CET372	FUNCTIONAL DESIGN OF BUILDINGS	Category	L	T	P	Credit	Year of Introduction
		PEC	3	0	0	3	2019

Preamble: The general objective of this course is to provide an insight to the students to various aspects of functional design of buildings and innovative construction methods.

Pre-requisite: CE204 Construction Technology

Course outcome : After the course, the student will able to**:**

CO1	Develop an understanding of acoustical design and noise control techniques
CO2	Understand elemental concepts of natural and artificial lighting designs
CO3	Know the principles involved in the design of buildings for thermal comfort and influence of climate on design of buildings
CO4	Have basic concept for electrical load calculation, plumbing design, HVAC load Calculation, functioning of elevators and escalators and rough cost estimation.
CO5	Acquire knowledge of innovative construction concepts

CET372 Functional Design of Buildings		PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3	3										
	CO2	3	3										
	CO3	3	3										
	CO4	3	3										
	CO5	3	3										

Assessment pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	5	5	15
Understand	10	10	15
Apply	20	20	40
Analyze	15	15	30
Evaluate			
Create			

Continuous Internal Evaluation Pattern:

Attendance	:	10marks
Continuous Assessment Test (2numbers)	:	25 marks
Assignment/Quiz/Course project	:	15marks
Total	**:**	**50marks**

End semester examination pattern – There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14marks.

Course Level Assessment Questions
(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1)
1. Develop an understanding of acoustical design and noise control techniques
2. Applications of acoustics
3. Explain the acoustical considerations for offices, hospitals and industrial buildings

Course Outcome 2 (CO2)
1. Explain the purposes of lighting
2. Explain the basic concepts of natural and artificial lighting
3. Explain the different methods used for the design of natural lighting
4. Explain the different methods used for the design of artificial lighting

Course Outcome 3 (CO3)
1. Evaluate the principles involved in the design of buildings for thermal comfort
2. Explain the influence of climate on design of buildings
3. Compute solar radiation on different surfaces
4. Describe thermo physical properties of buildings

Course Outcome 4 (CO4)
1. Describe the basic concepts for electrical load calculation of structures
2. Explain the basic criteria for plumbing design
3. Calculation of HVAC load
4. Explain the functioning of elevators and escalators
5. Understand the rough cost estimation

Course Outcome 5 (CO5)

1. Understand traditional techniques in Tropical climate with vernacular buildings in Kerala
2. Explain the concepts of green building
3. Describe concepts for intelligent buildings
4. Explain innovative construction methods

Course Code: CET 372
FUNCTIONAL DESIGN OF BUILDINGS
Syllabus

Module I

Acoustical / Sonic Environment and acoustical comfort: Sound, Nature of sound- Behavior of sound in enclosed spaces-Concept of Geometric Acoustics-Reflection of sound and their applications- Absorption of sound-Sound absorption coefficient-Human Audibility range-Reverberation & Reverberation Time Calculation- Flanking paths- Sound absorption-materials and fixings- Reverberation-Sabine's formula-Eyrings modification.-Basic design of the elements for the required degree of sound insulation- Air and structure born noises-equivalent noise levels-day and night equivalent.

Acoustics, applications: Measures of noise control- Source-path and receiving end. TL value and computation of TL value, Acoustical defects- acoustical design of auditoriums and small lecture halls-Acoustical considerations of offices, hospitals and Industrial buildings.

Module II

Natural lighting: Visual task requirements, Units of Light, Light, Vision and Buildings, Standards of Lighting and Visual comfort-The sky as a source of light, Daylight factor, Daylight penetration- Calculation of daylight factor. Design of side-lit windows-BIS and CBRI methods-skylights

Artificial lighting: Artificial lighting- illumination requirements-lux meter – lamps and luminaries – polar distribution curves– Color temperature and color rendering index- glare - Design of artificial lighting – lumen method – point by point method. Basic idea of street lighting and outside lighting

Module III

Thermal comfort: Factors affecting thermal comfort- effective temperature- thermal comfort indices-ET-CET Charts- Bioclimatic chart- Psychrometry and Psycrometric 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

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

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

Module IV

Functional elements: Concept for electrical load calculation of structures- basic criteria for plumbing design – basic concept of HVAC load calculation – Basic concept of functioning of elevators and escalators- basic cost estimation.

