School of Planning and Architecture: Vijayawada

(An autonomous institution established by Ministry of Human Resource Development, Govt. of India)
S.No. 71/1, NH-5, Nidamanuru, Vijayawada – 521 104, Andhra Pradesh, India

Department of Architecture

Course: Solar Passive Design (Concepts, Strategies & Services)
Instructors: Prof. Dr. S. Ramesh
Contact Periods/week: 3 hours
Internal Assessment Marks: 100

Attendance: 75%

Class: M. Arch (I Year)
Time table:

Code10210204
Total Marks: 100
Minimum Passing Marks: 50%

Course Objective:

OBJECTIVE:

The main objective is to meet the challenges of sustainable development by offering this specialized course of solar passive design emphasizing the strategies, concepts and services. The aim is to develop skills, knowledge and understanding related to environmental sustainability, construction and building technology, adopting the principles and practices of sustainable building design, while responding to environmental challenges such as Climate change, environmental degradation etc. The course offers a contextualized and deep understanding of sustainability in architecture. Study moves from the broad aspects Passive & active solar strategies for energy conservation will be explored along the way.

TEACHING PLAN

Sl. No.	Date	Topic of Class/Lecture & Discussion	Nature of Class
1	Week 1	Introduction of passive solar architecture, appreciation of Built form for different climates, building clusters and solar exposure, thermal environment.	LECTURE
2	Week 2	Types of passive systems, direct gain, thermal storage wall, attached green house, thermal storage roof and convective loop.	LECTURE
3	Week 3	Classification of passive cooling systems according to the major natural source from which the cooling energy is derived.	LECTURE
4	Week 4	Minimizing cooling needs by building design: building shape & layout, orientation, size of windows, shading of window, color of the envelope and climatic impact of plants around building.	LECTURE
5	Week 5	Radiative cooling –The earth as a cooling source for buildings.	LECTURE
6	Week 6	Discussion on Assignment - 1	(Announcement of Assessment-I)
7	Week 7	To study the solar passive and active concepts of the buildings and documenting the same during field work.	LECTURE
	Week 8	Submission or presentation	Display of Marks -

Sl. No.	Date	Topic of Class/Lecture & Discussion	Nature of Class
			Assessment – I
8	Week 9	Critical analysis of the concepts identified during the field visit meant for Architectural Design for discussion.	LECTURE
9	Week 10	**Discussion on Assignment - 2**	(Announcement of Assessment-II)
10	Week 11	Cooling of attached outdoor spaces.	LECTURE
11	Week 12	Passive solar configuration – outline of various passive systems for heat gain. Indirect Gain – Trombe wall, Water wall and Transwall.	LECTURE
12	Week 13	Sun space / attached solarium / conservatory. Roof Pond / Skytherm – Vary Thermal Wall	LECTURE
13	Week 14	Earth sheltered / earth bermed structures and earth-air tunnels	Display of Assessment – II Internal Marks
14	Week 15	The use of earth-air tunnels to heat or cool the buildings	LECTURE
15	Week 16	Modern and post modern passive architecture, methods, strategies, systems, and construction details emphasizing the passive architecture	LECTURE
16	Week 17	Modern and post modern passive architecture, methods, strategies, systems , and construction details emphasizing the non-passive architecture	LECTURE
17	Week 18	TEST / PROJECT WORK	-----

Break-up of Internal Assessment Marks

S. No.	Stages of Evaluation	Weightage	Note
1	Assignment – I / Seminar	30 Marks	Total internal marks 100 Attending all the tests / assignments / seminars is mandatory
2	Assignment – II / Tutorial	30 Marks	
3	TEST / PROJECT WORK	40 Marks	

Reference Books:

1) Givoni Baruch,(1994) "Passive and Low Energy Cooling of Buildings", Van Nostrand Reinhold, New Yord.
2) Sodha, M., Bansal, N. K., Bansal, P. K., KuMEB, A., and Malik, M. A. S.,(1986) "Solar Passive Buildings", Pergamon Press, Oxford.
3) Ramesh S.,(2010) "Appraisal of thermal energy conservation potential in conventional building material / typologies through solar thermal model" -proceedings of 4th International conference on build environment in developing countries 1-2, Penang, Malaysia .

