

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA**

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2019

DCB 5152: LIGHTING

TARIKH : 04 NOVEMBER 2019

MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)

Kertas ini mengandungi **ENAM BELAS (16)** halaman bercetak.

Bahagian A : Esei Berstruktur (2 soalan)

Bahagian B : Esei Berstruktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf/Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** structured essay questions. Answer **ALL** questions.

ARAHAN :

Bahagian ini mengandungi DUA (2) soalan esei berstruktur. Jawab SEMUA soalan.

QUESTION 1

SOALAN 1

- CLO1
C1
- (a) Define daylight.
Definisikan pencahayaan siang. [3 marks]
[3 markah]
- CLO1
C2
- (b) Describe the sky conditions for daylighting as stated below:
Jelaskan keadaan langit untuk siang hari seperti yang dinyatakan di bawah:
- i. Overcast sky
Langit mendung [2 marks]
[2 markah]
- ii. Clear sky
Langit cerah [2 marks]
[2 markah]
- iii. Partly cloudy sky
Langit sebahagian mendung [3 marks]
[3 markah]
- CLO2
C3
- (c) An office of 6m x 5m x 4m (height) has a vertical window with a dimension of 2.5m x 2m high. The reflection factors for the surface of ceiling, wall, floor and glass are 70%, 70%, 35% and 25% respectively. Calculate the following:

Sebuah ruang pejabat berukuran 6m x 5m x 4m tinggi, mempunyai tingkap pugak berukuran 2.5m x 2m tinggi. Faktor pemantulan dari permukaan siling, dinding, lantai dan kaca adalah sebanyak 70%, 70%, 35% dan 25%. Kirakan:

- i. The Average Daylight Factor (ADF) for the office if glass transmission is 90%.

Purata Faktor Cahaya Siang untuk pejabat jika transmisi kaca adalah 90%.

[10 marks]

[10markah]

- ii. The no-skyline area if the office is blocked by a 8m high building located about 5m away.

Lokasi garisan tiada langit bagi tingkap bilik tersebut jika bangunan dihalang oleh sebuah bangunan setinggi 8m pada jarak 5m.

[5 marks]

[5 markah]

QUESTION 2

SOALAN 2

CLO1
C3

- (a) List **FOUR (4)** important steps required in using Lumen Method for lighting design.

*Senaraikan **EMPAT (4)** langkah-langkah penting yang diperlukan dalam penggunaan Kaedah Lumen bagi rekabentuk pencahayaan.*

[4 marks]

[4 markah]

CLO3
C4

- (b) Construct a suitable layout plan of luminaires for the room that has a dimension of 10 m long, 6 m wide, and 4 m high by using the following data:

Binakan pelan susun atur lampu pencahayaan yang sesuai untuk bilik yang mempunyai ukuran 10 m panjang, 6 m lebar, dan 4 m tinggi menggunakan data berikut:

Number of luminaire (N) <i>Bilangan lampu pencahayaan</i>	15 luminaires
Spacing to Height Ration (SHR) <i>Nisbah Jarak terhadap Ketinggian</i>	1: 1.25
Mounting Height (Hm) <i>Ketinggian pelekap lampu dari kawasan kerja</i>	3.25 m

[6 marks]

[6 markah]

CLO3
C5

- (c) A general office which mainly focuses on clerical task is about to be refitted with new lighting system. Based on JKR Guidelines, the recommended standard illuminance for this area is 500 lux. The office has a dimension of 12 m x 7.5 m x 4 m (height) where the interior surface reflections are 70% for ceiling, 50% for wall and 20% for floor. Design a lighting system by using the lumen method. (Refer **Appendix A**)

*Sebuah pejabat am yang tertumpu kepada kerja pengkeranian bakal diubahsuai kepada sistem pencahayaan yang baharu. Berdasarkan Panduan JKR, keterangan khidmat piawai yang disarankan untuk kawasan ini ialah 500 lux. Pejabat tersebut mempunyai ukuran 12 m x 7.5 m x 4 m (tinggi) dimana faktor pemantulan permukaan bilik adalah 70% untuk siling, 50% untuk dinding, dan 20% untuk lantai. Rekabentuk sistem pencahayaan dengan menggunakan kaedah lumen. (Rujuk **Lampiran A**)*

