GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Bachelor of Vocation (B.Voc), 6thSemester
Branch: Solar & Renewable Energy
Subject Name: Green and Energy Efficiency Building
Subject Code: 1160701

Type of course: Core

Prerequisite: Basic of Energy, heat flow and Building Architecture.
Rationale: Building on concepts of passive solar architecture practices , students will attain further knowledge of green building techniques, materials and practices. Utilizing costs/benefits analysis, life cycle costs, embodied energy evaluation, and overall sustainability of various materials and methods. students will learn basic methods of green building design, technique, documentation and certification .the student in understanding and familiarization of different heat flow calculations how the various passive, low energy and energy saving concepts have been applied to real life buildings. The concepts of green buildings will be introduced and different rating systems for green buildings will be explained

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA(M)	ESE(V)	PA(I)	
3	0	0	3	50	0	0	0	50

unit	Topic	No. of Hours	Module Weightage
1	**Introduction:** Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development, classification of climate zones, traditional architecture of buildings .	06	**10%**
02	**Heat flow calculations in building**: Efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, concepts of Solar Passive Cooling and Heating energy metering and monitoring, concept of net zero buildings. Heat flow calculations in buildings through walls, roof, windows etc. Convective gains/losses, air exchange rates. Gains from Peoples, appliances etc, Air conditioning load calculations. Utility of Solar energy in buildings. Case studies of Solar Passive Cooled and Heated Buildings.	14	40%
03	**Passive and low energy concepts and applications in Building Design:** Criteria for site selection, preservation of landscape, minimizing urban heat island effect, maximize comfort by proper orientation of building, Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics, etc. Rainwater harvesting methods for roof & non-roof buildings Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud, fly ash brick Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of	16	40%

	Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment. Building form and orientation Internal and external shading devices passive concepts for composite climates, evaporative and nocturnal cooling Earth–air tunnel, sky-therm system Solar chimney-based hybrid system		
04	**Rating systems in different countries.** Green building rating systems such as LEED and GRIHA. BEE and ECBC codes , ASHRAE, UPC etc. **Case studies of green buildings**	06	10%

Distribution of marks weightage for cognitive level:

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	10	10	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create Above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Suggested Readings:
1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
5. Alternative Energy Systems in Building Design, Gevorkian P., McGraw-Hill, 2010.
6. Green Architecture, Attmann O., McGraw-Hill, 2010

Course Outcome:

Sr. No.	CO statement	Marks% weightage
CO1	Comprehend the basics of Green and Energy Efficient Building	10
CO2	Comprehend Heat flow and Energy efficiency calculations in building design and application	40
CO3	Comprehend use of enviro-friendly material and systems of low energy consumptions	40
CO4	Comprehends ratings and codes of green and energy efficient building	10