

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN KEJURUTERAAN AWAM

**PEPERIKSAAN AKHIR
SESI DISEMBER 2017**

DCB5152 : LIGHTING

**TARIKH : 06 APRIL 2018
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)**

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.

Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Lampiran (Appendix)

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)** essay questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1CLO1
C1

- (a) State **THREE (3)** sky condition of daylight.

Nyatakan TIGA (3) keadaan langit cahaya siang.

[3 marks]

*[3 markah]*CLO1
C2

- (b) Describe with the aid of a diagram daylight factors components.

Jelaskan dengan bantuan gambarajah komponen faktor cahaya siang.

[7 marks]

*[7 markah]*CLO2
C3

- (c) **Figure QA1** shows a horizontal window inside a room with the floor area of 6.3 m². The reflection factor of the wall and the floor are 60% and 10% respectively. The room is situated at a clean industrial area involving clean industrial work. By assuming that the Externally Reflection Component for the room is 0.31%, calculate the minimum daylight factor at point Q.

(Refer related table in Appendix A1, Appendix 2 and Appendix A3)

Rajah QA1 menunjukkan sebuah tingkap di dalam bilik yang berkeluasan lantai 6.3 m^2 . Faktor pantulan bagi dinding dan lantai adalah masing-masing 60 % dan 10 %. Bilik ini terletak di kawasan industri bersih yang melibatkan kerja-kerja industri bersih. Dengan mengandaikan bahawa Komponen Pantulan Luaran untuk bilik adalah 0.31 %, kirakan faktor cahaya siang minimum pada titik Q. (Rujuk Jadual berkaitan di Lampiran A1, Lampiran A2 dan Lampiran A3)

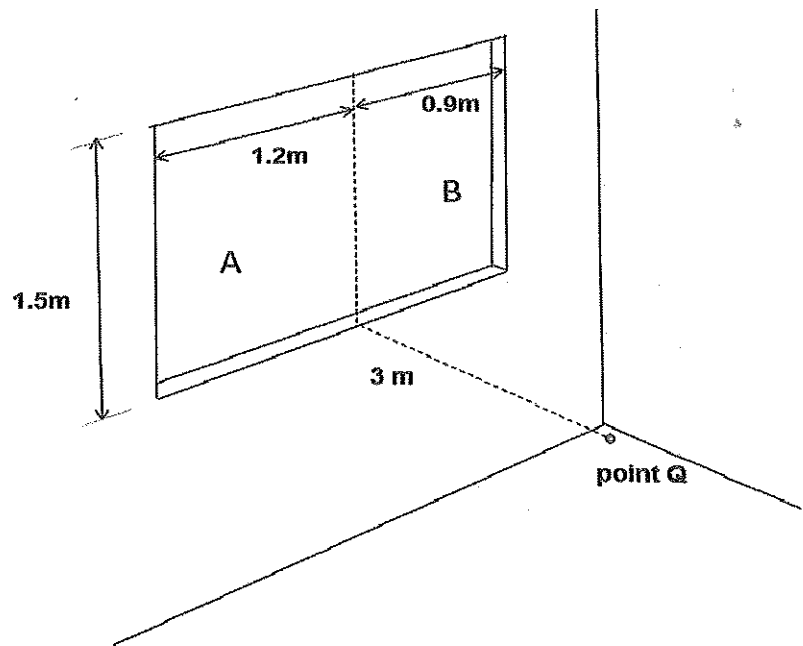


Figure QA1
Rajah QA1

[15 marks]

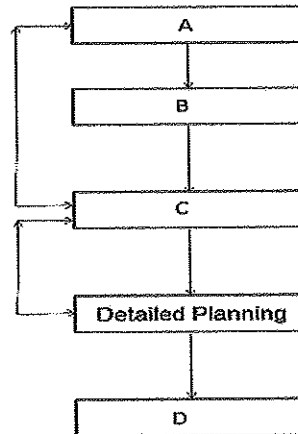
[15 markah]

QUESTION 2

SOALAN 2

CLO1
C3

- (a) Complete the flowchart that shows the processes of lighting design.

Lengkapkan carta alir yang menunjukkan proses-proses rekabentuk pencahayaan.

