



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ENERGY EFFICIENT BUILDINGS								
III Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTD33	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 48	Total Tutorials: Nil	Total Practical Classes: Nil			Total Classes: 48			
Prerequisite: NIL								

I. COURSE OVERVIEW:

The course provides knowledge regarding building physics, ventilation technology and indoor climate, etc. that provide a better understanding of building-related problems of various kinds, in order to apply technologies that will contribute to both energy efficient and healthy buildings. Energy efficient buildings are a cornerstone of a prosperous, sustainable and healthy society. This course aims to prepare participants to successfully advance energy efficient building construction and retrofits.

II. COURSE OBJECTIVES:

The student will try to learn:

- I. The concept of reduction in energy consumption through low energy building design.
- II. Strategies to integrate daylighting and low energy heating/cooling in buildings.
- III. Illumination requirements artificial lighting and factors affecting day lighting.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO 1 Understand the concept of reduction in energy consumption through low energy building design.
- CO 2 Examine strategies to integrate day lighting and low energy heating / cooling in buildings.
- CO 3 Demonstrate a good ability to calculate the energy balance of buildings without the help of available energy calculation programs.
- CO 4 Assess whether there is a potential conflict between energy conservation and indoor climate for different energy saving measures.
- CO 5 Analyze and interpret results both critically and independently regarding energy and indoor climate in buildings.
- CO 6 Demonstrate a good ability to work independently on investigating energy and indoor climate issues for buildings and to present the results both orally and in writing in well-prepared technical reports.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO ENERGY EFFICIENCY IN BUILDINGS (10)

Introduction to energy efficiency in buildings-Architecture- Building Science and its significance-Indoor Environment. Components of Indoor Environment - Classification of building materials based on energy intensity-Energy Management of Buildings and Energy Audit of Buildings.

MODULE-II: QUALITY OF INDOOR ENVIRONMENT (09)

Quality of Indoor Environment. Human Comfort-Thermal, Visual, Acoustical and Olfactory comfort. Concept of Sol-air temperature and its significance. Building technology and building services engineering (HVAC) Contribution to lower energy consumption, with different conditions for new and existing buildings.

MODULE-III: VENTILATION AND ITS SIGNIFICANCE (10)

Ventilation and its significance. Cooling and heating concepts, Passive solar heating, active solar heating and solar electricity - Passive concepts appropriate for the various climatic zones in India-Electric efficiency for fans, pumps, lighting etc. Heat pumps. Heat exchangers. Experiences from existing energy efficient buildings.

Building related problems and health issues. Indoor climate issues regarding air quality, thermal indoor climate and acoustics. The importance of ventilation for energy efficiency and indoor climate. Building technology and calculations regarding moisture problems.

MODULE-IV: ENERGY MANAGEMENT (09)

Energy management matrix monitoring and targeting. Energy Efficient Landscape Design - Modification of microclimate through landscape elements for energy conservation

MODULE-V: CASE STUDIES (10)

Case studies: Calculations of the energy balance of buildings without available energy calculation programs, primarily monthly calculations for residential buildings. Energy efficiency and conservation requirements for existing buildings – contradictions and opportunities. Energy efficiency and healthy buildings – contradictions and opportunities – Softwares.

V. TEXT BOOKS:

1. Sodha M. Bansal N.K., Bansal,P.K Kumar, A. and Malik, M.A.S., “Solar Passive Buildings”, Pergamon Press, 1986.
2. Koenigsberger, O.H., Ingersoll, T.G., Mayhew Alan and Szokolay, S. V., “Manual of Tropical Housing and Building part 1: Climatic Design”, OLBN 0 002120011, Orient Longman Limited, 1973

VI. REFERENCE BOOKS:

1. Levenspiel, Octave. Understanding Engineering Thermo. Upper Saddle River, NJ: Prentice Hall, 1996. ISBN: 9780135312032.
2. Ian M. Shapiro (2016), Energy Audits and Improvements for Commercial Buildings, John Wiley & Sons.
3. Lal Jayamaha (2006), Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance, McGraw Hill Professional.

VII. ELECTRONICS RESOURCES:

1. <https://elearning.iea.org/courses/course-v1:IEA+BUILDINGS1+Open/about>
2. <https://www.energy.gov/eere/energy-efficiency-buildings-and-industry>

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation