

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
EET463	ILLUMINATION TECHNOLOGY	PEC	2	1	0	3

Preamble: The basic objective of this course is to deliver the fundamental concepts of illumination engineering in the analysis and design of architectural lighting systems.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the fundamental concepts of natural and artificial lighting schemes
CO 2	Design efficient indoor lighting systems
CO 3	Design efficient outdoor lighting systems
CO 4	Describe aesthetic and emergency lighting systems

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2										
CO 2	2	2	3				1					1
CO 3	2	2	3				1					1
CO 4	2	2			3							

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination
	Tests		
	1	2	
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

ELECTRICAL AND ELECTRONICS

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

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 14 marks.

Course Level Assessment Questions**Course Outcome 1 (CO1):**

1. Explain the quality of a good lighting (K2 PO1)
2. Select the factors affecting the quality of artificial lighting (K2 PO2)
3. Define MHCP, MSCP. (K1 PO1)

Course Outcome 2 (CO2)

1. Define Maintenance Factor.(K1 PO1)
2. Problems related to design of indoor lighting systems.(K2 PO2 PO3 PO7)
3. What are the special features that must be taken care of while illuminating staircase. (K2 PO2 PO12)

Course Outcome 3(CO3):

1. Select the main factors for designing street/road lighting? .(K2 PO2 PO3 PO12)
2. Problems related to design of Flood Lighting system?(K2 PO2 PO3 PO7)
3. With a neat diagram give the application of Track Fixtures.(K2 PO2 PO3)

Course Outcome 4 (CO4):

1. Explain at least Five features of monument lighting.(K2 PO1 PO2)
2. What are the different factors to be considered while designing aesthetic illumination of bridges and statues? .(K2 PO1 PO2 PO5)
3. Selection of luminaries for different areas in hospitals? .(K2 PO1 PO2 PO5)

Model Question Paper

ELECTRICAL AND ELECTRONICS

QP CODE:

PAGES:

Reg No: _____

Name : _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION,
MONTH & YEAR**

Course Code: EET463

Course Name: ILLUMINATION TECHNOLOGY

Max. Marks: 100

Duration: 3 Hours

PART A (10X3=30marks)

Answer all Questions. Each question carries 3 Marks

1. What are the different schemes of artificial lighting?
2. Explain with neat diagram the different types of artificial lighting system used.
3. Explain how photometric bench is used for measuring candle power of a test lamp
4. Explain how illumination can be calculated for Line source and Surface source.
5. Illustrate at least five fixtures used for outdoor lighting?
6. Define Space to Mounting height ratio
7. How are the projectors in flood lighting classified according to the beam?
8. What are different methods available for aiming the lamp in flood lighting?
9. List out the requirements of a good Sport lighting.
10. List out and explain at least five features of auditorium lighting

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module-1

11(a) What is the impact of stroboscopic effect on visual comfort in an artificial lighting scheme? How the effect can be reduced

11(b) Explain with neat diagram the different types of artificial lighting system used.

12(a) Explain Colour rendering and stroboscopic effect

12(b) What is a glare? How it is classified.

Module-2

13(a) Four lamps 15m apart are arranged to illuminate a corridor. Each lamp is mounted at a height of 8m above the floor level. Each lamp gives 450 Cd in all directions below the horizontal. Find the illumination at the midway between 2nd and 3rd lamp

13(b) Illustrate with a neat diagram the concept of polar curve in illumination technology

14(a) State the Laws of Illumination

14(b) Explain with neat figures a.) Inverse square law b.) Lambert's Cosine law

Module-3

15(a) Specify the need of DLOR and ULOR in artificial architectural lighting. List out three factors on which DLOR and ULOR depends

15(b) Illustrate at least five fixtures used for interior lighting?

16(a) Define

1. Coefficient of utilisation
2. Depreciation factor

16(b) A drawing hall in an engineering college is to be illuminated with a lighting installation. The hall is $30\text{m} \times 20\text{m} \times 8\text{m}$ (high). The mounting height is 5m and the required level of illumination is 144 lm/m^2 . Using metal filament lamps, estimate the size and number of single lamp luminaries and draw their spacing layout. Assume: Utilization factor = 0.6, MF = 0.75; Space/Height = 1. Lumens/ Watt for 300-W lamp = 13, Lumens/Watt for 500-W lamp = 16

Module-4

17(a) How are the projectors in flood lighting classified according to the beam?

17 b) Describe the area of application of each type of flood light.

18(a) Illustrate at least five fixtures used for outdoor lighting?

