
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2007/2008

October/November 2007

**REG 562 – Building Services Technology
(Teknologi Perkhidmatan Bangunan)**

Duration: 3 hours
(Masa: 3 jam)

Please check that this examination paper consists of **ELEVEN** pages of printed material before you begin the examination.

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

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

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia.

Answer **FOUR** questions only. **SECTION A** is **COMPULSORY** and answer **TWO** questions from **SECTION B**.

*Jawab **EMPAT** soalan sahaja. **BAHAGIAN A** adalah **WAJIB** dan jawab **DUA** soalan dari **BAHAGIAN B**.*

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**SECTION A
(BAHAGIAN A)**

1. (a) What does it mean by passive fire prevention system and active fire protection? Why the fire safety or fire protection system within the building industry is important?

Apakah yang dimaksudkan dengan sistem perlindungan kebakaran pasif dan sistem pencegahan kebakaran aktif? Mengapakah sistem keselamatan kebakaran atau "fire safety" dikatakan begitu penting sekali di dalam industri binaan?

(10 marks/markah)

- (b) Elaborate in details the reasons of the fire protection system selection and application for the any one of the chosen type of building i.e.: Shopping Mall, Administrative Office, Hotel, Sport Complex or Hall. Also include the description of the fire safety requirements within the life cycle of a building.

Huraikan secara terperinci sebab-sebab pemilihan sistem perlindungan kebakaran dan kegunaannya bagi satu jenis bangunan yang anda pilih iaitu: Hotel, Kompleks Perniagaan, Pejabat Pentadbiran, Kompleks Sukan atau Dewan Perhimpunan. Jelaskan juga keperluan keselamatan kebakaran di dalam kitar hidup sebuah bangunan.

(15 marks/markah)

2. (a) Define "air-conditioning". Name **THREE (3)** purposes of air-conditioning

*Berikan definisi "penyamanan udara". Nyatakan **TIGA (3)** tujuan penyamanan udara.*

(5 marks/markah)

- (b) With the aid of a pressure-enthalpy chart sketch, discuss the changes in phases of refrigerant in refrigeration cycle.

Dengan bantuan lakaran carta pressure-enthalpy, bincangkan perubahan fasa bahan penyejuk dalam kitar penyejukan.

(20 marks/markah)

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**SECTION B
(BAHAGIAN B)**

3. (a) i) List the differences and draw the basic lift components for the Traction Lift and Hydraulic Lift of the vertical transportation system.

Nyatakan perbezaan dan lukiskan kedua sistem asas lif iaitu "Traction Lift" dan "Hydraulic Lift" tersebut serta berikan ciri-ciri komponen utama lif bagi sistem pengangkutan menegak ini.

- ii) List the criteria used for an analysis of the lift performances and elaborate the **THREE (3)** main requirements in lift design.

*Nyatakan kriteria yang digunakan untuk membuat penganalisaan prestasi lif dan huraikan **TIGA (3)** keperluan penting di dalam merekabentuk sistem lif.*

(10 marks/markah)

- (b) What does it mean by traveling time (T) for a lift service? Calculate the traveling time (T), RTT and quality of service for an office building with the following specifications:-

No. of car lift in group	=	4
Lift Car capacity	=	1600 kg
Contract lift Speed	=	2.5 m/s
Building floor height	=	4.0 m
Number of floor	=	16 floors(including ground floor)
Total Office areas per floor	=	500 sq.m
Density occupancy	=	12 sq.m/person
Width of the door lift	=	1100 mm
Lift Drive	=	Gearless variable voltage
Lift opening	=	Centre opening.

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Apakah yang dimaksudkan dengan Masa Perjalanan (T) bagi sesebuah perkhidmatan Lif? Kirakan masa perjalanan (T), RTT dan prestasi perkhidmatan untuk Lif sebuah bangunan pejabat dengan spesifikasinya adalah seperti berikut:-

Jumlah kereta Lif sekumpulan	=	4
Kapasiti kereta Lif	=	1600 kg
Kontrak kelajuan Lif	=	2.5 m/s
Ketinggian bangunan	=	4.0 m
Bilangan tingkat	=	16 tingkat(termasuk aras tingkat tanah)
Jumlah keluasan pejabat	=	500 sq.m
Ketumpatan penghunian	=	12 sq.m/person
Lebar pintu Lif	=	1100 mm
Jenis penggerak Lif	=	Gearless variable voltage
Jenis pintu Lif	=	Bukaan tengah

(15 marks/markah)

4. a) The average illuminance specified at desk top level (1 m above floor level) in an office is 460 lux. The dimensions are 10 m by 10 m with a ceiling height of 3.2 m. The specified square luminaires are recessed in the ceiling with 4 (18 watt) fluorescent tubes (each having an output of 1350 lumens). The maximum spacing to height ratio is 1.6. The light loss factor may be taken as 0.8. Give a dimensioned plan showing a suitable arrangement of luminaires.