[4 marks]

[4 markah]

CLO3
C4

- (b) Interpret the meaning of parameters used in Lumen method calculation below:

Tafsirkan maksud parameter yang digunakan dalam pengiraan kaedah Lumen di bawah:

- i. Utilisation factor
Faktor penggunaan

[3 marks]

[3 markah]

- ii. Maintenance factor
Faktor penyelenggaraan

[3 marks]

[3 markah]

CLO3
C5

- (c) A newly built locker room will be equipped with regular array of Plastic Trough Louvered luminaires which may provide a standard illuminance of 150 lux. The locker room dimensions are 10 m x 6 m x 4 m (height). The interior surface reflections are 50% for ceiling and 50% for wall. (Refer **Appendix A3**)

Sebuah bilik persalinan akan dilengkapi dengan luminaire jenis Plastic Trough Louvered dengan keterangan khidmat piawai 150 lux. Bilik tersebut berukuran 10 m x 6 m x 4 m (tinggi). Faktor pemantulan permukaan bilik adalah 50% untuk siling dan 50% untuk dinding. (Rujuk Lampiran A3)

Additional data:

Data Tambahan:

Lamp Specifications <i>Spesifikasi Lamp</i>	1 X 25 W lamp (F25T8/TL850 ALTO 30PK)
Luminous Flux <i>Fluk Lar</i>	2,100 Lumens
Work Surface Height <i>Ketinggian Satah Kerja</i>	0.75 m
Spacing to Height Ratio <i>Nisbah Jarak Terhadap Ketinggian</i>	1: 1.25
Maintenance Factor <i>Faktor Penyelenggaraan</i>	0.79

- i. Estimate the number of luminaire by using the Lumen method.

Anggarkan bilangan luminaire dengan menggunakan kaedah Lumen.

[10 marks]

[10 markah]

- ii. Show the layout of luminaire in Q2c(i).

Tunjukkan susunatur luminaire di Q2c(i).

[5 marks]

[5 markah]

SECTION B : 50 MARKS**BAHAGIAN B : 50 MARKAH****INSTRUCTION:**

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

ARAHAN:

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

QUESTION 1**SOALAN 1**CLO1
C2

- (a) Describe the term Luminous Flux.

Jelaskan istilah Fuk Lar.

[3 marks]

[3 markah]

CLO1
C2

- (b) Explain the factors that influence the quality of light as stated below:

Terangkan faktor-faktor yang mempengaruhi kualiti cahaya seperti yang dinyatakan di bawah:

- i. Colour

Warna

[4 marks]

[4 markah]

- ii. Glare

Silau

[3 marks]

[3 markah]

CLO2
C3

- (c) An LED lamp with a luminous intensity of 2850 cd is located 3.3 m on the ceiling (measured from the work surface) as shown in **Figure QB1**. The table is situated 1.6 m away from the light source and the radius of the table is 0.3 m.

*Sebuah lampu LED menghasilkan keamatan lar sebanyak 2850 cd. Ianya terletak 3.3 m dipermukaan siling (diukur dari permukaan kerja tersebut) seperti yang ditunjuk pada **Rajah QB1**. Meja terletak pada jarak 1.6 m dari sumber cahaya dan jejari meja adalah 0.3 m.*

- i. Calculate the maximum and minimum illuminance on the table

Kira pencahayaan maksima dan minima diatas meja tersebut.

[13 marks]

[13 markah]

- ii. Relate an illumination law used in **QB1c(ii)**.

*Kaitkan hukum pencahayaan yang digunakan di **QB1c(ii)**.*

[2 marks]

[2 markah]

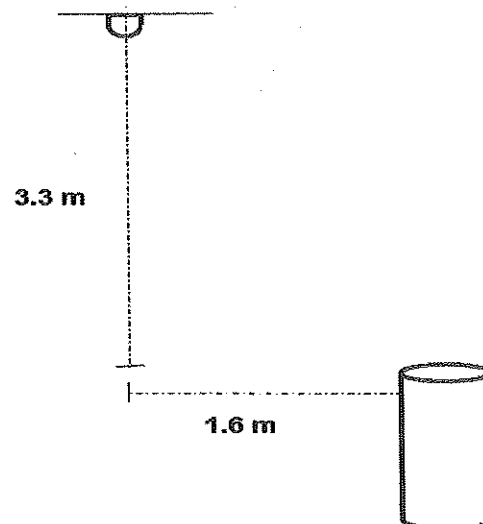


Figure QB1
Rajah QB1

QUESTION 2

SOALAN 2

CLO1
C2

- (a) Describe light output ratio (LOR).
Jelaskan nisbah keluaran cahaya (LOR).

