

Syllabus

Mechanical Design Master Course

HVAC | Plumbing | Fire Protection

HVAC DESIGN

- Heat Load Calculation
- Duct Design
- Ventilation
- Equipment Selection



PLUMBING DESIGN

- Water Supply
- Drainage System
- Pipe Sizing



FIRE PROTECTION DESIGN

- Sprinkler System
- Fire Alarm System
- Hydrant System



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WHY CHOOSE THE MECHANICAL DESIGN COURSE?

Build a successful career in Mechanical Building Services by mastering HVAC, Plumbing, and Fire Protection Design through hands-on training and real commercial building projects.

WHY JOIN?

- Learn HVAC, Plumbing & Fire Protection Design from scratch
- Gain hands-on experience with industry-standard design software
- Master engineering calculations and system design principles
- Understand international codes and industry best practices
- Build a professional project portfolio with commercial building projects

WHO'S IT FOR?

- Mechanical Engineering Students & Graduates
- Diploma Holders in Mechanical Engineering
- Freshers aspiring to build a career in Mechanical Building Services Design
- Working Professionals looking to build or advance their careers in Mechanical Building Services Design

WHY BIM CAFE LEARNING HUB?

- Autodesk Authorized Academic Partner
- Industry Experienced Trainers
- Practical Project-Based Learning
- Real Commercial Building Projects
- Industry Standard Curriculum (ASHRAE / SMACNA / IPC / NFPA Standards)
- Job Placement Assistance
- Small Batch Size for Personalized Learning

PLACEMENT SUPPORT

- Resume Preparation
- Interview Guidance
- Portfolio Assistance
- Mock Interviews
- Career Support & Placement Assistance

Prerequisites

- No prior MEP experience required.
- Basic knowledge of Engineering or Diploma-level technical concepts is beneficial.

COURSE OVERVIEW

(HVAC Design | Plumbing Design | Fire Protection Design)

5 Days / Week | 2 Hours / Day

Duration: 3 Months (80–100 Hours Including Project Practice)

Key Highlights

- Complete Mechanical Design Training
- Learn HVAC, Plumbing & Fire Protection Design from Scratch
- Master Engineering Calculations & Equipment Selection
- Hands-on Software Training
- Real Commercial Building Project
- Industry-Oriented Curriculum
- Placement-Oriented Training

Software & Design Tools

Software Covered	
AutoCAD	 AutoCAD
Microsoft Excel	
HAP (Heat Load Calculation)	
McQuay DuctSizer	
McQuay PipeSizer	
CODES & STANDARDS COVERED	
ASHRAE Standards	
SMACNA Standards	
IPC (International Plumbing Code)	
Local Authority Requirements	
NFPA	

COURSE SYLLABUS

AutoCAD

08 HR

1. Introduction & Interface

- AutoCAD basic concept
- AutoCAD interface & navigation
- Units, limits, snap, and grid setup

2. Basic Drawing Tools

- Line, Circle, Arc, Rectangle, Polygon, Ellipse
- Coordinate input (Absolute, Relative, Polar)
- Object selection methods

3. Modify Tools

- Move, Copy, Rotate, Mirror, Scale
- Trim, Extend, Offset, Fillet, Chamfer

4. Layers & Properties

- Layer creation and management
- Line types, colors, thickness
- Object properties control

5. Annotations & Dimensions

- Text (Single-line and Multi-line)
- Dimensions and styles
- Leaders, multileaders, hatching

6. Blocks & Layouts

- Creating/inserting blocks
- Viewports, Model space vs Paper space
- Introduction to dynamic blocks
- Title Block
- Shop Drawing

HVAC

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Module 1 –

Introduction to HVAC & Design Fundamentals

Introduction to HVAC

- What is HVAC?
- Scope of HVAC Design Engineer
- Types of HVAC Systems
- Comfort Air Conditioning
- Indoor Air Quality (IAQ)
- HVAC Design Process (Step-by-Step Workflow)
- Understanding Building Drawings
- Architectural Drawings required for HVAC Design
- Basic HVAC Design Standards
 - ASHRAE
 - SMACNA
 - DW144
 - Local Building Codes (Introduction)

Module 2 –

Cooling & Heating Load Calculation

Heat Load Analysis

- Sources of Heat Gain
- Indoor & Outdoor Design Conditions
- Weather Data
- Building Survey
- Occupancy Classification
- U-Factor & R-Value
- Solar Heat Gain
- Lighting Heat Gain
- Equipment Heat Gain
- Ventilation & Infiltration Load

- Sensible Heat
- Latent Heat
- SHF (Sensible Heat Factor)
- Room Sensible Heat
- Room Total Heat
- Grand Total Heat

Manual Heat Load Basics

- Basic Manual Calculation Procedure
- Estimating TR
- Airflow Requirement (CFM / L/s)

HAP Software

- Weather Data
- Building Spaces
- Construction Materials
- Internal Loads
- Systems
- Plants
- Load Reports
- Report Evaluation

