

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE365	FUNCTIONAL DESIGN OF BUILDINGS	3-0-0-3	2016

Prerequisite : CE204 Construction Technology

Course objectives:

- To understand the acoustical design concepts and noise control techniques
- To impart the fundamental concepts of natural and artificial lighting designs
- To provide principles of climatic conscious design of buildings with special emphasis on tropical climates.
- To understand the apparent position of sun with respect to earth during different periods of the year and apply it in computation of solar radiation and design of shading devices.

Syllabus:

Acoustics : Physics of sound- Behavior of sound- Sound insulation and reverberation control

Lighting: Principles- Day lighting and artificial lighting – design methods

Thermal design of buildings: Climatic elements – classification- thermal comfort and indices-solar radiation calculations and design of shading devices.

Thermo physical properties of building materials and thermal control- passive and active building design- Steady and periodic heat flow through building envelope. Concept of green building.

Expected Outcomes:

On completion of the course, the students will be able to:

- i. Analyze and make effective decisions in use of principles of functional planning of the buildings with respect to Acoustics and Lighting and Thermal design of buildings in various climatic zones that the student may encounter in his/her professional career.
- ii. Select different building materials and explain the manner in which they can be used in different types of buildings with respect to various functional requirements like acoustics, lighting and thermal comfort.
- iii. Apply the techniques learned to the estimate solar radiation falling on different surfaces of the buildings, design shading devices to protect from direct sunlight, design of energy efficient, functionally comfortable buildings, low energy buildings and green buildings.

References :

1. Ajitha Simha.D, Building Environment, Tata McGraw Hill Publishing Co., New Delhi, 1985
2. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987
3. Givoni. B Man.,. Climate and Architecture, Applied Science Publication, 1976
4. Knudsen V.O. and Harris C.M., Acoustical Design in Architecture, John Wiley, 1980
5. Koenigseberger, Manual of tropical Housing and Building Part I – Climatic design, Orient Longman, 2011
6. Krishnan, Climate responsive architecture, Tata McGraw Hill, 1999
7. M David Egan , Architectural Acoustics, J.Ross Publishing, 2007
8. Olgay Victor, Design with climate-A bioclimatic approach to architectural regionalism- Princeton University press-1963

COURSE PLAN			
Module	Contents	Hours	Sem. Exam Marks %
I	Acoustics, fundamentals: Physics of sound-Frequency, period amplitude. Intensity of sound- Watts/m ² - Bel- Decibel scales- dBA-Phon. Addition of sound levels. Human Audibility range. Behavior of sound in free and reverberant fields. Noise- allowable limits-effect of noise on human-Air and structure born noises-equivalent noise levels-day and night equivalent.	7	15
II	Acoustics, applications: Measures of noise control- Source-path and receiving end. TL value and computation of TL value, Flanking paths. Sound absorption-materials and fixings. Reverberation-Sabines formula-Eyrings modification. Acoustical defects- acoustical design of auditoriums and small lecture halls. Acoustical considerations of offices, hospitals and Industrial buildings.	7	15
FIRST INTERNAL EXAMINATION			
III	Lighting, Natural: Visual tasks – Natural lighting- illumination requirements for various buildings –principles of day lighting – day light factor and its components- Design of side-lit windows-BIS and CBRI methods-skylights	6	15
IV	Lighting, Artificial: Artificial lighting- illumination requirements- lux meter – lamps and luminaries – polar distribution curves– Colour temperature and colour rendering index- glare -Design of artificial lighting – lumen method – point by point method. Basic idea of street lighting and outside lighting	6	15
SECOND INTERNAL EXAMINATION			
V	Thermal comfort: Factors affecting thermal comfort Effective temperature –Thermal comfort indices-ET-CET Charts-Bioclimate chart- Psychrometry and Psychrometric chart. Earth-Sun relationship: Sun’s apparent movement with respect to the earth. Solar angles-Computation of solar radiation on different surfaces-solar path diagram-shadow-throw concept and design of shading devices	8	20
VI	Heat flow through building envelope: Thermo physical properties of building materials: Thermal quantities – heat flow – thermal conductivity – resistance and transmittance and surface coefficient - Sol- air temperature concept- solar gain factor. Thermal transmittance of structural elements – thermal gradients – heat gain/loss calculation. Periodic heat flow – time lag and decrement factor. Design approaches: Climate conscious designs- Climatic zones in India- orientation and shape of buildings in different climatic zones-Passive solar-Active solar and Active approaches. Requirements of buildings in tropical areas-Thermal insulation-Introduction to the concept of green-building	8	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100

Exam Duration: 3 Hrs

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2 Each question can have a maximum of 4 subdivisions (a,b,c,d)

