



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 190E219 BUILDING AUTOMATION

IV YEAR /VII SEMESTER

Unit 2- CONTROL LOOPS

Topic : Heat Types and Heat Transfer Principles



Introduction



- In HVAC (Heating, Ventilation, and Air Conditioning) systems, various types of heat are used to achieve the desired indoor temperature and comfort.



Types



Forced Air Heating:

- **Electric Resistance Heating:** Electric coils or elements generate heat when an electric current passes through them. This type of heating is relatively inefficient but is still used in some HVAC systems.
- **Gas or Oil Furnaces:** These systems burn natural gas or oil to generate heat, which is then distributed through a forced-air system using a blower.

Hydronic Heating:

- **Hot Water Radiators:** Boilers heat water, and the hot water flows through radiators or baseboard heaters to release heat into the space.
- **Underfloor Heating:** This system uses hot water pipes or electric heating elements installed beneath the floor to radiate heat upward.
- **Hydronic Air Handlers:** In this setup, heated water is used to warm air in an air handler, which is then distributed through ducts.



Heat Pumps:

- **Air Source Heat Pumps:** These systems use refrigeration cycles to extract heat from outdoor air and transfer it indoors for heating. They can also provide cooling in the summer.
- **Ground Source (Geothermal) Heat Pumps:** These systems use the stable temperature of the ground to exchange heat, providing both heating and cooling.

Solar Heating:

- Solar panels collect energy from the sun and use it to heat a fluid (usually water or a special heat transfer fluid). This heated fluid can then be used for space heating.

Steam Radiators:

- Steam boilers heat water to produce steam, which is then distributed through pipes to radiators. When the steam condenses, it releases heat into the space.



Electric Heat Pumps:

- While electric resistance heating is generally inefficient, heat pumps are a more efficient form of electric heating. They work by moving heat from one location to another and can provide both heating and cooling.

Combination Systems:

- Some HVAC systems use a combination of heating sources, such as a heat pump for moderate heating needs and a gas or oil furnace for extremely cold weather.



Radiant Heating:

- Radiant heating systems use heating elements (such as electric wires or hot water pipes) installed in walls, floors, or ceilings to directly warm objects and surfaces in a space. This type of heating is known for providing even, comfortable warmth.

Pellet Stoves and Wood-Burning Stoves:

- These are standalone heating appliances that burn pellets or wood to produce heat. They can be used as supplementary heating sources in some HVAC systems.



Heat Transfer Principles



- Heat transfer is a fundamental principle in HVAC (Heating, Ventilation, and Air Conditioning) systems.
- Understanding how heat is transferred within these systems is crucial for designing, operating, and optimizing HVAC systems for efficient and effective heating and cooling.
- The three primary methods of heat transfer in HVAC systems are conduction, convection, and radiation,



Conduction



Definition:

- Conduction is the transfer of heat through a solid material or between solids in direct contact.
- Heat is transferred from a region of higher temperature to a region of lower temperature by molecular collisions.

HVAC Application:

- In HVAC systems, conduction is relevant in components like building walls, windows, and insulation materials.
- Effective insulation reduces heat loss or gain through walls and roofs, helping maintain indoor comfort and energy efficiency.



Convection



Definition:

- Convection is the transfer of heat through a fluid (liquid or gas) due to the movement of the fluid itself.
- It can occur naturally (natural convection) or with the assistance of fans or blowers (forced convection).

HVAC Application:

- Convection is central to HVAC systems for both heating and cooling.
- Air is heated or cooled by passing it over a heat source (e.g., a furnace or a cooling coil) or by circulating it through ducts and vents.
- Fans or blowers are used to enhance convection and distribute conditioned air throughout the building.



