Ref:Ex/PG/IlluE/T/1210A/2018

Examination: M.E. Illumination Engineering 1st Year 2nd Semester 2018

Time: 3 Hours | Full marks 100

Subject: Illumination Audit & Management

Use separate Answer script for each Part
Part-I (34 Marks)

Answer Q.No. 1 and any two questions

Q.1. A) Explain the followings in case of light generation and extraction of LEDs -
i) Direct band gap and indirect band gap semiconductor materials
ii) Radiative and non-radiative recombination
iii) Injection luminescence and its radiative efficiency
iv) Thermal resistance and its physical significance.

4+3+4+3=14

Q.2. A) Briefly discuss the steps of illumination survey of an existing indoor commercial lighting system.
B) How 9-point method is applied to evaluate an existing roadlighting installation?

7+3=10

Q.3. Explain, with suitable examples, the procedure of quantification of energy efficiency of a lighting installation.

10

Q.4. How retrofit design alternatives are proposed for an existing street lighting installation considering its functional and technical performances?

10

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M. E. IN ILLUMINATION ENGG. FIRST YEAR SECOND SEMESTER EXAMINATION, 2018

SUBJECT : ILLUMINATION AUDIT AND MANAGEMENT

Time : Three hours **Full Marks-100**
(66 marks in this part)

Part-II

Use Separate Answer Script for each Part

No. of question	**Answer any two questions from each Group** **Group-A (32 Marks)**	Marks
1.a)	"Lighting power Density is more effective than Normalized Power Density for an indoor lighting system with different types of task specific working planes"---- Correct and/or justify the statement.	4
b)	An existing lighting System (A) is proposed to be replaced by lighting upgrade of the system (B) after performing an illumination audit. Compare the systems on the basis of following data from energy saving point of view and comment on the viability of the audit proposal. Consider the life of the lighting system as 10 years & annual hours of use of the system is 2000 hours. Energy cost is Rs.7/- per unit & labour cost to replace lamp is Rs. 10/lamp. System (A)– Initial cost:-Rs. 100000. Description of Luminaires:-30 nos of 2x40 Watt Fluorescent Lamp with electromagnetic ballast, Ballast Loss is 10 Watt/lamp. Cost per lamp:-Rs. 70/- Cost per Luminaire:-Rs. 1000/- Lamp Life:-8000hrs. System (B)– Initial cost:-Rs. 150000. Description of the lighting system:-30 nos of 2x36 Watt Fluorescent Lamp with electronic ballast, Ballast Loss is 2 Watt/lamp. Cost per lamp:-Rs. 80/- Cost per Luminaire:-Rs. 2000/- Lamp Life:-12000hrs.	10
c)	Mention different lighting control strategies for designing any energy efficient lighting control system.	2
2. a)	Briefly explain Comprehensive Audit and the information to be collected during this type of audit.	8

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Part-II

Use Separate Answer Script for each Part

b)	What are the different causes of light loss? Describe various factors for determination of maintenance factor in any lighting system as per the guidelines of CIE.	8
3. a)	Explain the effects of lighting retrofit on energy saving, emission reduction and cost benefit analysis in residential sector.	10
b)	What are the differences between 'Building Area Method' and 'Space Function Method' to calculate LPD? Explain the applications of these methods along with examples with reference to ECBC 2007.	6
4. a)	Explain the method for determining the maximum allowable electrical power for any indoor lighting installation.	12
b)	What is 'Green Building'? Explain 'LEED' rating system for green building	4

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Time : Three hours **Full Marks-100**
(66 marks in this part)

Part-II

Use Separate Answer Script for each Part

<table>
<tr><th>No. of question</th><th>Group-B (34 Marks)
Answer any two questions</th><th>Marks</th></tr>
<tr><td>5.a)</td><td>Design an off-grid solar PV system for the given loads in the table after considering two days of autonomy. Assume the system efficiency and other parameters.
<table>
<tr><th>Sl. No.</th><th>Load</th><th>Number</th><th>Power rating of each appliance (Watt)</th><th>Usage (hr/day)</th></tr>
<tr><td>1</td><td>LED table lamp</td><td>4</td><td>3</td><td>8</td></tr>
<tr><td>2</td><td>CFL</td><td>3</td><td>15</td><td>9</td></tr>
<tr><td>3</td><td>LED tube</td><td>2</td><td>12</td><td>9</td></tr>
<tr><td>4</td><td>DC Fan</td><td>2</td><td>12</td><td>7</td></tr>
<tr><td>5</td><td>TV</td><td>1</td><td>60</td><td>5</td></tr>
<tr><td>6</td><td>Laptop</td><td>1</td><td>50</td><td>12</td></tr>
</table></td><td>12</td></tr>
<tr><td>b)</td><td>Draw the V-I characteristic of a solar cell at different irradiance. Explain why variation of V_{oc} is less with respect to that of I_{sc}.</td><td>5</td></tr>
<tr><td>6. a)</td><td>What are the reasons of mismatching PV modules, when connected in series or parallel? Explain the methods to solve the mismatches.</td><td>6</td></tr>
<tr><td>b)</td><td>What is the equivalent circuit of a solar cell? From it deduce the expressions for output current, open circuit voltage and short circuit current.</td><td>6</td></tr>
<tr><td>c)</td><td>What are the differences between renewable and non-renewable energy sources?</td><td>3</td></tr>
<tr><td>d)</td><td>A 75 watt peak crystalline silicon module has a length and width of 1195 mm and 541 mm respectively. Calculate the efficiency of the module.</td><td>2</td></tr>
<tr><td>7. a)</td><td>Explain why maximum power point tracking (MPPT) is needed to extract the maximum available power from a SPV module? Describe any three MPPT algorithms.</td><td>11</td></tr>
<tr><td>b)</td><td>What is the standard test condition (STC) for solar cell testing?</td><td>2</td></tr>
<tr><td>c)</td><td>What is the fill factor of a solar cell? A solar cell has the following parameters V_{oc} = 0.66V, I_{sc} = 35mA/cm^2 and efficiency = 17%. Calculate the fill factor.</td><td>4</td></tr>
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