Additional data:

Data Tambahan:

Lamp Specifications <i>Spesifikasi Lampu</i>	25W tubular fluorescent lamp (Plastic Trough Louvered)
Luminous Flux (F) <i>Fluks Lar</i>	2150 Lumens
Work Surface Height <i>Ketinggian Aras Kerja</i>	0.85 m
Spacing to Height Ratio (SHR) <i>Nisbah Kawasan kepada Tinggi</i>	1.25
Maintenance Factor (MF) <i>Faktor Penyelenggaraan</i>	0.83

[15 marks]

[15 markah]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured essay questions. Answer **TWO (2)** questions only.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan esei berstruktur. Jawab DUA (2) soalan sahaja.

QUESTION 1
SOALAN 1

- CLO1
C2 (a) Identify **THREE (3)** factors which affect visual performance.
Kenalpasti TIGA (3) faktor yang mempengaruhi prestasi penglihatan. [3 marks]
 [3 markah]
- CLO1
C2 (b) Describe the factors that influence the quality of light as stated below:
Jelaskan faktor-faktor yang mempengaruhi kualiti cahaya seperti yang dinyatakan di bawah:
- i. Surface reflectance
Pantulan permukaan [3 marks]
 [3 markah]
- ii. Brightness
Kecerahan [4 marks]
 [4 markah]
- CLO2
C3 (c) A TL-D lamp with luminous flux of 2400 lumen is located 2.8 m on the ceiling (measured from the work surface) as shown in **figure B1**.
Sebuah lampu TL-D menghasilkan fluks lar sebanyak 2400 lumen. Ianya terletak 2.8 m dipermukaan siling (diukur dari permukaan kerja tersebut) seperti yang ditunjuk pada rajah B1.

- i. Determine the luminous intensity level of the lamp.

Tentukan nilai keamatan lar bagi lampu

[2 marks]

[2 Markah]

- ii. Calculate the illuminance for point A, B and C on the table

Kira penyinaran di titik A, B dan C diatas meja tersebut

[11 marks]

[11 markah]

- iii. Identify which point has the maximum and minimum illuminance

Kenalpasti titik manakah mencatatkan penyinaran maksima dan minima

[2 marks]

[2 markah]

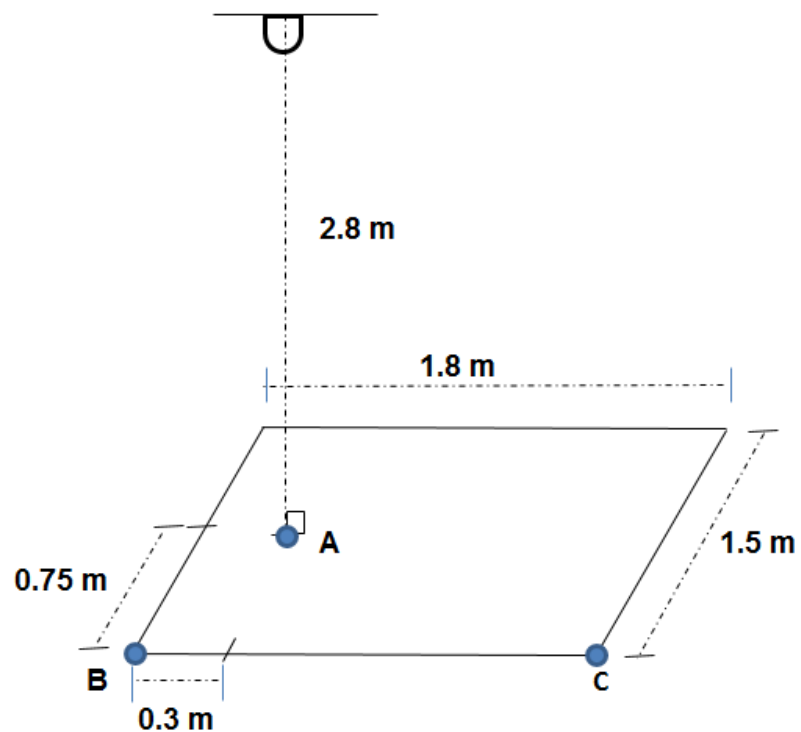


Figure B1

Rajah B1

QUESTION 2**SOALAN 2**CLO1
C2

(a) Describe the following properties of lamp:

