SECOND SEMESTER 2022-2023

Course Handout Part II

Date: 16-01-2023

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

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| Course No. | **: CE F423** |
| Course Title | **: Green Buildings and Energy Conservation** |
| Instructor-in-charge | **: Murari R R Varma** |

**Scope and Objectives:**

The course introduces sustainability and bioclimatic design concepts in the planning and construction of buildings. This will equip students with technical knowledge of energy-efficient green buildings. The course covers various aspects of bioclimatic architecture, like climate-sensitive design, passive solar architecture, and water management. The course will also guide students through projects to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.

**Course Outcomes**

At the end of the course, the student will be able

1. Identify and categorize vernacular architecture
2. Estimate heat flow through simple building elements and buildings.
3. Describe green building concepts and approaches like passive design.
4. Apply green building concepts to plan and design a simple green building.
5. Appraise a simple building based on any one green building rating system such as GRIHA

**Textbooks:**

T1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). *Climate responsive architecture, a design handbook for energy efficient buildings.* New Delhi: Tata McGraw–Hill Publishing Company. Contents available at CLEAR - Comfortable Low Energy Architecture: <http://learn.greenlux.org/packages/clear/index.html>

T2. TERI & ICAEN (Institut Catala d’Energia). (2015). *Sustainable building design manual* (Vol. II). New Delhi: The Energy and Resources Institute (TERI) Press.

**Reference Books:**

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| [1] | The Energy and Resources Institute (TERI), Green Rating for Integrated Habitat Assessment (GRIHA) manual, New Delhi: TERI press, 2011. |
| [2] | S. V. Szokolay, Introduction to Architectural Science – The Basis of Sustainable Design, Second ed., Architectural Press / Elsevier, 2008. |
| [3] | O. Koenigsberger, A. Mayhew, S. V. Szokolay and T. G. Ingersoll, Manual of Tropical Housing and Building, Hyderabad: Universities Press, 2011. |

[4] Online materials, Notes

**Course Plan:**

| Lecture no. | Learning Outcome | Topics to be Covered | Chapter in the Text Book |
| --- | --- | --- | --- |
| 1-5 | Differentiate traditional vs Vernacular Architecture; identify aspects of vernacular buildings in various Climate zones in India. | Introduction to bioclimatic architecture, Need for Sustainability in building environment;  Traditional Vs Vernacular architecture;  Vernacular buildings in different climate zones | T1, T2, R4 |
| 6-10 | Describe the five climate zones in India, Interpret sun path Diagrams | Climate zones, Design Charts, Sun path diagram | T1, T2, R3,R2 |
| 11-15 | List the sequence of climate responsive process of design  Describe the aspects to be considered in the of a building in achieving minimal environmental footprint | Climate Responsive Scientific Process of Design Landform, topography, vegetation, water bodies; Orientation, S/V ratio, P/A ratio, Walls, Fenestration, Roof and floors | T1,T2 |
| 16-20 | Explain adaptive model of thermal comfort. Calculate heat flow through building envelope | Thermal comfort and Heat flow in Buildings: Indices of thermal comfort, Calculation of thermal conductance, Heat flow through different building elements; Various software | T1, R4, R3 |
| 21-23 | Describe various aspects of passive cooling and passive heating | Active vs passive, Passive solar architecture | T1,T2, R4 |
| 24-26 | Describe daylight factor.  Incorporate passive strategies for placement of openings in buildings | Ventilation and day lighting: Design and placement of openings | T1, T2, R2 |
| 27-28 | Demonstrate strategies to conserve and recycle in buildings | Techniques to recycle, reuse and harvest water | T2, R4 |
| 29-34 | Identify criteria essential to determining what makes a building material truly “green”.  Demonstrate concepts of life-cycle analysis, including economic and sustainability aspects and apply these concepts to green building materials. | Material properties, Energy efficiency using various materials, Emerging new materials, and Techniques for roofs, wall and foundations. | T2,R4 |
| 35-42 | Appraise a simple building based on any one green building rating system such as GRIHA, IGBC, LEED | Energy Conservation Building Code Green building rating systems : Evaluation criteria of LEED, IGBC, GRIHA, BEE | R4 |

**Evaluation Scheme:**

| EC No. | Evaluation Component | Duration | Weightage | Date, Time | Nature of Component |
| --- | --- | --- | --- | --- | --- |
| 1 | Mid semester Test | 90 min. | 30 | 17/03 4.00 - 5.30PM | OB |
| 2 | Term Project\* | TBA | 10 | TBA | OB |
| 3 | Class Participation# | Continuous | 10 | TBA | OB |
| 4 | Assignment | TBA | 15 | TBA | OB |
| 5 | Comprehensive Examination | 180 min. | 35 | 18/05 AN | OB |
|  | # Will be assessed using short quizzes/ design problems announced in class | \*Two evaluations |  |  |  |

**Chamber Consultation Hour: Tuesday 5- 6 PM.**

**Notices:** Concerned notices will be displayed on Canvas.

**Make-up Policy**:

* Frivolous make- ups are not entertained. Prior permission is mandatory in genuine cases. Medical emergencies have to be supported by valid certificates*.*
* Make-up will not be provided in the case of in-class *evaluations/quizzes.* The best n evaluation out of a minimum n+2 (usually 7) will be considered. Students are requested to make an effort to attend the maximum no of *assessments* to avoid the need for makeup

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester, and no academic dishonesty is acceptable.

**Instructor-in-charge**

**CE F423**