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UNIVERSITI SAINS MALAYSIA

Second Semester Examination  
2009/2010 Academic Session

April/May 2010

**REG 261 – Building Services**  
***[Perkhidmatan Bangunan]***

Duration: 3 hours  
*[Masa: 3 jam]*

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

*Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN 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 **FIVE** questions only.

*Jawab **LIMA** soalan sahaja.*

In the event of any discrepancies, the English version shall be used.

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai].*

1. (a) State the characteristics of vertical transportation system that need to be present for tall buildings design?

*Nyatakan ciri-ciri sistem pengangkutan menegak yang perlu ada untuk rekabentuk bangunan tinggi?*

(12 marks/markah)

- (b) What are the main problems usually found in water supply and solid waste services for tall building maintenance?

*Apakah masalah utama yang sering ditemui dalam perkhidmatan bekalan air dan buangan pepejal bagi penyelenggaraan bangunan tinggi?*

(8 marks/markah)

2. You have been assigned to plan the water supply system for a 10-storey low-cost apartment. At every floor there are 2 units.

With the aid of sketches, describe the main characteristics of your proposed water supply system. You can use any system or a combination of systems you deem appropriate. Factors that need to be considered are:-

- The main pipe pressure can only supply direct water supply up to 2 floors only.
- The Water Authority does not allow direct pumping system from the main pipe.
- The water pressure for the top floor is low if it is to receive water supply from the roof water tank.
- If roof water tank system is used, assume the water pressure for the bottom half is too high.

*Anda ditugaskan untuk merancang sistem bekalan air untuk satu bangunan pangsapuri kos rendah 10 tingkat. Di setiap tingkat terdapat 2 unit.*

*Dengan bantuan lakaran, huraikan ciri-ciri utama cadangan sistem bekalan air anda. Anda boleh guna sebarang sistem atau cantuman sistem yang difikirkan munasabah. Fakta-fakta yang perlu diambil kira adalah:*

- *Tekanan paip utama hanya mampu membekalkan air secara langsung kepada 2 tingkat sahaja.*
- *Pihak Berkuasa Air tidak membenarkan kaedah pam secara langsung dari paip utama.*
- *Tekanan paip air untuk tingkat teratas pangsapuri adalah rendah jika ianya menerima bekalan air dari tangki air atas bumbung.*
- *Jika tangki air atas bumbung digunakan, andaikan tekanan paip air di separuh bawah bangunan adalah terlalu tinggi.*

(20 marks/markah)

3. You have been assigned to plan the toilet facility of a school. With the aid of sketches, describe **Five (5)** main characteristics that a good designed toilet should have, taking into consideration the following factors; layout, lighting, construction material, sanitary appliances (wash basin, water closet and urinal), ventilation, basic amenities and the needs of the handicapped.

*Anda ditugaskan untuk merancang kemudahan tandas sebuah tandas di sekolah. Dengan bantuan lakaran, huraikan **Lima (5)** ciri utama yang perlu ada bagi satu tandas yang direkabentuk dengan baik dengan mengambil kira faktor berikut:- tatatur, pencahayaan, bahan binaan, peralatan sanitari (besin basuh tangan, mangkuk tandas dan urinal), pengudaraan, kemudahan asas dan keperluan warga kurang upaya.*

(20 marks/markah)

4. (a) List **Four (4)** sources of fire within a building and describe how they develop into a major conflagration by referring to the fire triangle.

*Senaraikan **Empat (4)** sumber-sumber api dalam bangunan dan terangkan bagaimana ianya merebak sehingga berlakunya kebakaran yang memusnahkan dengan merujuk kepada segitiga api.*

(8 marks/markah)

- (b) List **Three (3)** objectives of automatic fire detectors. With the aid of sketches, discuss **Three (3)** types of their operations.

*Senaraikan **Tiga (3)** objektif pengesanan kebakaran automatik. Dengan bantuan lakaran, bincangkan **Tiga (3)** jenis operasi pengesanan kebakaran.*

(12 marks/markah)

5. (a) List down **Three (3)** conditions on how air purity is maintained. With the aid of sketches, discuss briefly **Three (3)** mechanical ventilation system that can be applied in buildings.