Jelaskan sifat-sifat lampu berikut:

i. Luminous efficacy.

Keberkesanan cahaya.

ii. Colour rendering.

Menyerlahkan ketrampilan warna.

[3 marks]

[3 markah]

CLO1
C2

(b) Describe with the aid of diagram, the type of luminaire below with reference to the proportion of light emission.

Jelaskan dengan bantuan gambarajah jenis luminare di bawah dengan merujuk kepada agihan keluaran cahaya.

i. Direct.

Secara langsung.

[2 marks]

[2 markah]

ii. General diffusing

Penyebaran secara Umum.

[2 marks]

[2 markah]

iii. Semi direct.

Secara separa langsung.

[3 marks]

[3 markah]

CLO2
C3

- (c) A light point source with the luminous intensity of $I = 1350 (1 + 1.5\cos \theta)$ cd is mounted 3.8 metres above the work surface as shown in **Figure B2**.

*Satu sumber titik cahaya dengan keamatan lar $I = 1350 (1 + 1.5\cos \theta)$ cd dipasang 3.8 meter dari aras permukaan kerja seperti ditunjukkan dalam **Rajah B2**.*

- i. Calculate the illuminance at point **Ex**, **Ey** and **Ez**.

*Kirakan pencahayaan di titik **Ex**, **Ey** dan **Ez**.*

[12 marks]

[12 markah]

- ii. If a light point source has a luminous intensity of 2700 cd, calculate the illuminance at point **Q**.

*Jika sumber titik cahaya mempunyai keamatan lar sebanyak 2700 cd, kirakan nilai bagi pencahayaan di titik **Q**.*

[3 marks]

[3 markah]

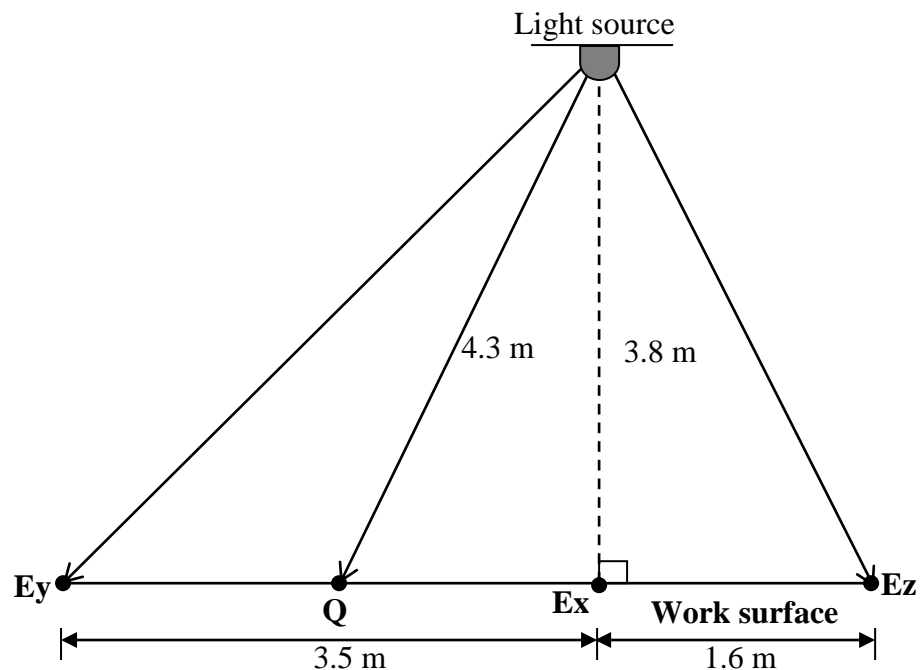


Figure B2

Rajah B2

QUESTION 3**SOALAN 3**CLO1
C2(a) Identify **THREE (3)** objectives of emergency lighting.*Kenalpasti **TIGA (3)** objektif pencahayaan kecemasan.*