18(b) Explain the various types of lamps used in street lighting.

Module-5

19a) What are different factors to be considered while designing aesthetic illumination of bridges and statues?

19 b) What is the importance of modelling and shadows in the case of sports field lighting?

20 a) Describe any five characteristics of statue lighting

20(b) During the Onam week celebration organised by the Dept. of Tourism, it is a customary to illuminate the Kerala Secretariat Building and the arterial road in the capital city in different colours. As an illumination engineer what are the different factors which must be considered for

- i) Illuminating the Secretariat building
- ii) The roads way aesthetic lighting
- iii) A Statue in front of Secretariat building

Syllabus

Module 1

Introduction of Light: Types of illumination, Day lighting, Artificial light sources- artificial lighting and total lighting, Quality of good lighting, Factors affecting the Physical processes- Incandescent and Halogen lamps, Fluorescent lamps, LPSV and HPSV lamps, mercury vapour lamps, metal halide lamps, LED lamps- modern trends. Supplementary lighting- shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems- direct, indirect, semi direct, semi indirect, Lighting scheme, General and localised, Different types of Luminaires

Module 2

Measurement of Light: Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source. Measuring apparatus- Goniophotometer, Integrating sphere, lux meter.

Module 3

Design of Interior Lighting: Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilisation and factors affecting it, Illumination required for various work planes, Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminance, Selection of utilisation factor, reflection factor and maintenance factor, Determination of Lamp Lumen output taking into account voltage and temperature variations, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaire, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.

Module 4

Design of Outdoor Lighting: Street Lighting - Types of street and their level of illumination required, Terms related to street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaire, Calculation of illumination level available on road. Tunnel

Lighting, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio.

Flood Lighting: Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, recommended method for aiming of lamp, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio.

Module 5

Special Features of Aesthetic Lighting: Monument and statue lighting, Sports lighting, Hospital lighting, Auditorium lighting

General Aspects of emergency lighting. Lighting controllers – dimmers, motion and occupancy sensors, photo sensors and timers. Lighting system design using software (eg: DIALux and Relux).

Note: Case study of indoor and outdoor lighting design using software may be given as assignment.

Text Books

1. D.C. Pritchard Lighting, Routledge, 2016
2. Jack L. Lindsey, Applied Illumination Engineering, PHI, 1991

References:

1. John Matthews Introduction to the Design and Analysis of Building Electrical Systems, Springer, 1993
2. M.A. Cayless, Lamps and Lighting , Routledge, 1996
3. Craig DiLouie, Advanced Lighting Controls: Energy Savings, Productivity, Technology and Applications, CRC Press, 2005.
4. Lighting Engineering Applied calculations R. H. Simons and A. R. Bean, Routledge; 1st edition, 2020

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Introduction of Light (7 hours)	
1.1	Types of illumination, Day lighting.	1
1.2	Artificial light sources-Physical processes- Incandescent and Halogen lamps, Fluorescent lamps, LPSV and HPSV lamps, mercury vapour lamps, metal halide lamps, LED lamps- modern trends.	2
1.3	Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour	2

	rendering and stroboscopic effect.	
1.4	Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localised, Different types of Luminaires.	2
2	Measurement of Light. (7 hours)	
2.1	Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance.	2
2.2	Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source.	2
2.3	Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source.	2
2.4	Measuring apparatus- Goniophotometer, Integrating sphere, lux meter.	1
3	Design of Interior Lighting (8 Hours)	
3.1	Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilisation and factors affecting it, Illumination required for various work planes.	2
3.2	Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminance, Selection of utilisation factor, reflection factor and maintenance factor.	2
3.3	Determination of Lamp Lumen output taking into account voltage and temperature variations, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaire, Calculation of space to mounting height ratio.	2
3.4	Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.	2
4	Design of Outdoor Lighting (10 Hours)	
4.1	Street Lighting - Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application.	2
4.2	Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaire, Calculation of illumination level available on road. Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio.	2
4.3	Tunnel Lighting, Calculation of their wattage and number and their	2

	arrangement, Calculation of space to mounting height ratio.	
4.4	Flood Lighting: Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, Recommended method for aiming of lamp.	2
4.5	Flood Lighting: Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio.	2
5	Special Features of Aesthetic and Emergency lighting (6 Hours)	
5.1	Monument and statue lighting, Sports lighting	2
5.2	Hospital lighting, Auditorium lighting	1
5.3	General Aspects of emergency lighting, Lighting controllers – dimmers, motion and occupancy sensors, photo sensors and timers	2
5.4	Lighting system design using software	1

