22MEPE22	ENERGY EFFICIENT BUILDINGS DESIGN		SEMESTER VI			
PREREQUISITES		**CATEGORY**	**L**	**T**	**P**	**C**
1.Basic knowledge about energy efficient technologies		**PE**	**3**	**0**	**0**	**3**
2.Concepts of psychometry and renewable energy technologies						

COURSE OBJECTIVES:

1.	Explaining the future building aspects and need for comfort human living.
2.	Designing an energy efficient landscape system for pleasant living environment.
3.	Developing novel solutions for storage integration in buildings and will evolve passive building strategies.
4.	Performing building load estimates and applying them real time procedure.
5.	Explaining the importance of renewable energy integration in buildings.

UNIT I	INTRODUCTION TO ENERGY EFFICIENT BUILDING CONCEPTS	9	0	0	9

Conventional versus energy efficient buildings – Historical perspective – Water – Energy – IAQ requirement analysis – Future building design aspects – Effective use of resources and needs of modern living – Building assessment and green building processes - Energy conservation building codes.

UNIT II	LANDSCAPE AND BUILDING ENVELOPES	9	0	0	9

Energy efficient landscape design – Micro climates – various methods – Shading, water bodies –Building envelope: Building materials, Envelope heat loss and heat gain and its evaluation, paints, insulation, Design methods and tools.

UNIT III	HEATING, VENTILATION AND AIR CONDITIONING	9	0	0	9

Natural Ventilation, Passive cooling and heating: Thermal mass effects – Application of wind, water and earth for cooling, evaporative cooling, radiant cooling – Hybrid methods – energy conservation measures, thermal storage integration in buildings.

UNIT IV	HEAT TRANSMISSION IN BUILDINGS	9	0	0	9

Surface co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; heat transfer due to infiltration, internal heat transfer; solar temperature; decrement factor; phase lag. Design of day lighting; estimation of building loads: steady state method, network method, numerical method, correlations; computer packages for carrying out thermal design of buildings and predicting performance. Thermal load estimation: Heat balance method. Degree day method for seasonal energy consumption.

UNIT V	BUILDING COOLING AND RENEWABLE ENERGY IN BUILDINGS	9	0	0	9

Passive cooling concepts, Application of wind, water and earth cooling; shading, paints and cavity walls for cooling; roof radiation traps, Earth air tunnel. Solar sorption cooling and solar vapour compression cooling for buildings – Solar water heating systems in buildings – Small wind turbines, standalone PV, Hybrid systems for residential buildings with economics.

TOTAL (45L): 45 PERIODS

TEXT BOOKS:

1.	Krieder. J., and Rabi. A., Heating and cooling of buildings: design for efficiency, McGraw Hill, 2016.
2.	Charles. J. Kibert, Sustainable Construction: Green Building Design and Deliver, John Wiley & Sons, 2016.

REFERENCES:

1	Duffie, A and Beckmann, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
2	Sukhatme, S.P., Solar Energy, Tata McGraw Hill, 1984.
3	Michael Bauer, Peter Mosle and Michael Schwarz, Green Building - Guidebook for Sustainable Architecture, 2009.
4	Velraj.R, 'Sensible heat Storage for solar heating and cooling systems' in the book titled "Advances in Solar Heating and Cooling" – Pages 399 - 428 Elsevier Publication, 2016.

E-REFERENCES:

1.	https://nptel.ac.in/courses

2.	UrsalaEicker, "Solar Technologies for buildings", Wiley Publications, 2003.3 Guide book for national certification examination for energy managers and energy auditors (downloaded from www.energymanagertraining.com).

COURSE OUTCOMES: Upon completion of this course, the students will be able to:		**Bloom Taxonomy Mapped**
CO1	Apply the modern building aspects and the need of indoor air quality for comfort living.	Apply
CO2	Design an energy efficient landscape and evaluate the heat loss or gain through building components.	Analyze
CO3	Develop novel solutions for storage integration in buildings and evolve passive building strategies.	Understand
CO4	Estimate the actual and accurate thermal load for various types of buildings.	Analyze
CO5	Explain the importance of integrating various renewable energy resources in buildings.	Understand

COURSE ARTICULATION MATRIX

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	0	2	0	0	0	0	0	0	2	1	1
CO2	0	0	3	2	0	0	1	0	0	0	0	0	1	1	0
CO3	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
CO4	1	1	1	1	0	0	1	1	0	0	0	0	1	1	1
CO5	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
Avg	**0.6**	**0.4**	**1.2**	**1.0**	**0.0**	**0.6**	**0.8**	**0.2**	**0.2**	**0.2**	**0.0**	**0.0**	**0.8**	**0.6**	**0.4**

3/2/1 – indicates strength of correlation (3 – high, 2- medium, 1- low)