

### **Course Structure**

**Course Code :** SM7309

**Course Title :** Building Management Systems

**Credit Hours :** 3

### **Course Description**

the need for analysis of built environments, Energy services modelling, Thermal Comfort, Heat and Cooling Loads, HVAC systems, Electrical equipment's, Energy Efficiency Measures, Energy Audits in Buildings, IPMVP, Energy efficiency projects evaluation, European Regulations (Directives), Other Standards (ISO50001).

### **Course Objectives**

The student should become acquainted with:

- Understand the energy service concept
- Model and estimate different energy services
- Perform energy audits
- Identify energy efficiency measures
- Develop and implement energy management plans
- Know the most update regulations on energy consumption and use of buildings

### **Course Topics**

- Introduction: the need for analysis of built environments: comfort health and energy costs. Typical consumptions of types of buildings  
Users comfort in buildings (thermal, lighting, air quality)
- Energy services modelling. Heating, Cooling, Lighting, Mechanical Power, others.  
Introduction to Building simulation. Physical principles. Tools and softwares.
- Thermal Comfort. PMV (Predicted Mean Vote) and PPD (Predicted Percentage Dissatisfied) Psychometrics. Fundamentals. The psychrometric chart. Typical processes of air conditioning: equipment's, energy and mass balances, and evolutions in the psychrometric chart.
- Heat and Cooling Loads. Solar radiation. Internal gains.  
Indoor Air Quality (IAQ). Conditions for acceptable IAQ. Sick buildings. Ventilation. Ventilation and infiltration. Concepts of ventilation (natural and forced convection) and infiltration.
- Introduction to HVAC systems in buildings. HVAC systems  
Visual Comfort. Lighting systems in buildings
- Electrical equipment's. Other uses.
- Renewable energy systems in buildings: solar thermal and photovoltaic systems.  
Renewable energy systems in buildings: biomass and others
- Energy Efficiency Measures. Measures regarding buildings envelope.  
Energy Efficiency Measures. Measures regarding buildings systems.
- Energy Efficiency Measures. Measures regarding users behavior.  
Cross-effects between energy efficiency measures.
- Energy Management Systems. Introduction. Policies. Procedures. Methods.
- Energy Management Systems: supporting tools and softwares.
- Energy Audits in Buildings. Energy audit phases. Energy audits data gathering and analysis.

## **M.Sc. in Smart Control Systems for Energy Management**

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### **Course Structure**

- Energy Management Plan Development
- IPMVP. Introduction. Definitions. Measurement and verification plan.  
Energy Tariffs and Energy Bills
- Energy efficiency projects evaluation. Introduction to NPV, IRR and PayBack.  
Energy Efficiency Contracts. Types of contract. ESCO models.
- European Regulations (Directives)  
Other Standards (ISO50001)
- Case studies analysis.

### **References**

- Energy Management Handbook, Steve Doty, Wayne C. Turner (Author)