[3 marks]

[3 markah]

CLO1
C2

- (b) Describe with the aid of a luminaires diagram by referring to the proportion of light emission below:

Jelaskan dengan gambarajah luminaire dengan merujuk kepada arah keluaran cahaya di bawah:

- i. Direct
Terus

[3 marks]

[3 markah]

- ii. Indirect
Tidak Terus

[4 marks]

[4 markah]

CLO2
C3

- (c) A light point source with the luminous intensity given as $I = 1000 (1 + 2 \cos \theta)$ is mounted 5 metres above the work surface as shown in **Figure QB2**.

*Satu sumber titik cahaya dengan keamatan lar yang diberi iaitu $I = 1000 (1 + 2 \cos \theta)$ dipasang 5 meter dari aras permukaan kerja seperti yang ditunjuk dalam **Rajah QB2**.*

- i. Calculate the illuminance at point Ea, Eb and Ec

Kira pencahayaan di titik Eb dan Ec.

[15 marks]

[15 markah]

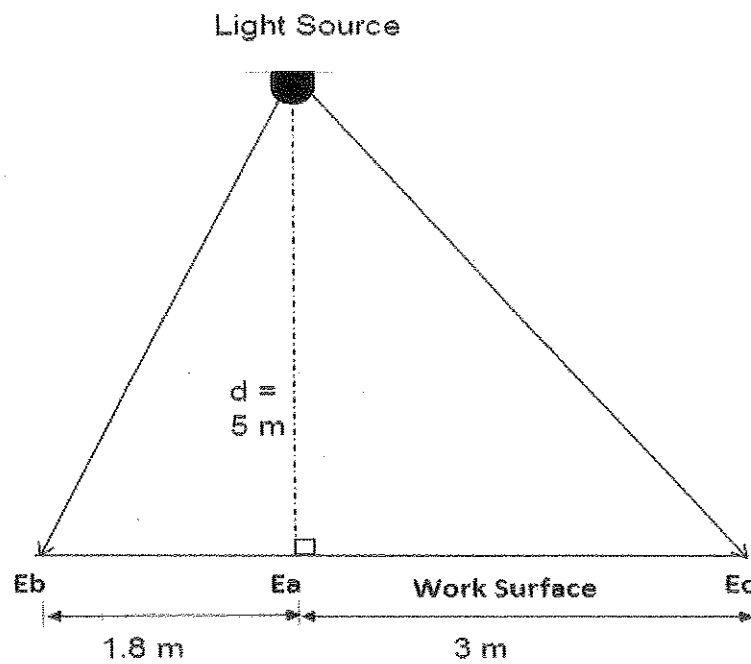


Figure QB2

Rajah QB2

QUESTION 3

SOALAN 3

- CLO1
C2
- (a) Identify **THREE (3)** characteristics of a generator system as a main power supply system for emergency lighting.
Kenalpasti TIGA (3) ciri sistem janakuasa sebagai sistem bekalan kuasa utama untuk pencahayaan kecemasan.
- [3 marks]
[3 markah]
- CLO1
C2
- (b) Describe the emergency lighting power supplies below:
Jelaskan bekalan kuasa pencahayaan kecemasan di bawah:
- i. Generator
Janakuasa
- [4 marks]
[4 markah]
- ii. Central battery
Bateri sepusat
- [3 marks]
[3 markah]
- CLO1
C3
- (c) List the locations of emergency light luminaires stated below with reference to BS 5266:
Senaraikan lokasi kedudukan sistem lampu kecemasan dibawah seperti yang dinyatakan dalam BS 5266:
- i. Mandatory point of emphasis
Penekanan pada titik mandatori
- [9 marks]
[9 markah]

- ii. Additional point of emphasis
Penekanan pada titik tambahan

[6 marks]

[6 markah]

QUESTION 4**SOALAN 4**CLO1
C2

- (a) Explain the characteristics of the Metal Halide lamp by referring to its wattage range, luminous efficacy and lamp life.

