

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2003/2004

September/Oktober 2003

REG 562 – Teknologi Perkhidmatan Bangunan
(Building Services Technology)

Masa/Time: 3 jam/hours

Sila pastikan bahawa kertas peperiksaan ini mengandungi **TUJUH** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.

Please check that the examinations paper contains SEVEN printed papers before the commencement of the examination.

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia ATAU kombinasi kedua-duanya.

Students are allowed to answer all questions in English OR in Bahasa Malaysia OR in both languages.

Jawab **EMPAT** soalan.

Answer FOUR questions.

1. (a) Senaraikan dan terangkan secara ringkas jenis-jenis silauan 'glare' dan nyatakan kaedah mengatasi setiap satu permasalahan tersebut. Sila jelaskan kenapa pembelajaran reka bentuk pencahayaan amat penting diberi perhatian dan bagaimana ianya dapat menyumbang kepada prestasi sesebuah bangunan?

List down the types of glare and explain in brief how to overcome the problems caused due to each type of glare. Why is the study of lighting design considered to be important in building and how does it contributes towards the total building performance?

- (b) Apakah contoh dan potensi masalah yang boleh diwujudkan oleh pencahayaan semulajadi, dan nyatakan kelebihan-kelebihan sistem kawalan pencahayaan.

What are the example and potential problems of daylighting, and write the advantages of lighting controls.

(25 markah/marks)

2. (a) Secara amnya, jelaskan kaedah kawalan lif yang boleh didapati pada sesebuah bangunan tinggi terutamanya untuk meningkatkan prestasi keseluruhan lif bagi pergerakan menegak dalam bangunan.

Explain in general the application of lift control methods available within a high rise building in order to increase the overall performance of a lift for any vertical transportation in buildings.

(5 markah/marks)

- (b) Kirakan kualiti perkhidmatan lif dan kapasiti pengangkutan sistem lif yang dipasang pada sesebuah bangunan sebanyak 4 kereta lif dengan berat 1250 kg. pada kapasiti kelajuan kontrak 2.0 m/s dan mempunyai 1100 mm bukaan tengah sebanyak 3.0 saat (tutup) dan 3.0 saat (buka). Ia memberikan perkhidmatan untuk 16 tingkat dengan 4.0 m tinggi dari lantai ke lantai serta mempunyai keluasan lantai 500 meter persegi setiap satu.

(Rujuk Jadual diberi pada **Lampiran A**)

Calculate the Quality of Service and the Transportation Capacity for an installation of 4 lifts each of 1250 kg capacity at a contract speed of 2.0 m/s with 1100 mm center opening doors (3.0 s closing and 3.0 s opening) serving a 16 storey building with 4.0 m floors each having an area of 500 sq.m.

(Refer to the Tables provided in **Appendix A**)

(20 markah/marks)

3. Satu aspek penting keselamatan bangunan ialah keselamatan kebakaran. Bagaimanakah anda dapat melihat dan menjelaskan kepentingan Undang-Undang Kecil Bangunan Seragam 1984 (UBBL) yang dikaitkan dengan keperluan keselamatan kebakaran? Huraikan secara berasingan kefahaman anda mengenai komponen-komponen keselamatan kebakaran yang diketahui merujuk kepada Gerak Peringkat Tumbesaran Api dalam satu-satu kemalangan kebakaran.

One of the important aspects of total safety in a building is the fire safety. How do you perceive the important of Uniform Building by Law 1984 related to fire safety requirements and explain separately the understanding of the fire safety components within the Fire Growth Graph?

(25 markah/marks)

4. Perkhidmatan bangunan adalah suatu bidang yang biasa diberi keutamaan bagi pembinaan sesebuah bangunan bermula dari peringkat reka bentuk sehinggalah ianya diduduki oleh penghuni. Namuin, banyak masalah timbul akibat integrasi yang kurang baik diantara perkhidmatan bangunan dengan reka bentuk bangunan. Sebagai seorang pakar bangunan, huraikan kenapa isu-isu ini wujud dan merujuk kepada Kitar Hayat Sebuah Bangunan (Tahap Reka Bentuk, Pemilihan Bahan Binaan, Susunatur dan Perancangan, Pembinaan, Penyelenggaraan dan Pengubahsuaian) bagaimanakah setiap peringkat ini dapat meningkatkan kecekapan perkhidmatan bangunan dalam sesebuah persekitaran bangunan.

Building services are commonly installed or built during design stages up till the time of occupying by tenants. There are many problems caused by bad integration between building services and building design. As a building expert, explain why these issues occur and referring to the Building Life Cycle (Building Design, Selection of Materials, Layout and Planning, Construction, Maintenance and Alteration) how can each of the stages be improved in terms of building services contributions in total building environment.

(25 markah/marks)

5. (a) Senaraikan dan bincang faktor-faktor yang mempengaruhi keselesaan terma.