[3 marks]

[3 markah]

CLO1
C2

(b) Describe the types of emergency lighting system as stated below:

Jelaskan jenis-jenis sistem pencahayaan kecemasan seperti dinyatakan dibawah:

i. Emergency escape lighting.

Pencahayaan kecemasan keluar.

[2 marks]

[2 markah]

ii. Escape route lighting.

Pencahayaan laluan keluar.

[2 marks]


[2 markah]

iii. High risk task area lighting.

Pencahayaan kawasan risiko tinggi.

[3 marks]

[3 markah]

CLO1
C3(c) Draw clearly the locations of the mandatory emergency light luminaires on the floor plan of the office building (**Appendix B**) in accordance with BS5266. The symbol used for the emergency light luminaire is *Kenal pasti dan lukis dengan jelas lokasi kedudukan sebenar bagi sistem lampu**kecemasan mandatori dan tambahkan pada pelan lantai 1 (**Lampiran B**) seperti yang**dinyatakan dalam BS 5266. Simbol lampu kecemasan adalah*

[15 marks]

[15 markah]

QUESTION 4

SOALAN 4

CLO1
C2

- (a) Explain the characteristics of the Low Pressure Sodium lamp by referring to its wattage range, lamp life and its typical application.

Terangkan ciri-ciri lampu Sodium Bertekanan rendah dengan merujuk kepada rangkaian watt , hayat lampu dan aplikasi.

[3 marks]

[3 markah]

CLO1
C2

- (b) Describe these modes of operation of emergency light luminaire

Jelaskan jenis-jenis mod operasi bagi luminaire lampu kecemasan

- i. Non-Maintained

Tidak tersenggara

- ii. Maintained

Tersenggara

[7 marks]

[7 markah]

CLO2
C3

- (c) **Figure B3** shows a horizontal window inside a room with the floor area of 19.2 m². The reflection factors of the wall and floor are 60% and 20% respectively. The room is situated at Non-industrial area involving clean industrial work. Assuming that the Externally Reflection Component (ERC) for the room is 0.33%, calculate the:

(Appendices C – D may be used to answer this question)

Rajah B3 menunjukkan sebuah tingkap di dalam bilik yang berkeluasan lantai 19.2 m². Faktor pantulan bagi dinding dan lantai adalah masing-masing 60 % dan 20 %. Bilik ini terletak di kawasan bukan industri yang melibatkan kerja-kerja industri bersih. Dengan mengandaikan bahawa Komponen Pantulan Dalaman (IRC) untuk bilik adalah 0.33 %, kirakan: (Lampiran C-D boleh digunakan bagi menjawab soalan ini)

- i. Sky Component (SC)

Komponen langit (SC)

[8 marks]

[8 markah]

- ii. Internally Reflected Component (IRC)

Komponen pantulan dalaman (IRC)

[3 marks]

[3 markah]

- iii. Daylight factor at point Y

Nilai faktor siang di titik Y

[4 marks]

[4 markah]