*Senaraikan **Tiga (3)** keadaan bagaimana ketulenan udara dapat dikekalkan. Dengan bantuan lakaran, bincangkan secara ringkas **Tiga (3)** sistem pengudaraan mekanikal yang boleh digunakan dalam bangunan.*

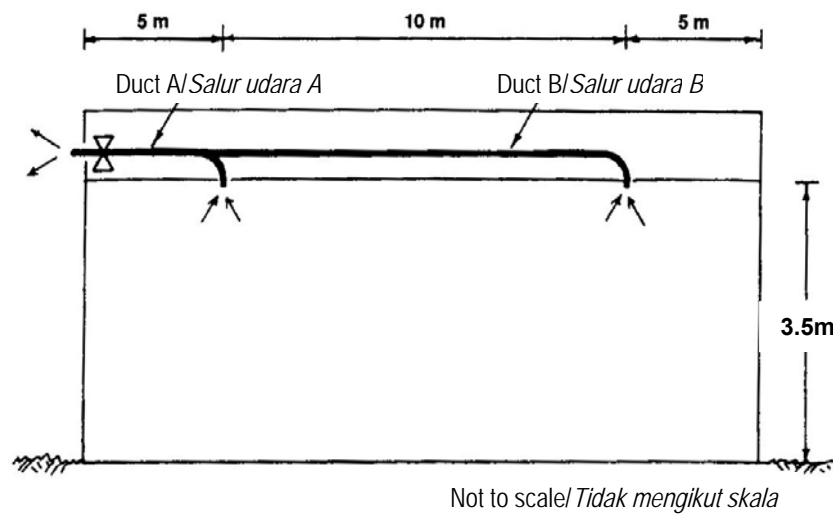
(9 marks/markah)

- (b) The dimension of an office space is given as 20m length, 10m width and 3.5m height. By referring to the attached tables and charts, determine:-

- (i) Duct sizes (use any chosen methods)
- (ii) Fan rating

Diberi satu ruang pejabat berukuran 20m panjang, 10m lebar dan 3.5m tinggi. Dengan berpandukan maklumat dan jadual serta carta yang diberi, tentukan:-

- (i) Saiz salur udara (gunakan kaedah yang dipilih)
- (ii) Keupayaan kipas



(11 marks/markah)

6. (a) What is heat gain? List down the components of heat gains into a space.

Apakah beban haba? Senaraikan komponen-komponen beban haba ke dalam sesuatu ruang.

(7 marks/markah)

- 6 -

- (b) An air-conditioning system is used to cool intake air at 30°C db with an RH of 70% to 20°C db with an RH of 50%, in an office of 2400 m<sup>3</sup> volume requiring 3 air changes per hour. Determine these parameters on the psychrometric chart provided:-
- (i) The wet-bulb temperatures
  - (ii) The specific volumes
  - (iii) The chiller enthalpy
  - (iv) The chiller rating

(The chart needs to be submitted together with your answer script)

*Satu sistem pendinginan udara diguna untuk menyejukkan udara ambilan pada 30°C bk dengan kelembapan relatif 70% kepada 20°C bk dengan kelembapan relatif 50% untuk sebuah pejabat berisipadu 2400 m<sup>3</sup> yang memerlukan 3 tukaran udara per jam. Tentukan parameter-parameter ini di atas psychrometric yang dibekalkan:-*

- (i) *Suhu-suhu bebuli basah*
- (ii) *Isipadu-isipadu tentu*
- (iii) *Enthalphy pendingin*
- (iv) *Kuasa pendingin*

*(Carta perlu diserahkan bersama kertas jawapan anda)*

(13 marks/markah)

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**ATTACHMENT FOR QUESTIONS 5(b)**  
**LAMPIRAN UNTUK SOALAN 5(b)**