List and discuss the factors affecting thermal comfort.

- (b) Terangkan bagaimana penyiasatan tentang keselesaan terma bagi sesebuah bangunan boleh diukur.

Describe how an investigation into the thermal comfort provided in a building can be conducted.

(25 markah/marks)

6. (a) Bincangkan faktor-faktor yang menyumbang kepada beban penyejukan bagi suatu ruang tertutup.

Discuss the cooling load factors in an enclosed space.

- (b) Lakar dan bincangkan tiga sistem pendingin udara. Nyatakan aplikasi yang sesuai untuk setiap satu.

Sketch and describe three different systems of air conditioning. State a suitable application for each.

(25 markah/marks)

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Assessing the Quality of Lift Service

Quality of Service

Classification	Transportation Time
excellent	less than 45s
good	45s to 55s
fair	55s to 65s
satisfactory	above 65s

Calculation of Transportation Time

$$\text{Transportation Time} = \text{INTERVAL}(2+N)/4$$

Round Trip Time

To calculate the Round Trip Time it is necessary to determine the following :

- Probable number of stops per trip
- Travelling time allowing for acceleration and deceleration
- Door opening time
- Passenger entering and leaving time

$$S_p = S - S \left[\frac{(S-1)}{S} \right]^n$$

Where S_p = probable number of stops
 S = number of floors served above ground floor
 n = number of passengers entering lift on ground floor
 (normally taken as 80% of the lift contract load)

Where the population on each floor are different :

$$S_p = S - \left[\left[\frac{(P_t - P_1)}{P_t} \right]^n + \left[\frac{(P_t - P_2)}{P_t} \right]^n + \dots + \left[\frac{(P_t - P_n)}{P_t} \right]^n \right]$$

Where S_p = probable number of stops
 S = number of floors served above ground
 P_t = total population on all floors above ground
 P_1 = population on floor 1
 P_2 = population on floor 2
 P_n = population on the nth floor
 n = number of passengers entering lift at ground floor
 (normally taken as 80% of the lift car contract load)

$$t = 2(dS_p + D + d)/V$$

Where	t	=	total travelling time
	V	=	lift speed (m/s)
	d	=	acceleration distance
	S _p	=	probable number of stops
	D	=	Overall distance between ground and top floors

The acceleration distance depends on the particular lift drive and design speed and the following are normally used values :

Lift Speed	Type	Acceleration Distance(d)
0.5 m/s	Geared Rheostatic	0.3 m
1.0 m/s	Geared Rheostatic	1.5 m
1.5 m/s	Geared Rheostatic	2.6 m
1.5 m/s	Variable Voltage GR	1.3 m
2.0 m/s	Gearless Variable Voltage	2.2 m
2.5 m/s	Gearless Variable Voltage	3.1 m
3.0 m/s	Gearless Variable Voltage	4.0 m

Door Width (mm)	Side Opening		Centre Opening	
	Opening	Closing	Opening	Closing
800	2.5	2.6	1.4	1.8
900	2.7	3.0	1.6	2.0
1100	2.9	3.7	1.9	2.6

Actual number of passengers entering	8	10	12	14	16	18	20
Passenger entering time (s)	8	10	11	13	14	16	20

Transportation Capacity

The transportation capacity is defined as the total number of persons the lift installation can handle in a peak 5 minute period. The requirement depends on the type of building and the tenancy arrangement. The peak generally occurs during the morning when people are arriving to start work and the Transportation Capacity is normally specified as 17% of the total number of persons to be handled in a 5 minute period in the case of a single tenancy building and 12% in the case of a multi let building. The transportation capacity can be calculated as follows and has units of persons per 5 minutes :

Lift Capacity (kg)	900	1150	1400	1600	1800
Exit time per stop (s)	1.2	1.5	1.6	1.8	2.0

Door Width	800	900	1100	1200
Efficiency	0.92	0.92	0.95	1.00

$$\text{Transportation Capacity (5mins)} = (N \times n (5 \times 60)) / \text{RTT}$$

Where

- N = the number of lifts in the bank
- n = number of passengers entering lift on ground floor
(normally taken as 80% of the lift contract load)
- RTT = round trip time

The Required Capacity is calculated from the following :

$$\text{Required Capacity (5 mins)} = \frac{\text{No of floors above ground floor} \times \text{floor area of each floor} \times P_5}{A_p}$$

Where

- P₅ = Five-minute peak traffic as a percent of the building population above the ground floor
- A_p = the occupancy density in sq.m per person

The value taken for P₅ varies with the type of building and suggested values are given in the following table :

Five Minute Peak Traffic P ₅	
Apartment building	6%
College residence	12%
Department Store	20%
Hospital	12%
Hotel	10%
Office(single tenant)	17%
Office(multi tenant)	12%

Standard Lift Car Sizes

Load kg	Persons
630	8
800	10
1000	13
1250	16
1600	21