Radiation



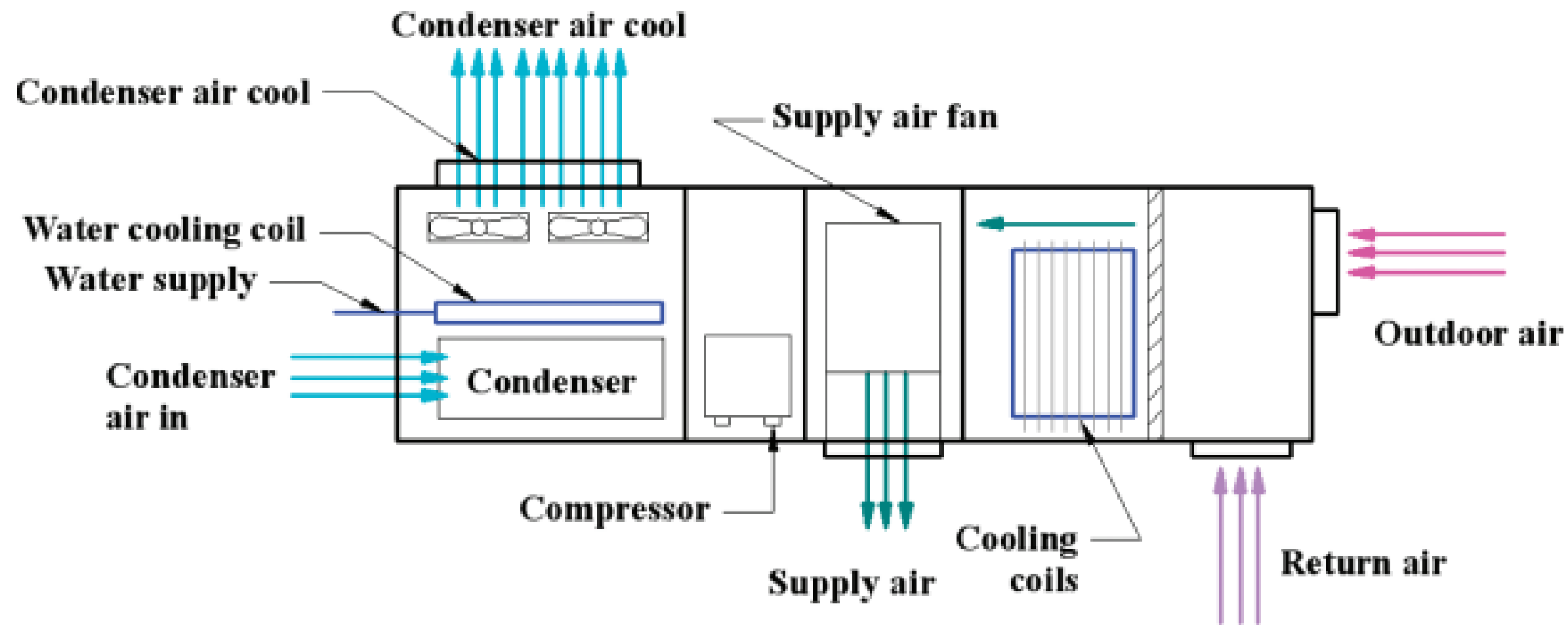
Definition:

- Radiation is the transfer of heat in the form of electromagnetic waves (infrared radiation) without the need for a physical medium.
- All objects emit and absorb thermal radiation based on their temperature and emissivity.

HVAC Application:

- Radiant heating and cooling systems use the principles of radiation to transfer heat.
- Radiant panels or surfaces emit radiant energy to warm nearby objects (including occupants) or absorb heat to cool the environment.
- Radiant systems can provide comfortable and efficient heating and cooling, particularly in spaces with high ceilings or specific occupancy requirements.

1. Can you say this shown in fig. is the example of which method of HVAC?





References



1. Shengwei Wang, “ Intelligent Buildings and Building Automation”, Routledge 2010.
2. Reinhold A, Carlson Robert A, Di Giandomenico, “Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lightning, Building”, R. S Means company limited, 1st edition, 1991.

Thank You