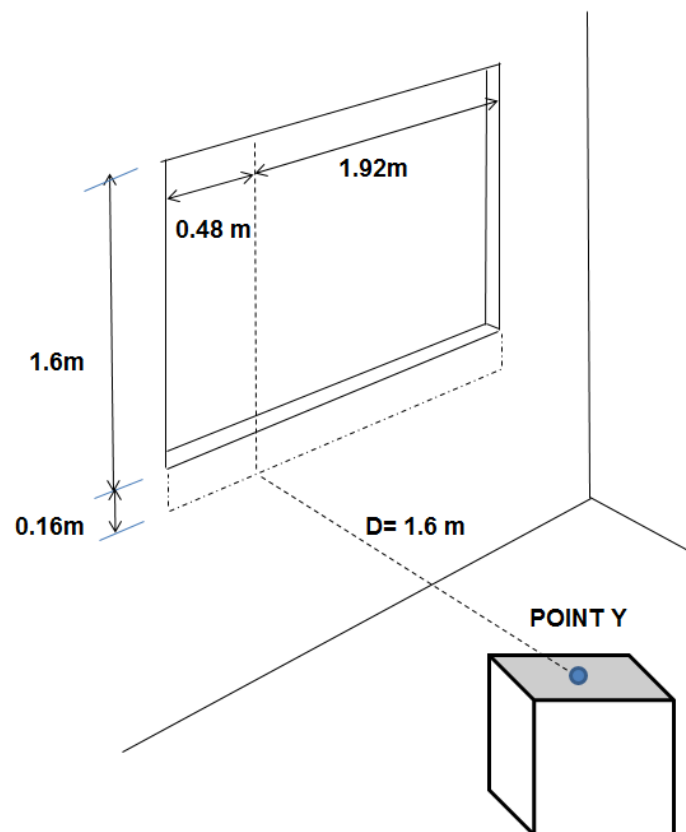


Figure B3

Rajah B3

SOALAN TAMAT

Appendix A
Lampiran A

Table 1: Utilization Factor for Plastic Trough Louvered Luminaire.

Jadual 1: Faktor Penggunaan lampu pencahayaan jenis Plastic Trough Louvered.

Utilization Factors			LOR = 57% DLOR = 57.8% ULOR = 0.0%								
Room Reflection			Room Index (RI)								
C	W	F	0.75	1	1.25	1.5	2	2.5	3	4	5
0.7	0.5	0.2	0.32	0.38	0.43	0.46	0.50	0.53	0.55	0.58	0.59
	0.3		0.28	0.34	0.38	0.41	0.46	0.50	0.52	0.55	0.57
	0.1		0.24	0.30	0.35	0.38	0.43	0.47	0.49	0.53	0.55
0.5	0.5	0.2	0.31	0.37	0.41	0.44	0.48	0.51	0.53	0.55	0.57
	0.3		0.27	0.33	0.37	0.41	0.45	0.48	0.50	0.53	0.55
	0.1		0.24	0.30	0.34	0.38	0.42	0.46	0.48	0.51	0.54
0.3	0.5	0.2	0.31	0.36	0.40	0.43	0.46	0.49	0.51	0.53	0.55
	0.3		0.27	0.32	0.37	0.40	0.44	0.47	0.49	0.52	0.53
	0.1		0.24	0.30	0.34	0.37	0.42	0.45	0.47	0.50	0.52
0.0	0	0.0	0.23	0.28	0.32	0.35	0.40	0.42	0.45	0.47	0.49
			SHR NOM = 1.25								

KERTAS JAWAPAN PEPERIKSAAN

No Skrip Jawapan:

*(Sila koyak dan ikat **Appendix B** kepada skrip jawapan utama)*

Office Building Emergency Evacuation Plan

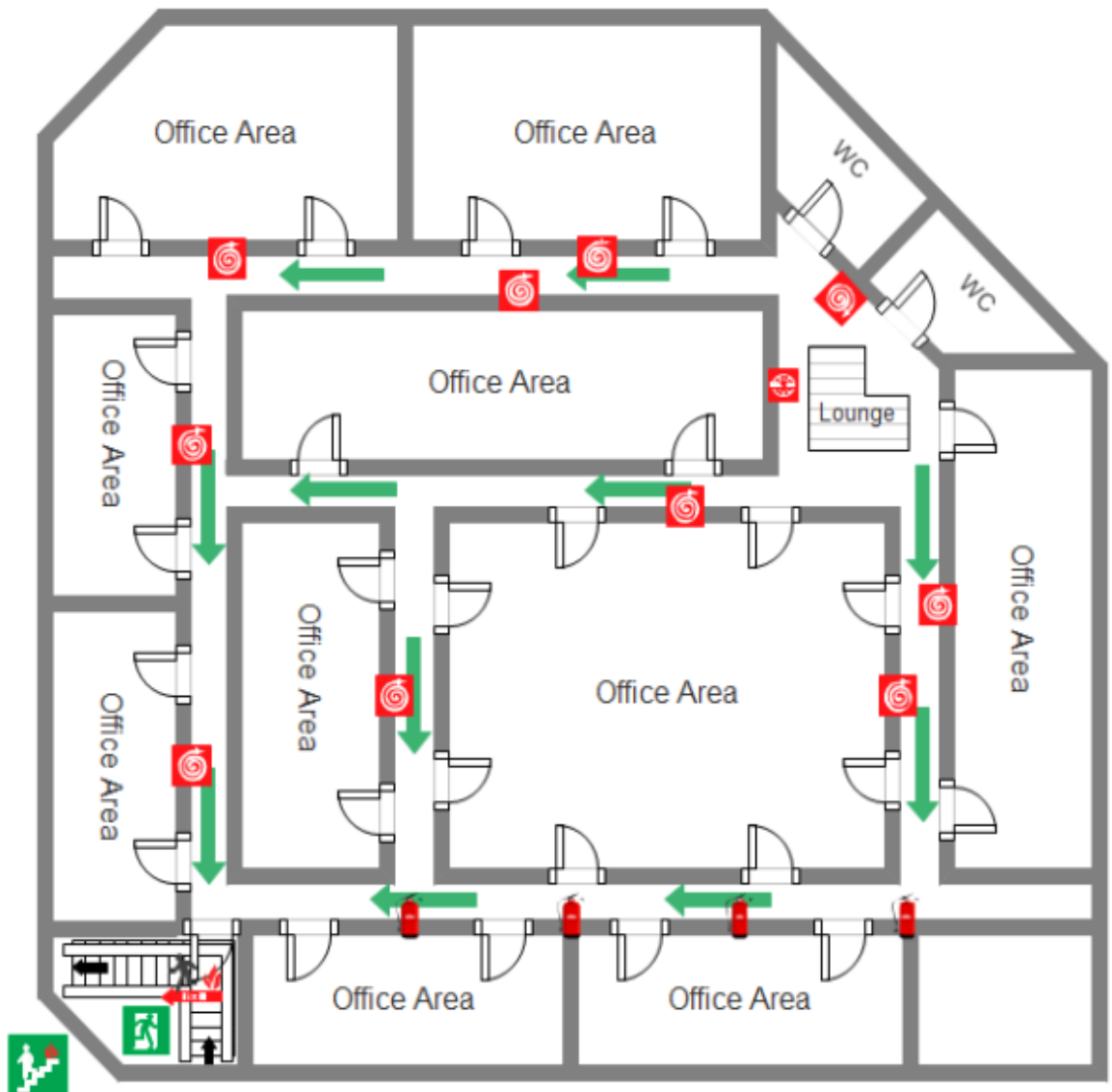


Table of Sky Component

Daylight Factor Estimation																					
Sky components (CIE Standard overcast sky) for vertical rectangular windows with clean clear glass																					
Ratio W/D = Width of Window to One Side of Normal : Distance from Window																					
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0	2.5	3.0	4.0	6.0	∞
∞	0	1.3	2.5	3.7	4.9	5.9	6.9	7.7	8.4	9.0	9.6	10.7	11.6	12.2	12.6	13.0	13.7	14.2	14.6	14.9	15.0
5.0	0	1.2	2.4	3.7	4.8	5.9	6.8	7.6	8.3	8.8	9.4	10.5	11.1	11.7	12.3	12.7	13.3	13.7	14.0	14.1	14.2
4.0	0	1.2	2.4	3.6	4.7	5.8	6.7	7.4	8.2	8.7	9.2	10.3	10.9	11.4	12.0	12.4	12.9	13.3	13.5	13.6	13.7
3.5	0	1.2	2.4	3.6	4.6	5.7	6.6	7.3	8.0	8.5	9.0	10.1	10.6	11.1	11.8	12.2	12.6	12.9	13.2	13.2	13.3
3.0	0	1.2	2.3	3.5	4.5	5.5	6.4	7.1	7.8	8.2	8.7	9.8	10.2	10.7	11.3	11.7	12.0	12.4	12.5	12.6	12.7
2.8	0	1.1	2.3	3.4	4.5	5.4	6.3	7.0	7.6	8.1	8.6	9.6	10.0	10.5	11.1	11.4	11.7	12.0	12.2	12.3	12.3
2.6	0	1.1	2.2	3.4	4.4	5.3	6.2	6.8	7.5	7.9	8.4	9.3	9.8	10.2	10.8	11.1	11.4	11.7	11.8	11.9	11.9
2.4	0	1.1	2.2	3.3	4.3	5.2	6.0	6.6	7.3	7.7	8.1	9.1	9.5	10.0	10.4	10.7	11.0	11.2	11.3	11.4	11.5
2.2	0	1.1	2.1	3.2	4.1	5.0	5.8	6.4	7.0	7.4	7.9	8.7	9.1	9.6	10.0	10.2	10.5	10.7	10.8	10.9	10.9
2.0	0	1.0	2.0	3.1	4.0	4.8	5.6	6.2	6.7	7.1	7.5	8.3	8.7	9.1	9.5	9.7	9.9	10.0	10.1	10.2	10.3
1.9	0	1.0	2.0	3.0	3.9	4.7	5.4	6.0	6.5	6.9	7.3	8.1	8.5	8.8	9.2	9.4	9.6	9.7	9.8	9.9	9.9
1.8	0	0.97	1.9	2.9	3.8	4.6	5.3	5.8	6.3	6.7	7.1	7.8	8.2	8.5	8.8	9.0	9.2	9.3	9.4	9.5	9.5