Module 3 – Ventilation System Design

Introduction

- Purpose of Ventilation
- Types of Ventilation

Fresh Air Design

- ASHRAE 62.1 Introduction
- Indoor Air Quality
- Breathing Zone Outdoor Air
- Outdoor Air Calculation
- Fresh Air Requirements

Exhaust System Design

- Toilet Exhaust
- Kitchen Exhaust
- Pantry Exhaust
- Parking Ventilation
- Basement Ventilation
- Industrial Ventilation (Basic Concept)

Smoke Management (Introduction)

- Staircase Pressurization
- Lift Lobby Pressurization

Module 4 – HVAC Equipment Selection

Refrigeration Fundamentals

- Vapor Compression Cycle
- Refrigeration Cycle
- Refrigerants
- Compressors
- Condensers
- Expansion Valves
- Evaporators

HVAC Equipment

Selection based on:

- Heat Load
- Airflow
- Static Pressure
- Application
- Manufacturer Catalogue

Equipment Selection

- AHU
- FCU
- Chillers
- Cooling Towers (Introduction)
- Pumps
- Split AC
- Package AC
- VRF / VRV
- Exhaust Fans
- Centrifugal Fans
- Axial Fans
- Diffusers
- Grilles
- Kitchen Hood

Module 5 –

Air Distribution & Chilled Water System Design

Air Distribution

- Duct Classification
- Duct Materials
- Duct Routing
- Duct Levels
- Aspect Ratio
- Air Velocity Criteria
- Duct Sizing Methods
- Equal Friction
- Velocity Reduction (Introduction)
- McQuay Duct Sizer
- Static Pressure Concept
- External Static Pressure
- Pressure Loss in Ducts

Air Terminals

- Diffusers
- Grilles
- Registers

Duct Accessories

- VCD
- FD
- SD
- NRD
- Sound Attenuator
- VAV Box (Introduction)
- Flexible Duct

Chilled Water System

- Chilled Water System Concept
- Primary System
- Secondary System
- Primary-Secondary System
- Pipe Sizing
- GPM Calculation
- Pipe Routing
- Valves
- Pump Head Calculation
- Pump Selection
- Equipment Connections

Module 6 – **HVAC Controls & Basic System Coordination**

HVAC Controls

- Thermostats
- Temperature Sensors
- Pressure Sensors
- Humidity Sensors
- Control Valves
- Actuators
- Variable Frequency Drive (VFD)
- Building Management System (BMS)

Basic HVAC Coordination

- Coordination with Architecture
- Coordination with Electrical
- Coordination with Plumbing
- Ceiling Coordination
- Equipment Clearance
- Maintenance Clearance

Module 7 – **HVAC Installation, Drawings & Commissioning**

HVAC Drawings

- HVAC Layout Drawings
- Duct Layout
- Chilled Water Layout
- Equipment Layout
- Schematic Diagram (Introduction)
- Sections & Details

Installation

- Duct Installation Basics
- Pipe Installation Basics
- Equipment Installation

Testing & Commissioning

- Air Balancing (Introduction)
- Water Balancing (Introduction)
- Testing Procedures
- Functional Testing
- Commissioning Process

Practical Assignments

- Heating and Cooling Load Calculation
- Duct Sizing

PLUMBING

08 HR

Module 1 –

Introduction to Plumbing Design

Plumbing Fundamentals

- Introduction to Plumbing Engineering
- Scope of Plumbing Design
- Plumbing Terminology
- Types of Plumbing Systems
- Reading Architectural Drawings for Plumbing
- Plumbing Design Workflow

Plumbing Codes & Standards

- Introduction to International Plumbing Code (IPC)
- Local Authority Requirements
- Basic Plumbing Design Standards

Module 2 – **Water Supply System Design**

Water Supply System

- Cold Water Supply System
- Hot Water Supply System
- Domestic Water Distribution
- Direct & Indirect Water Supply Systems
- Gravity & Pumped Water Supply Systems

Water Demand Calculations

- Water Demand Estimation
- Fixture Unit Concept (Introduction)
- Water Demand Calculations
- Peak Demand
- Diversity Factor (Basic Introduction)

Water Storage

- Underground Water Tank (UG Tank)
- Overhead Water Tank (OH Tank)
- Domestic Water Pumps
- Water Storage Calculations

Plumbing Materials

- Common Water Supply Pipe Materials
- Pipe Fittings
- Valves used in Water Supply Systems

Module 3 – **Sanitary Drainage System Design**

Drainage System

- Types of Drainage Systems
- Sanitary Drainage Principles
- Internal Drainage
- External Drainage

Plumbing Materials

- Plumbing Fixtures
- Faucets
- Fixture Fittings
- Fixture Traps (P-Trap, S-Trap, Floor Trap)
- Floor Drains
- Cleanouts

Drainage Design

- Single Stack System
- Two Stack System
- Vent Pipe System
- Soil Pipe
- Waste Pipe
- Vent Pipe

Pipe Sizing

- Drainage Pipe Sizing
- Slope Requirements
- Pipe Routing Principles
- Pipe Material Selection