Purata pencahayaan untuk sebuah meja kerja (terletak 1 m dari paras lantai) di dalam sebuah pejabat adalah 460 lux. Ukuran bilik pejabat tersebut ialah 10 m panjang, 10 m lebar dan 3.2 m tinggi. Pemasangan lampu tersebut adalah jenis 4 tiub fluorescent (18 watt) tertanam dalam paras siling (setiap satu memberi "output" 1350 lumen). Kadar jarak maksimum dengan tinggi ialah ratio 1.6. Sementara faktor kehilangan cahaya diambil sebanyak 0.8. Lukiskan sebuah pelan berdimensi yang menunjukkan aturan pemasangan lampu tersebut.

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The following table gives the utilisation factors as a function of room index.

RI	0.75	1.00	1.25	1.50	2.00	2.50	3.00	4.00	5.00
UF	0.44	0.49	0.53	0.56	0.60	0.62	0.64	0.66	0.68

The Room Index $(RI) = \frac{L \times W}{H(L + W)}$

Where L = Room Length, W = Room Width & H = Luminaire Mounting Height

Average illuminance over the reference surface s is E(s) lux, given by the formula:

$$E(s) = \frac{N \times n \times F \times LLF \times UF(s)}{A(s)}$$

Where N = the number of luminaire
 n = the number of lamps per luminaire
 F = the bare lamp flux of each lamp
 LLF = the light loss factor
 UF(s) = utilization factor for the reference surface
 A(s) = area of surface s

(10marks/markah)

- (b) i) Discuss the importance of understanding and learning the field of acoustic in building industry.

Bincangkan kepentingan pembelajaran dan pemahaman bidang akustik (kawalan bunyi) di dalam industri binaan.

(7 marks/markah)

- ii) Explain the relationship between "Sound Pressure Level" (SPL) and "Sound Power Level" (SWL).

Terangkan hubungan diantara "Paras Tekanan Bunyi" (SPL) dan Paras Kekuatan Bunyi (SWL).

(4 marks/markah)

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- iii) A source of sound has a power of 5 Watts, propagated into a free field. What is the acoustic intensity at a distance of 10 m? What is the acoustic intensity at 20 m?

Terdapat suatu sumber bunyi pada kuasa 5 Watts yang dihasilkan ke dalam medan bebas. Apakah kekuatan "intensity" akustik pada jarak 10 m dan juga pada jarak 20 m?

(4 marks/markah)

5. (a) Name **FIVE (5)** components of space heat gain.

*Nyatakan **LIMA (5)** komponen yang menyumbang kepada haba dalaman.*

(5 marks/markah)

- (b) Recirculated air at 22 °C db and 17 °C wb temperature mixed with fresh air at 30 °C db and 25 °C wb temperature in the ductwork before being processed in the AHU. If the ratio of recirculated air to fresh air is 3:1

- (i) Plot the conditions on the psychrometric chart (The plot must be submitted together with your answering script)
- (ii) State the conditions of mixed air.

Udara kitaran semula pada suhu 22 °C bk and 17 °C bb bercampur dengan udara segar pada suhu 30 °C bk dan 25 °C bb di dalam salur udara sebelum diproses di dalam unit kendalian udara (AHU). Jika nisbah udara kitar semula kepada udara segar ialah 3:1

- (i) *Plotkan keadaan berkenaan pada carta psychrometric (Mesti dihantar bersama buku jawapan)*
- (ii) *Nyatakan keadaan udara campuran yang diperolehi.*

(20 marks/markah)

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6. An air conditioned space has a sensible heat load of 53 kW, a latent heat load of 13 kW and is maintained at 24 °C db and 18 °C wb. 100% fresh air is used at an outside condition of 35 °C db and 24 °C wb. The conditioned air enters the space at 16 °C. Calculate:

- (a) The space SHR
- (b) The flow rate of supply air to the space expressed in kgs^{-1} and m^3s^{-1}
- (c) The load on the cooling coil.

Satu ruang berhawa dingin mempunyai haba pendam 53 kW dan haba lakur 13 kW. Ruang berkenaan dikekalkan pada suhu 24 °C bk dan 18 °C bb. 100% udara luar pada keadaan suhu luaran 35 °C bk and 24 °C bb. Udara yang dirawat memasuki runag pada suhu 16 °C. Kira:

- (a) SHR bagi ruang*
- (b) Kadar aliran udara bekalan dalam kgs^{-1} and m^3s^{-1}*
- (c) Beban ke atas gegelung penyejuk.*

(25 marks/markah)

...8/-

CALCULATION FOR LIFT DESIGN**(Rujukan/References)**

Transportation Time = INTERVAL (2+N)/4
 Where : INTERVAL = RTT/N

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

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

$$T = \frac{2(d Sp + D + d)}{V}$$

Where: T = total travelling time
 d = acceleration distance
 Sp = probable number of stops
 D = Overall distance between ground and top floors.
 V = lift speed (m/s)

