A EUROPEAN M.Sc. COURSE

SOLAR ENERGY: TECHNOLOGY AND *MANAGEMENT*

MODULE SPECIFICATIONS

1. Module title: Modelling Low Energy Passive Designed Buildings

2. Credits: 10 ECTS Credits

3. Keywords

Passive solar design, low energy, environmental impact, modeling environmental performance shadowing, energy gain; economics and cost-effectiveness.

4. Pre-requisites: Basics I and II

Co-requisites: *Energy management, Solar Thermal Engineering*

5. Summary

This module develops appropriate modeling techniques for the analysis and evaluation of the environmental performance of low energy passive solar designed buildings. This module will be of interest to students concerned with the impact of buildings on the natural environment. Competitive against the conventional concept. Economic issues.

6. Learning Objectives/Skills

On successful completion of this module students should be able to:

1. Analyze and evaluate the environmental performance of buildings
2. Use appropriate techniques to model the energy and environmental impact of buildings
3. Utilize the passive design features of a building to minimize its environmental impact
4. Evaluate the effectiveness of a variety of environmental modeling techniques for a variety of European climates
5. Evaluate the effectiveness of current computer simulation tools
6. Minimize the need for active environmental services to a building for a variety of European climates
7. Advise clients on best practice
8. Utilize scientific and research methods appropriate to studying at masters level

7. **Content/ Knowledge Base.**

1. Control of solar radiation in and around buildings.

2. The day lighting of buildings and shading issues.
3. The natural ventilation of buildings.
4. Night cooling.
5. Energy and environmental characteristics of domestic and non-domestic buildings, (rate of heat loss, peak rate, and seasonal consumption, internal incidental gains, solar gains, climate data, energy related carbon dioxide emissions, global warming).
6. Thermal storage systems. Health and well-being of occupants. Thermal and visual comfort.
7. Environmentally friendly material specification.

8. Learning Strategies/ Activities	**Hours**	**Comments**
Lectures	30	
Practical/Laboratories	15	
Tutorials/Seminars	10	
Computer Laboratory	15	
Student managed learning	*130*	
Total hours	200	

9.Assessment	**Weight %**	**Comments**	**Outcomes Tested**
Assignment 1	50	Domestic buildings	*1 to 8*
Assignment 2	50	Commercial buildings	*1 to 8*

10. References.

1. CIBSE, Energy Efficiency in Buildings, CIBSE Guide, 1998.
2. Howard Nigel, BREEAM Office 1998, BRE, DETR, 1998.
3. Baker, N V, the LT Method, Version 2.
4. Frame I, Environmental Spreadsheets, APU, 1999.
5. BRE, Energy Consumption Guide, BRE, DETR, 1998.
6. Howard Nigel, The Green Guide to Specification, BRE, 1998.
7. Rennie david, Foroutan Parand,. Environmental Design Guide, BRE, 1998. Bell james, Burt William, Designing Buildings for Daylight, BRE, 1995.
8. Goulding, J, Energy Conscious Design - A Primer for Architects, B. T. Batsford, 1992.
9. Nicol, F, Standards for Thermal Comfort, E & FN Spon, 1995.
10. European Passive Solar Handbook; Commission of the European Communities DG XII for Science, Research and Development.

11. Learning Resources/Support.

1. Course material: text books and reference books as in no.10
2. Project reports and Case Studies related to the subject.
3. Journals: Buildings and Environment, Solar Energy, Environmental Modelling & Software.
4. Artificial sky/solar laboratory; Computer (PC). Multimedia Lab.

5. A variety of environmental software;
6. Illumination devices, Luximeter, Comfort measuring devices. Measuring/monitoring system, Data Logging system for temperature, humidity, illuminosity, wind etc. for the case of houses or other applications.

12. Projects, Case studies, Final Year Thesis, Publications, Reviews and other issues related to the module;

1. A friendly software package to provide for indoor natural lighting.
A final year project TEI Patra.
2. Design of Passive solar systems for buildings based on the f-chart.
Final year thesis: Renewable Sources of Energy, Laboratory T.E.I. Patra, 1992
3. A friendly software package to estimate day-lighting and internal gain.
A final year project in TEI Patra
4. Artificial sky design and construction. A development project; Anglia Polytechnic University, UK
5. Traditional Architecture and contemporary Passive Solar Technologies.
A joint research project. Transilvania University of Brasov and TEI Patra
6. Passive Solar Technologies:Design of civil and commercial buildings.
Projects by the Anglia Polytechnic University and F.H. Berlin.
7. Design and Construction of a Passive Solar Buildings.
A joint project by F.H. Aachen and TEI Crete.
8. Study of the comfort for a bio-climatic building.
Final year projects in TEI Patra, TEI Crete, FH Berlin, Anglia Polytechnic University.