Functional protection: Causes of fire, Mechanism of fire spread in buildings, classification of fire-High temperature effects and combustibility of building materials and structure- Fire alarm system, and means of escape-Firefighting installations.

Module V

Functionality as per Vastusastra: Basic concepts- Governing criteria of functionality- Energy pattern- understand traditional techniques in Tropical climate with vernacular buildings in Kerala as case study.

Innovative concepts of functionality: Concept of green building- case studies on low energy and green buildings-Concepts of Intelligent building- Thirsty concrete- Blue roads- self healing concrete

Text Books and References:

1. Knudsen V.O. and Harris C.M., Acoustical Design in Architecture, John Wiley,1980

2. M David Egan , Architectural Acoustics, J.Ross Publishing,2007

3. Marshall Long, “Architectural Acoustics”, Second Edition, Academic Press, Waltham, USA, 2014

4. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T)-1987

5. Pritchard, D.C., "Lighting", Longman Scientific & Technical, Harlow,1995.

6. Benjamin Evans, "Daylight in Architecture", McGraw - Hill Book Company, Newyork,1981.

7.Koenigseberger, Manual of tropical Housing and Building Part I – Climatic design, Orient Longman,2011

8. AjithaSimha.D, Building Environment, Tata McGraw Hill Publishing Co., New Delhi,1985

9. Jain. V.K., "Design and Installation of Services in Building complexes &High Rise Buildings", Khanna Tech. Publishers, New Delhi,1986.

10. National Building Code of India (NBC2016)

11. Wayne Forster and Dean Hawkes, “Energy Efficient Buildings: Architecture, Engineering, and Environment”. W.W. Norton Company Inc.2002.

12. Bureau of Energy Efficiency, India. Design Guidelines for Energy Efficient Multi-Storey Buildings,2014.

Module	Topic	Course outcome addressed	No of Hours
Module I (8 Hours)			
1.1	Acoustical / Sonic Environment and acoustical comfort: Sound, Nature of sound- Behavior of sound in enclosed spaces	CO1	1
1.2	Concept of Geometric Acoustics-Reflection of sound and their applications- Absorption of sound-Sound absorption coefficient-	CO1	1
1.3	Human Audibility range-Reverberation & Reverberation Time Calculation- Flanking paths. Sound absorption-materials and fixings. Reverberation-Sabine's formula-Eyrings modification.	CO1	2
1.4	Basic design of the elements for the required degree of sound insulation- Air and structure born noises-equivalent noise levels- day and night equivalent	CO1	1
1.5	Acoustics, applications: Measures of noise control- Source-path and receiving end. TL value and computation of TL value, Acoustical defects-	CO1	1
1.6	Acoustical design of auditoriums and small lecture halls. Acoustical considerations of offices, hospitals and Industrial buildings.	CO1	2
Module II (6 Hours)			
2.1	Natural lighting: Visual task requirements, Units of Light, Light, Vision and Buildings	CO2	1
2.2	Standards of Lighting and Visual comfort-The sky as a source of light, Daylight factor, Daylight penetration-Calculation of daylight factor.	CO2	1
2.3	Design of side-lit windows-BIS and CBRI methods-skylights	CO2	1
2.4	Artificial lighting: Artificial lighting- illumination requirements-lux meter – lamps and luminaries – polar distribution curves	CO2	1
2.5	Color temperature and color rendering index- glare - Design of artificial lighting – lumen method – point by point method. Basic idea of street lighting and outside lighting	CO2	2
Module III (8Hours)			