1.7	0	0.94	1.9	2.8	3.6	4.4	5.1	5.6	6.1	6.5	6.8	7.5	7.8	8.2	8.5	8.6	8.8	8.9	9.0	9.1	9.1
1.6	0	0.90	1.8	2.7	3.5	4.2	4.9	5.4	5.8	6.2	6.5	7.2	7.5	7.8	8.1	8.2	8.4	8.5	8.6	8.6	8.6
1.5	0	0.86	1.7	2.6	3.3	4.0	4.6	5.1	5.6	5.9	6.2	6.8	7.1	7.4	7.6	7.8	7.9	8.0	8.0	8.1	8.1
1.4	0	0.82	1.6	2.4	3.2	3.8	4.4	4.8	5.2	5.6	5.9	6.4	6.7	7.0	7.2	7.3	7.4	7.5	7.5	7.6	7.6
1.3	0	0.77	1.5	2.3	2.9	3.6	4.1	4.5	4.9	5.2	5.5	5.9	6.2	6.4	6.6	6.7	6.8	6.9	6.9	7.0	7.0
1.2	0	0.71	1.4	2.1	2.7	3.3	3.8	4.2	4.5	4.8	5.0	5.4	5.7	5.9	6.0	6.1	6.2	6.2	6.3	6.3	6.3
1.1	0	0.65	1.3	1.9	2.5	3.0	3.4	3.8	4.1	4.3	4.6	4.9	5.1	5.3	5.4	5.4	5.5	5.6	5.6	5.7	5.7
1.0	0	0.57	1.1	1.7	2.2	2.6	3.0	3.3	3.6	3.8	4.0	4.3	4.5	4.6	4.7	4.7	4.8	4.8	4.9	5.0	5.0
0.9	0	0.50	0.99	1.5	1.9	2.2	2.6	2.8	3.1	3.3	3.4	3.7	3.8	3.9	4.0	4.0	4.0	4.1	4.1	4.2	4.2
0.8	0	0.42	0.83	1.2	1.6	1.9	2.2	2.4	2.6	2.7	2.9	3.1	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.5
0.7	0	0.33	0.68	0.97	1.3	1.5	1.7	1.9	2.1	2.2	2.3	2.5	2.5	2.6	2.6	2.6	2.6	2.7	2.7	2.8	2.8
0.6	0	0.24	0.53	0.74	0.98	1.2	1.3	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1
0.5	0	0.16	0.39	0.52	0.70	0.82	0.97	1.0	1.1	1.2	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5
0.4	0	0.10	0.25	0.34	0.45	0.54	0.62	0.70	0.75	0.82	0.89	0.92	0.95	0.95	0.96	0.96	0.96	0.97	0.97	0.98	0.98
0.3	0	0.06	0.14	0.18	0.26	0.30	0.34	0.38	0.42	0.44	0.47	0.49	0.50	0.50	0.51	0.51	0.52	0.52	0.52	0.53	0.53
0.2	0	0.03	0.06	0.09	0.11	0.12	0.14	0.16	0.20	0.21	0.21	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24
0.1	0	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ratio H/D = Height of Window Above Working Plane : Distance from Window

