.

Ceramic materials are obtained by firing them at high temperatures. Traditional ceramics are clay products like bricks, tiles and porcelain. China ceramics are obtained by firing clay products.

15. Give classification of ceramics based on crystal structure

- i) Crystalline Ceramics
- ii) Non-Crystalline Ceramics
- iii) Bonded Ceramics.

16. What is crystalline Ceramics?

Single crystal structure, such as aluminium oxide, magnesium oxide, silicon carbide. Most of the oxides can be considered packing of oxygen ions with the cations occupying the tetrahedral/octahedral sites in the structure.

17. What are non-crystalline Ceramics?

These are usually regarded super cooled liquids. Their molecules are not arranged in regular geometric shapes.

This types of ceramics is used for mirrors, optical lenses, reinforcement fibres of GRP and optical fibres for data transmission.

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18. What are bonded ceramics?

Ceramics contain both crystalline and non-crystalline materials which are bound together by a glassy matrix after firing. This group includes the lining and clay products.

Bonded ceramics are used as electrical insulators, refractory for furnace, spark plugs etc.

19. Mention the steps for the processing of ceramic materials

- i) raw material processing
- ii) fabrication
- iii) densification

20. What are ceramic fibres?

They are known as refractory ceramic fibres. Ceramic fibers comprise a wide range of amorphous or crystalline synthetic mineral fibers characterized by their refractory properties.

They typically are made of alumina, silica and other metal oxides, or less commonly, of nonoxide materials such as silicon carbide.

Most ceramic fibers are compounds of alumina and silica in an approximate 50/50 mixture.

21. What are ferromagnetic ceramics?

The soft magnetic ceramics, exhibits similar properties as that of soft magnetic materials.

The magnetic ceramic materials are classified into three types

- Spinel
- garnets
- hexagonal ferrites.

Q2. What is high alumina ceramics?

- High alumina ceramics contains 85% or more by weight of Al_2O_3 .
- Alumina is nothing but an aluminium oxide (Al_2O_3), which is the oldest engineering ceramic.
- Alumina is produced from bauxite ($Al_2O_3 \cdot 2H_2O$)

unit V

Natural Disasters

Two mark questions

1. What are the causes of hazards?
Some of the hazards which cause environmental degradation are floods, earthquakes, cyclones etc
2. What are the types of hazards?
 - i) Natural hazards
 - ii) Anthropogenic hazards.
3. What are natural hazards?
 - Air related hazards : Hurricanes, cyclones, storms etc
 - Water related hazards : Floods, droughts etc
 - Earth related hazards : Earthquakes, landslides, volcanoes
4. What are anthropogenic hazards?
 - Industrial accidents
 - War, riots, acts of terrorism etc
 - Toxic spills
5. What is earthquake?

An earthquake is caused by a portion of the rigid crust of the earth giving way or getting fractured, some distance below its surface.
6. Define focus and epicentre of earthquake?

The place where the actual fracture occurs is called the focus of the earthquake.
The point nearest to the focus on the surface of the earth is called the epicentre.

7. What are the effects of earthquake?

- i) Ground shaking
- ii) Liquefaction of ground
- iii) Ground displacement
- iv) Land slides
- v) Flood
- vi) Fire
- vii) Tsunami

8. What are the types of surface waves?

- a) Rayleigh waves
- b) Love waves

9. What is seismology?

The study of the seismic waves constitutes the science of seismology. It deals with earthquakes and seismic waves that move through and around the earth.

10. Mention the most important factors affecting seismic hazard at a location

- Earthquake magnitude
- Source to site distance
- Earthquake rate of occurrence
- Duration of ground shaking,

11. What is cyclone?

Cyclones are huge revolving storms in the atmosphere with very strong winds circulating round a central area.

12. What is a Storm Surge?

A Storm Surge is an abnormal rise of sea level near the coast due to which sea water inundates low-lying areas of coastal region. It causes damage to human life and property.

13. How are cyclones classified?

- i) Extra Tropical Cyclones
- ii) Tropical Cyclones

14. What is flood hazard?

The accumulation of large quantity of water at a place or the presence of more water than what can be handled by the drainage of the area is known as flood.

15. Mention the methods of flood prevention

- Plantation on slopes
- Drainage management
- Flood - plain Zoning
- Forecasting