Lift speed	Jenis/Type	Jarak memecut/ 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

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Time taken to leave the lift at every stops above the ground floor with a lift door width of 1200 mm is given in the table below. Different door width sizes, do refer to the following table:-

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 (mm)	800	900	1100	1200
Efficiency	0.92	0.92	0.95	1.00

Transportation Capacity (5mins) = $[N \times n (5 \times 60)]/RTT$

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

Required Capacity (5 mins) =
$$\frac{\text{No of floors above Ground floor} \times \text{floor area of each floor} \times P5}{A_p}$$

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

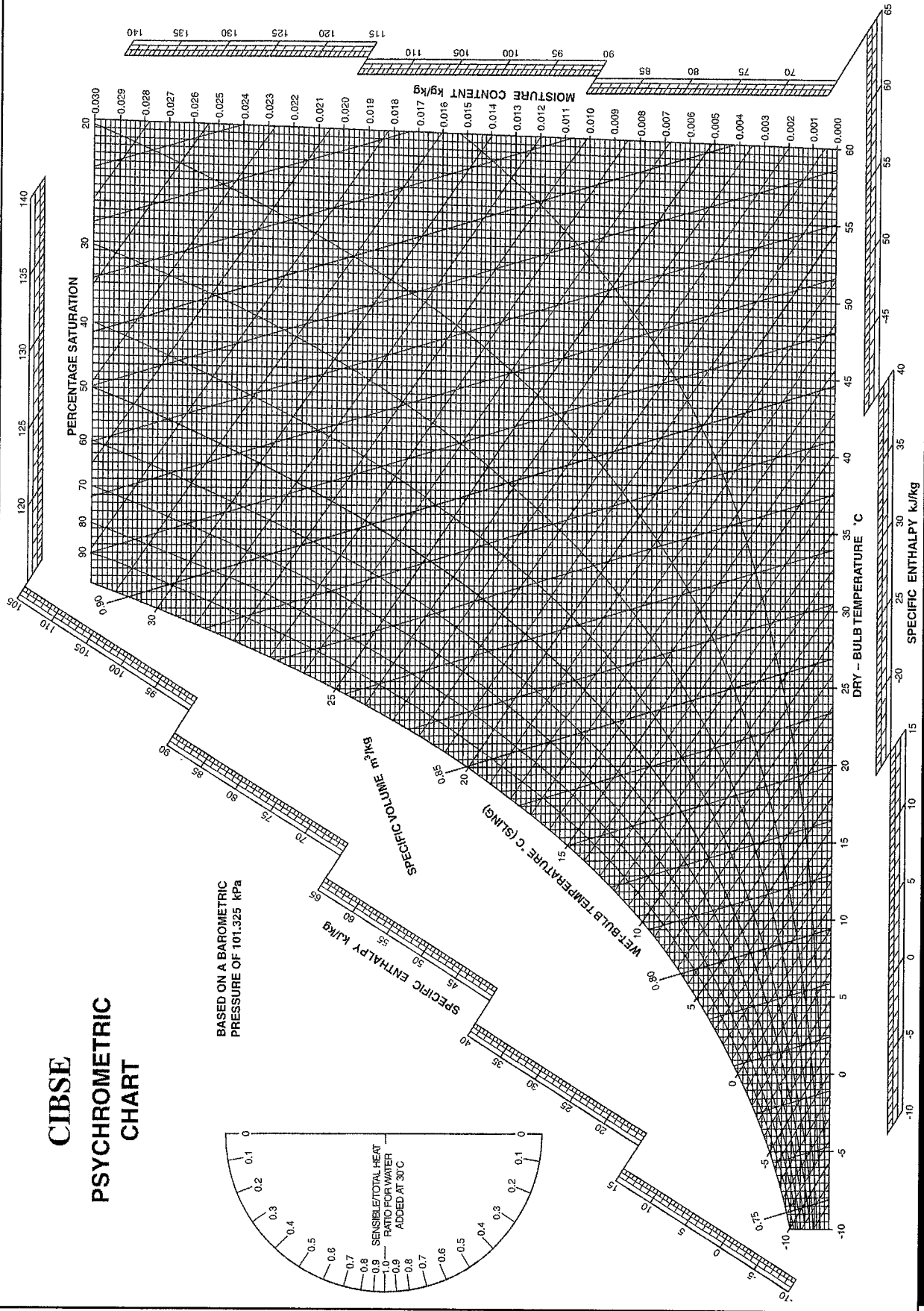
Five minute Peak traffic P5	
Apartment building	6%
College residence	12%
Department store	20%
Hospital	12%
Hotel	10%
Office (single tenant)	17%
Office (multi tenant)	12%

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

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CIBSE PSYCHROMETRIC CHART

BASED ON A BAROMETRIC
PRESSURE OF 101.325 kPa



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