Appendix D
Lampiran D

Table of Externally Reflected Component

Ratio of window area to floor area	Window area as percentage of floor area	Floor reflection factor											
		10%				20%				40%			
		Wall reflection factor											
		20%	40%	60%	80%	20%	40%	60%	80%	20%	40%	60%	80%
1 : 50	2	—	—	0.1	0.2	—	0.1	0.1	0.2	—	0.1	0.2	0.2
1 : 20	5	0.1	0.1	0.2	0.4	0.1	0.2	0.3	0.5	0.1	0.2	0.4	0.6
1 : 14	7	0.1	0.2	0.3	0.5	0.1	0.2	0.4	0.6	0.2	0.3	0.6	0.8
1 : 10	10	0.1	0.2	0.4	0.7	0.2	0.3	0.6	0.9	0.3	0.5	0.8	1.2
1 : 6.7	15	0.2	0.4	0.6	1.0	0.2	0.5	0.8	1.3	0.4	0.7	1.1	1.7
1 : 5	20	0.2	0.5	0.8	1.4	0.3	0.6	1.1	1.7	0.5	0.9	1.5	2.3
1 : 4	25	0.3	0.6	1.0	1.7	0.4	0.8	1.3	2.0	0.6	1.1	1.8	2.8
1 : 3.3	30	0.3	0.7	1.2	2.0	0.5	0.9	1.5	2.4	0.8	1.3	2.1	3.3
1 : 2.9	35	0.4	0.8	1.4	2.3	0.5	1.0	1.8	2.8	0.9	1.5	2.4	3.8
1 : 2.5	40	0.5	0.9	1.6	2.6	0.6	1.2	2.0	3.1	1.0	1.7	2.7	4.2
1 : 2.2	45	0.5	1.0	1.8	2.9	0.7	1.3	2.2	3.4	1.2	1.9	3.0	4.6
1 : 2	50	0.6	1.1	1.9	3.1	0.8	1.4	2.3	3.7	1.3	2.1	3.2	4.9

*Assuming ceiling reflection factor = 70 per cent; angle of external obstruction = 20 degrees.

Maintenance Factor for the calculated daylight factor

Building Locations	Glazing Conditions	Maintenance Factor	
		Non Industrial Work or Clean Industries	Dirty Industrial Work
Non Industrial or Clean Industrial Area	Vertical	0.9	0.8
	Sloping	0.8	0.7
	Horizontal	0.7	0.6
Dirty Industrial Area	Vertical	0.8	0.7
	Sloping	0.7	0.6
	Horizontal	0.6	0.5

FORMULA

$$E = \frac{I}{d^2}$$

$$E = \frac{I (\cos \theta)}{H^2}$$

$$E = \frac{I (\cos^3 \theta)}{d^2}$$

$$DF_{\text{avg}} = \frac{T (W) (\theta) \%}{A (1 - R^2)}$$

$$RI = \frac{L \times W}{Hm (L + W)}$$

$$N = \frac{E \times A}{n \times F \times UF \times MF}$$