

Course Outline

HVAC DESIGN ENGINEERING

Introduction to HVAC

- Scope of HVAC Industry with overview of Consulting & Construction industry.
- Concepts of Air conditioning systems.
- Codes & Standards
- Principles of air conditioning
 1. Vapour compression cycle
 2. Absorption Chilling system
- Air conditioning systems
- Local cooling comfort System
 1. Window Air conditioning
 2. Split Air conditioning
 3. Multi Split Air conditioning
 4. Chilled water Fan coil unit

- Centrally air conditioned system
 1. Central Air Conditioning System
 2. Chilled water system.

- Psychometric chart
- Properties of Air (DBT, %RH, WBT, HR, DPT, ENTHALPY.)
- Components of AHU & its functioning
 1. Cooling
 2. Heating
 3. Humidification Methods
 4. Dehumidification Methods
 5. Filtration

Refrigerant

- Types of refrigerant
- Evaporating & Condensing properties of refrigerant.
- Refrigerant Pipe sizing methods

Cooling & Heating load estimation.

- Basics of Heat transfer in a building envelop.
- Understanding of Outdoor & Indoor Conditions.
 1. Correction to Outdoor temperature & Indoor temperature requirements
 2. Exposure of Wall, Latitude of Location, Yearly Range, Daily Range etc
 3. Factors affecting the loads estimate.

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- Sources of Heat Gain
 1. External- Sun Gain through Glass/Window, Sun Gain through Roof/Wall, Partition gain
 2. Internal - People, Lights, Electrical Equipments, Motors, Kitchen Appliances, Heat gain through Infiltration air, Heat gain thorough Ventilation & By-pass air, Heat gain through ducts. Calculating ESHF, GTH, ADP, Dehumidified CFM.
- Heat loss calculations
- Basics of Heat loss in a building envelop.
- Sources of Heat loss –
 1. Heat loss through Glass/window, Heat loss through Roof/Wall
 2. Heat loss through Partition Glass/wall/Floor/slab,
 3. Heat loss through Infiltration air/Ventilation air & Bypass air
 4. Heat loss through slab on Grade

Design of Air Distribution System.

- Components of Air distribution system.
- Types of Ducts, Duct Fittings, Dampers, Types of Diffusers, RAG, Flexible Duct, Flexible Connector, End Cap, Sound Attenuator etc.
- Duct Elbows selections (Long radius, Short radius-No throat, Throat elbows, with heel radius, throat radius & radius of elbow).
- Vanes location & number of vanes required
- Duct Material Calculation- GI sheet, Total sheet required in kgs. Gauge of duct & Thickness of Gauge. Hanger Spacing, Hanger Rod Diameter and Angle support Size.
- Duct designing methods.
 1. Velocity reduction method.
 2. Equal friction Method.
 3. Static regain method.
- Fan selection & Static pressure calculation.
- Supply & Return Duct configuration, Assigning Velocity of Air (FPM) to each Section of Supply and Return Duct Low Velocity system, Medium Velocity System and High Velocity System.
- Components of Air Distribution System, Supply and Return Duct configurations (Extended Plenum Systems, Radial System, Trunk and Branch system)
- Stair Well Pressurization System Designing
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Design of Ventilation system.

- Introduction to Ventilation system,
- Components of Ventilation system.

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- Restaurant and Residence Kitchen Ventilation System Design
- Sizing of Hood, Number of filters required & Duct designing.

Chilled Water system design.

- Introduction to Chilled water system, Hot water system.
- Classification of chillers
 1. As per Evaporator.
 2. As per Condenser.
 3. As per compressor.
- Chiller arrangements, Cooling tower arrangement,
- Types of cooling tower & Expansion tank connections.
- Pumps required in Chilled water system
 1. Production Pumps
 2. Distribution Pumps
 3. Pump Classifications.
- Chilled water system pipe designing
- Piping fundamentals
 1. Pipe designators, Piping standards.
 2. Piping fittings and Components.
 3. Valves used in Chilled water system
- Chilled water and Hot water GPM calculation.
- Calculation of Water Velocity FPS on Suction and Discharge side of Pump.
- Hydraulic Design for Sizing the Pipe for Amount of Flow.(Open & Closed Piping Systems).
- District Cooling System.
- Friction loss calculation for the piping system
 1. Friction Loss in Straight Pipes.
 2. Friction Loss in Straight Pipes. Friction Loss in Fittings. Valves used in
 3. Chilled Water System.
 4. Friction Loss in Valves & Special components.
- Calculating TDH for Pump (Open Piping System and Closed Piping System).
- Pipe Sizing Manual Method Hazen-Williams Equation for Calculating Friction Loss.
- Pump Cavitations & NPSH Calculation for Pump.

Equipment Selection

- AHU & FCU classification and selection.

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- Package Unit Selection DX- Chiller Selection.
- Condenser Selection (Air cooled, Water Cooled, Evaporative).
- Cooling Tower Selection Mixed Air Temperature Calculation.
- HRF for Open and Closed Compressor.
- Expansion Tank Selection

Erection of Equipments

- Detailing & Installation of Chillers
- Detailing & Installation of Air handling units.
- Detailing & Installation of Package units.
- Detailing & Installation of Fan coil units.
- Detailing & Installation of Condensing units

Estimation of Project

- Understanding the tendering requirements
- Quantity take off
- Preparing Inquiry for Suppliers & Finalizing the suppliers.
- Final Billing & Quotations finalization

Documents Approvals

- Preparation of Material submittals,
- Shop drawing submittals,
- Types of approval.
- Preparation of BOQ and design documents,
- Specifications.

Project Procurement works

- Identifying the critical equipments
- Preparation of purchase orders
- Letter of Intent
- Letter of credit
- Minutes of meeting

Drafting of HVAC Systems

- Introduction to Drafting,
- Types of Drawings used in the industry,
- Study & Preparation of Floor Drawings,
 1. Roof Drawings,
 2. Sectional Drawings
 3. Builders Work Drawings.