

**M.TECH ILLUMINATION TECH. AND DESIGN**  
SECOND YEAR , SECOND SEMESTER EXAM 2018

**SUBJECT: - DAY LIGHTING DESIGN & ANALYSIS**

Full Marks 100  
Time: Three hours

(50 marks for this part)

Use a separate Answer-Script for each part

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No. of Questions	PART - I Answer question number 1 and any Two	Marks															
1a)	<p>Explain with proper diagram the physical significance of the following equation along with each parameters:</p> $\cos \theta = \sin \phi (\sin \delta \cdot \cos \beta + \cos \delta \cdot \cos \gamma \cdot \cos \omega \cdot \sin \beta) + \cos \phi (\cos \delta \cdot \cos \omega \cdot \cos \beta - \sin \delta \cdot \cos \gamma \cdot \sin \beta) + \cos \delta \cdot \sin \gamma \cdot \sin \omega \cdot \sin \beta$	8															
b)	Derive the equation for duration of daylength from the above	6															
c)	<p>Every year International Sunday is celebrated on 3<sup>rd</sup> May. This year we want to celebrate it Jadavpur University in open sky till daylight will be available .</p> <p>The latitude and longitude angles of nearby probable places are given below to select:</p> <table border="1" data-bbox="332 1264 1214 1474"> <thead> <tr> <th>Place</th><th>Latitude</th><th>Longitude</th></tr> </thead> <tbody> <tr> <td>Delhi</td><td>28.61°N</td><td>77.23°E</td></tr> <tr> <td>Chennai</td><td>13.08°N</td><td>80.27°E</td></tr> <tr> <td>Kolkata</td><td>22.57°N</td><td>88.37°E</td></tr> <tr> <td>Mumbai</td><td>18.97°N</td><td>72.83°E</td></tr> </tbody> </table> <p>Calculate :</p> <p>(i) Duration of the programme</p> <p>(ii) Find the intensity of Beam radiation at 3PM.</p>	Place	Latitude	Longitude	Delhi	28.61°N	77.23°E	Chennai	13.08°N	80.27°E	Kolkata	22.57°N	88.37°E	Mumbai	18.97°N	72.83°E	4
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No. of Questions	PART - I Answer question number 1 and any Two	Marks
2a)	Describe with diagram the relative movement of Sun and Earth which causes seasonal variations.	6
b)	Explain how the colour of light appears blue . By which mechanism it scatters and at what time of the day this mechanism does not follow properly.	6
c)	Expand the terminology TSI .What is the latest value obtained by satellite experiments ? -----	4
3a)	For a lighting design in a foot ball ground what are the parameters of daylight availability at that place need to consider.  Explain what are the types instrument to be employed for measurement purpose. Name at least one number of each type of instrument.	8
b)	Describe an instrument which can forecast the duration of the game.	8

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No. of Questions	<p style="text-align: center;"><b>PART - I</b>  <b>Answer question number 1 and any Two</b></p>	Marks
4a)	<p>What is meant by Local Apparent Time.            Explain what are the corrections involved here.</p>	6
b)	<p>FIFA U-17 was scheduled to start at 19:50 on 28<sup>th</sup> Oct 2017(IST) at Salt Lake stadium . If it would had been started as per local time how much early or delayed the starting of the match was.</p> <ul style="list-style-type: none"> <li>- IST is the standard time in Delhi.</li> <li>- Equation of time correction on 28<sup>th</sup> Oct was [10].</li> </ul> <p>=====</p>	10

Time: 3 Hours

Full marks 100

Subject: Daylighting Design & Analysis

Use separate Answer script for each Part  
Part-II(50 Marks)

ANSWER Q.No.1 and ANY FOUR FROM THE REST

Q.1. Explain the followings with justification (Any Five) -

- A) Sky luminance distribution data or model is necessary to predict daylight availability for an indoor space.
- B) Zenith luminance value is required to use CIE standard sky luminance distribution model.
- C) Electrochromic glazing material is better choice than conventional glazing material for daylight integration.
- D) Suitable lighting control scheme is an integral component of daylight-linked artificial lighting system.
- E) U-value of double-pane window system is less than that of single-pane window system.
- F) Light-to-Solar heat gain ratio is one of the important selection criteria of glazing material.

5 x 2 = 10

Q.2. Briefly discuss on CIE standard sky luminance distribution model with proper diagram.

10

Q.3. A) What do you understand by 'Smart' window system? Give example.

B) How visible light transmittance is computed for a glazing material?

C) Define U-value and Solar heat gain coefficient with SI unit.

4+2+4 = 10

Q.4. A) Define Daylight Coefficient(DC).

B) Derive the expression of DC for point- specific horizontal illuminance and vertical illuminance.

10

Q.5. A) Define Daylight Factor(DF).

B) Derive the mathematical expression of average DF with initial assumptions.

10

Q.6. Illustrate different lighting control schemes which are useful for daylight integrated lighting system with suitable diagrams.

10

Q.7. Write down short notes on any two-

i) Subdivision of sky-vault for sky luminance measurement.

ii) Building integrated photovoltaic system.

iii) Daylight pipe.

iv) Top lighting & sky lights.

10

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