4) Kishnani, N., (2012) "Greening Asia – Emerging principles for sustainable Architecture" publications : FuturArc., Singapore.
5) Bansal, Narender, K.., Hauser Gerd and Minke Gernot,(1994) "Passive Buildings Design:
6) A Hand book of Natural Climatic Control", Elsevier Science, Amsterdam.
7) Chandra,M.,(1995) " Passive and low energy cooling systems of buildings – A review with special reference to Indian conditions" IE(I) , A.R Vol.76,p.p 12-22
8) Chandra, M and Puri, J.S, (2000) "Cooling and Heating of Buildings with buried Earth – tube heat exchanger: An experiment study." SESI Journal, Vol.10,No.1,p.p 1-10.
9) Cook, J., and Bansal, N.K (2001) "Sustainability Through Building," Omega Scientific publishers, India.
10) Bansal,N.K., (1983) 'Periodic Analysis of Ventilated Trombe Wall', Int. J. Energy Research 7 (1), 163.
11) CBRI, (1878) "SummerTtropical Index", , Building digest no 135 CBRI, Roorke, India.
12) Kaushik, S. C., Tiwari, G. N. and Nayak, J. K., (1988) 'Thermal control in passive solar building," Go-Environ Academia press, Jodhpur.
13) Chandra,M.,(1997) " Design Principles of external shading devices for solar control in Buildings"IE(I) journal – AR Vol.77,p.p 33-52
14) Sodha, M. S., Bansal, N. K., Kumar, A., Malik, M. A. S.,(1986) "Solar passive building", Pargamon press., New york.
15) Sodha, M. S., Kaur, J., Sawhney, R.L (1992) 'Effect of underground floor water storage on thermal performance of a room', Int. J. Energy Research, 16,315-325.
16) Trombe A, Seress L.(1994) 'Air-Earth exchanger study in real site experimentation and simulation. Energy and buildings 21,pp:155-162.
17) Antinucci, M. Fleury, B. Lopez, D. Asian, J, Maldonado, E, Santamouris, M., Tombazisa. And Yannas, S., (1992) "Passive and hybrid cooling of buildings," State of Art, Vol. 11, pp. 251-27.
18) Bansal, N.K.,(1983)'Periodic Analysis of Ventilated Trombe Wall', Int. J. Energy Research 7 (1), 163.
19) Worth,D.,(1992) 'Embodied Energy Analysis of Buildings.' Part 1: Determining the energy content of the Building Materials. ESD seminar, Deakin University.
20) Chandra,M.,(1997), 'Trombe wall as solar solution" Indian Architect & Builder, Vol.10,No.6 ,p.p 106-109.
21) Bansal,N.K., (2002) 'Evaluation of Natural Cooling Techniques in Indian Climatic Conditions' , International Journal of Ambient Energy, 23(1).
22) Bansal,N.K.,(1999) 'Emerging Trends for Energy Efficiency in Buildings', Invited Review International Journal of Renewable Energy Engineering, 1 (3), 77-87.
23) Bansal,N.K (1986) 'Evaluation of an Earth Air Tunnel System for Cooling of a Hosptial Complex', Building and Environment, 20 (2), 115.
24) Ramesh, S.,(2003)"Performance Evaluation and Energy conservation potential of earth air tunnel system coupled with non air conditioned building". Building and Environment, 38,pp. 807-813.
25) Singh, S. P.,(1994) 'Optimization of earth air tunnel for space cooling energy conversion and management'.35(8):721-5.
26) Sodha, M.S., Sharma, A.K., Singh, S.P, Bansal, N. K., Kumar, A., (1985) ' Evaluation of an earth air tunnel system for cooling and heating of a hospital complex. Building and Environment'; 20(2): 115-22.
27) Ramesh, S., (2011) "Appraisal of vernacular building materials and alternative technologies for roofing and terracing options of embodied energy in buildings" 2nd International conference on advances in energy engineering (ICAEE 2011) December 27-28, Bangkok, Thailand.
28) Kishnani, N., (2012) "Greening Asia – Emerging principles for sustainable Architecture" publications : FuturArc., Singapore.
29) Nirmal. Kishnani, (2012) "Greening Asia: Emerging Principles for Sustainable Architecture" Publisher: FuturArc (BCI Asia).(ISBN: 978-981-07-0116-1)
30) Krishan, A., Baker,N., Yannas, S and Szokolay,.(1999) "CLIMATE RESPONSIVE ARCHITECTURE:A Design Handbook for Energy Efficient Buildings" McGraw Hill Education (India) Private Limited.(ISBN-10: 0074632183)
31) Axley, J. 2001. "Residential Passive Ventilation Systems: Evaluation and Design", Air Infiltration and Ventilation Center, Tech note 54. INIVE, Belgium.
32) California Energy Commission 2008a, Residential Alternative Calculation Manual (ACM) Approval Method.
33) California Energy Commission 2008b, Residential Compliance Manual.
34) DeGids, W. 1997. "Controlled Air Flow Inlets". Proc. 18th AIVC Conference, Air Infiltration and Ventilation Center, INIVE, Belgium.
35) Givoni Baruch,(1994) "Passive and Low Energy Cooling of Buildings", Van Nostrand Reinhold, New Yord.
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38) Bansal Narendra, K., Hauser Gerd and Minke Gernot,(1994) "Passive Buildings Design: A Hand book of Natural Climatic Control", Elsevier Science, Amsterdam.
39) Goulding, John, R., Lewis, Owen, J., and Steemers, Theo, C.,(1986) "Energy in Architecture", Bastford Ltd., London.
40) Bansal,N.K.,(1999) 'Emerging Trends for Energy Efficiency in Buildings', Invited Review International Journal of Renewable Energy Engineering.

Course Instructors **Head of the Department**