Terangkan ciri-ciri lampu Halida Logam dengan merujuk kepada rangkaian watt, keberkesanan bercahaya dan hayat lampu.

[3 marks]

[3 markah]

CLO1
C2

- (b) Describe the types of emergency lighting luminaires given below:

Jelaskan jenis-jenis sistem lampu bagi lampu kecemasan tersebut:

- i. Single point luminaire

Sistem lampu titik tunggal

[3 marks]

[3 markah]

- ii. Slave luminaire

Sistem lampu Kandung diri

[2 marks]

[2 markah]

- iii. Combined luminaire

Sistem lampu digabung

[2 marks]

[2 markah]

CLO2
C3

- (c) A master bedroom measuring of 6 m x 5 m x 4 m (height) has a vertical window with a dimension of 3.5 m x 1.8 m. The reflection factor for the surface of ceiling, wall, floor and glass are 60%, 70%, 10% and 25% respectively. The glass transmission value is 65% and the angle of visible sky is 60° .

Sebuah bilik tidur utama berukuran 6 m x 5 m x 6 m (tinggi) mempunyai tingkap pugak berukuran 3.5 m x 1.8 m. Faktor pemantulan bagi permukaan siling, dinding, lantai dan kaca adalah 60%, 70%, 35% dan 25%. Manakala nilai transmisi kaca adalah 75% dan sudut langit yang kelihatan pada 60° .

- i. Calculate the average daylight factor for the room

Kira purata faktor cahaya siang bagi bilik

[10 markss]

[10 markah]

- ii. Illustrate the no-sky line if the room is blocked by an 8 metre high building located 5 metres away. Assume the window sill is 0.95 m from the floor.

Gambarkan garisan tiada langit jika bilik tersebut dihalang oleh bangunan setinggi 8 m yang terletak 5 m daripada bilik tersebut. Andaikan ambang tingkap 0.95 m dari lantai.

[5 marks]

[5 markah]

SOALAN TAMAT

Appendix A1
Lampiran A1

Table 1: Sky Component

Sky components (CE Standard overcast sky) for vertical rectangular windows with clean clear glass		Daylight Factor Estimation																			
		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	7.8	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	8.1	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	6.9	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	1.5	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	0.97	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	0.52	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	0.23	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	0.07	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

Appendix A2

Lampiran A2

Table 2: Internally 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.

Table 3: of Maintenance Factors to be applied to the IRC for Dirt on the room surface

Location of building	Maintenance factor (MF)	
	Non-industrial or Clean Industrial Work	Dirty Industrial Work
Non-industrial or Clean Industrial Area	0.9	0.7
Dirty Industrial Area	0.9	0.6

Appendix A3

Lampiran A3

Table 4: 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

Table 5 : Utilization Factor for Plastic Trough Louvered Luminaire

Utilization Factors			LOR = 57.8% DLOR = 57.8% ULOR = 0.0%								
Room Reflection			Room Index								
C	W	F	0.75	1	1.25	1.5	2	2.5	3	4	5
0.7	0.5	0.2	.32	.38	.43	.46	.50	.53	.55	.58	.59
	0.3		.28	.34	.38	.41	.46	.50	.52	.55	.57
	0.1		.24	.30	.35	.38	.43	.47	.49	.53	.55
0.5	0.5	0.2	.31	.37	.41	.44	.48	.51	.53	.55	.57
	0.3		.27	.33	.37	.41	.45	.48	.50	.53	.55
	0.1		.24	.30	.34	.38	.42	.46	.48	.51	.54
0.3	0.5	0.2	.31	.36	.40	.43	.46	.49	.51	.53	.55
	0.3		.27	.32	.37	.40	.44	.47	.49	.52	.53
	0.1		.24	.30	.34	.37	.42	.45	.47	.50	.52
0.0	0.0	0.0	.23	.28	.32	.35	.40	.42	.45	.47	.49
			SHR NOM = 1.25								

FORMULA

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

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

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

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

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

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