Module 4 – **Storm Water Drainage Design**

Storm Water System

- Introduction to Storm Water Drainage
- Roof Drainage
- Rainwater Pipes
- Gutters
- Downpipes

Storm Water Calculations

- Rainfall Intensity (Basic)
- Storm Water Flow Calculation
- Storm Water Pipe Sizing

External Drainage

- Catch Basin
- Gully Trap
- Inspection Chamber
- Manhole
- Soak Pit
- Oil Interceptor (Introduction)

Module 5 – **Plumbing Drawings & Coordination**

Plumbing Drawings

- Water Supply Layout
- Drainage Layout
- Storm Water Layout
- Riser Diagram
- Water Supply Schematic
- Sanitary Drainage Schematic
- Isometric View (Introduction)

Plumbing Coordination

- Coordination with Architectural Drawings
- Coordination with Structural Drawings
- Coordination with HVAC
- Coordination with Electrical
- Shaft Planning
- Ceiling Coordination

Assignment

- Water Demand Calculation

FIRE FIGHTING

05 HR

Module 1 –

Introduction to Fire Protection

Fire Protection Fundamentals

- Introduction to Fire Protection Engineering
- Objectives of Fire Protection Systems
- Fire Triangle & Fire Tetrahedron
- Types (Classes) of Fire
- Types of Fire Extinguisher
- Fire Protection Terminology
- Active & Passive Fire Protection
- Fire & Life Safety Concepts

Codes & Standards

- Introduction to NFPA Codes
- Local Fire Authority Requirements
- Basic Fire Protection Design Standards

Module 2 – **Fire Detection & Alarm System**

Fire Detection System

- Components of Fire Alarm Systems
- Types of Fire Detectors
 - Smoke Detectors
 - Heat Detectors
 - Beam Detectors (Introduction)
- Manual Call Points (MCP)
- Hooters / Sounders
- Strobe Lights
- Fire Alarm Control Panel (FACP)

Fire Alarm Design

- Detector Placement Basics
- Fire Alarm Zoning (Introduction)
- Basic Fire Alarm Layout Design

Module 3 – **Fire Fighting Systems**

Water-Based Fire Fighting Systems

- Automatic Sprinkler System
- Sprinkler Types
- Sprinkler Head Selection
- Hose Reel System
- Hydrant System
- Fire Pumps (Introduction)
- Fire Water Storage Tank (Introduction)

Fire Fighting Components

- Landing Valve
- Breeching Inlet
- Control Valves
- Pipe Materials (Introduction)

Module 4 – Fire Suppression Systems

Special Fire Protection Systems

- Clean Agent Fire Suppression System (Introduction)
- CO₂ Fire Suppression System (Introduction)
- Kitchen Hood Fire Suppression System
- Foam System (Basic Introduction)

Applications

- Data Centers
- Electrical Rooms
- Commercial Kitchens
- Industrial Areas

Module 5 – Fire Protection Drawings

Fire Protection Drawings

- Fire Alarm Layout
- Sprinkler Layout
- Hydrant Layout
- Hose Reel Layout
- Fire Protection Symbols
- Fire Protection Schematics (Introduction)

SOFTWARE COVERED

- AutoCAD
- Microsoft Excel
- HAP
- Ashrae
- DuctSizer
- PipeSizer

FINAL CAPSTONE PROJECT

Students will complete a real commercial building MEP design project including:

- **HVAC Design**
- **Plumbing Design**
- **Fire Fighting Design**
- **Design Calculations**
- **AutoCAD Drawings**
- **Project Documentation**

COURSE OUTCOMES

Upon successful completion, students will be able to:

- ✓ Prepare HVAC Heat Load Calculations
- ✓ Perform HVAC Duct Sizing
- ✓ Perform Plumbing Pipe Sizing
- ✓ Understand Fire Protection System Layouts
- ✓ Select Mechanical Equipment
- ✓ Prepare Mechanical Design Drawings Using AutoCAD
- ✓ Understand Mechanical Building Services Design Principles

WHO SHOULD JOIN?

- Mechanical Engineering Students
- Mechanical Engineering Graduates
- Diploma Holders
- Working Professionals
- Engineers aspiring to build a career in Mechanical Building Services Design

CAREER OPPORTUNITIES

After completing this course, students can pursue careers in the following industries and apply for positions such as:

Industries

- MEP Consultancy
- Construction Companies
- BIM Companies
- Facility Management
- Infrastructure Projects
- Oil & Gas
- Airports
- Hospitals
- Commercial Buildings
- Data Centers
- Pharmaceutical Facilities
- Semiconductor Facilities

Job Roles

- HVAC Design Engineer
- Plumbing Design Engineer
- Fire Protection Design Engineer
- Mechanical Design Engineer
- Building Services Engineer
- HVAC Project Engineer
- MEP Design Engineer
- Mechanical CAD Engineer

**Start Your Journey to Becoming a Mechanical
Building Services Design Engineer**