3.1	Thermal comfort: Factors affecting thermal comfort- effective temperature	CO3	1
3.2	Thermal comfort indices-ET-CET Charts- Bioclimatic chart-Psychrometry and Psycrometric chart.	CO3	1
3.3	Earth-Sun relationship: Sun's apparent movement with respect to the earth. Solar angles	CO3	1
3.4	Computation of solar radiation on different surfaces-solar path diagram-shadow-throw concept and design of shading devices	CO3	1
3.5	Thermal design of buildings: Thermo physical properties of building materials and thermal control- Passive andactive building design- Steady and periodic heat flow through building envelope.	CO3	1
3.6	Design approaches: Climate conscious designs- Climatic zones inIndia-orientationandshapeofbuildingsindifferentclimatic zones	CO3	2
3.7	Passive solar-Active solar and Active approaches. Requirements of buildings in tropical areas-Thermal insulation	CO3	1
Module IV (7 Hours)			
4.1	Functional elements: Concept for electrical load calculation of structures	CO4	1
4.2	Basic criteria for plumbing design	CO4	1
4.3	Basic concept of HVAC load calculation	CO4	1
4.4	Functional protection: Causes of fire, Mechanism of fire spread in buildings, classification of fire-High temperature effects and combustibility of building materials and structure- Fire alarm system, and means of escape. Firefighting installations	CO4	2
4.5	Basic concept of functioning of elevators and escalators and basic cost estimation ofservices.	CO4	2
Module V (6Hours)			
5.1	Functionality as per Vastusastra: Basic concepts- Governing criteria of functionality - Energy pattern	CO5	1
5.2	Understand traditional techniques in Tropical climate with vernacular buildings in Kerala as case study	CO5	2
5.3	Innovative concepts of functionality: Concept of green building-case studies on low energy and green buildings-	CO5	2
5.4	Concepts of Intelligent building- Thirsty concrete- Blue roads-self healing concrete	CO5	1

MODEL QUESTION PAPER

Reg. No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CET372

Course Name: FUNCTIONAL DESIGN OF BUILDINGS

Max.Marks: 100 Duration: 3hours

Part A

(Answer all questions; each question carries 3 marks)

1. Write briefly about the audibility range of human beings. (3 Marks)
2. Discuss any three common acoustical defects seen in an auditorium. (3 Marks)
3. What are the advantages and disadvantages of sky lighting? (3 Marks)
4. Briefly describe polar distribution curves (3 Marks)
5. What are the thermal insulating materials used to maintain comfortable conditions inside a building? (3 Marks)
6. What do you understand by the following (i) Solar Constant (ii) Solar Azimuth (iii) Solar Altitude (3 Marks)
7. Write short note on "Handling capacity of Lifts" (3 Marks)
8. Briefly describe firefighting installations (3 Marks)
9. Describe self healing concrete. (3 Marks)
10. List out the advantages of self healing concrete. (3 Marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module – 1

11. (a) TL value of a $16m^2$ solid wall is 45 dB. If a hole of 2 cm^2 is drilled through it, find the reduction in TL value? (10 Marks)

    (b) Discuss how the TL value of a separating wall varies with its mass. (4 Marks)

12. (a) Explain how sound intensity varies with distance from a point source

I. In free field

II. In a reverberant field (8 Marks)

(b) What you mean by Acoustical Day Time and Acoustical Night Time. Explain the concepts of $L_{eq}$and L_{dn}? (6Marks)

Module – 2

13. (a) Explain the procedure of design of Artificial lighting by Lumen Method. (7 Marks)

(b) A point source of light has an intensity 2000 candela in the vertically downward direction. The intensity reduces with the angle and reaches 1000 cd at the horizontal direction (90degrees with vertical). If the source is mounted 4m above the working plane, find the illumination due to this light source at points (i) directly under the lamp (ii) at 3m away in the same plane.

(7 Marks)

14. (a) Define the different components of daylight factor? (6 Marks)

(b) What do you understand by the concepts Passive solar design, Active solar design and active design? (8 Marks)

Module – 3

15. (a) Explain the considerations to be made in achieving thermal comfort in hot & dry and Warm and humid regions? (7 Marks)

(b) Explain the concept of shadow angles and shadow throws. How shadow throws are used in the design of shading devices? (7 Marks)

16. (a) Explain the concept of comfort zone based on Bio-climatic chart (7 Marks)

(b) What is Psychrometry? What are the usual input parameters to a Psychrometric chart? What are the various informations we get from a Psychrometric chart? (7 Marks)

Module – 4

17. Explain the features, operation arrangements, location and types of Elevators in public buildings. (14 Marks)

18. Explain the high temperature effects and combustibility of building materials and structures

(14Marks)

Module – 5

19. (a) Explain the concepts of green building. (7 Marks)

(b) Describe LEED and GRIHA ratings for the evaluation of green buildings. (7 Marks)

20. Describe the modern construction materials and its merits (14 Marks)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd. 2014