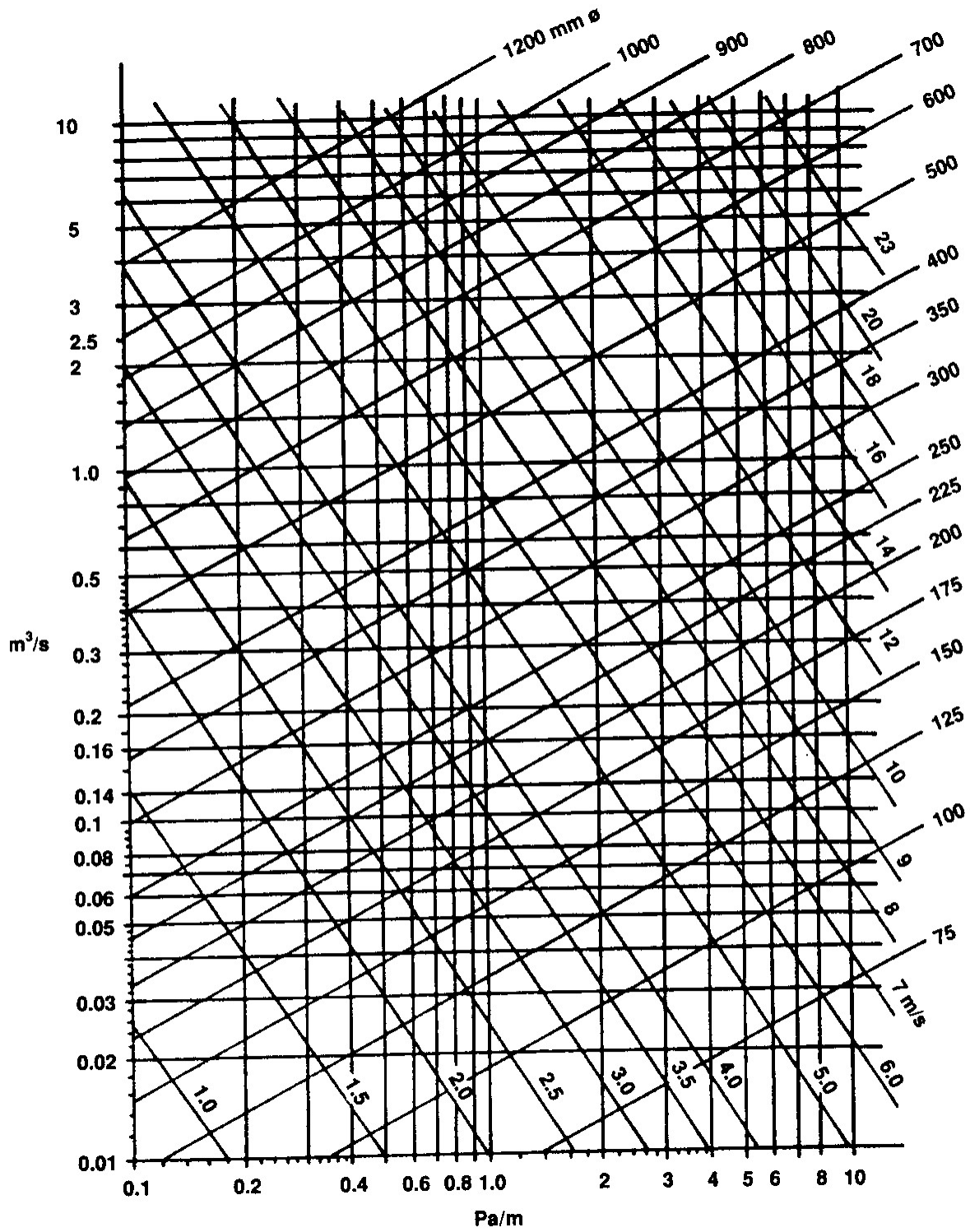
1. (a) **Air change rate table/**  
**Jadual kadar pertukaran udara**

Accommodation	Air changes per hour
Offices – above ground	2–6
Offices – below ground	10–20
Factories – large, open	1–4
Factories/industrial units	6–8
Workshops with unhealthy fumes	20–30
Fabric manufacturing/processing	10–20
Kitchens – above ground	20–40
Kitchens – below ground	40–60
Public lavatories	6–12
Boiler accommodation/plant rooms	10–15
Foundries	8–15
Laboratories	10–12
Hospital operating theatres	<20
Hospital treatment rooms	<10
Restaurants	10–15
Smoking rooms	10–15
Storage/warehousing	1–2
Assembly halls	3–6
Classrooms	3–4
Domestic habitable rooms	Approx. 1
Lobbies/corridors	3–4
Libraries	2–4

(b) **Recommended air velocity table/**  
**Jadual halaju udara yang dicadangkan**

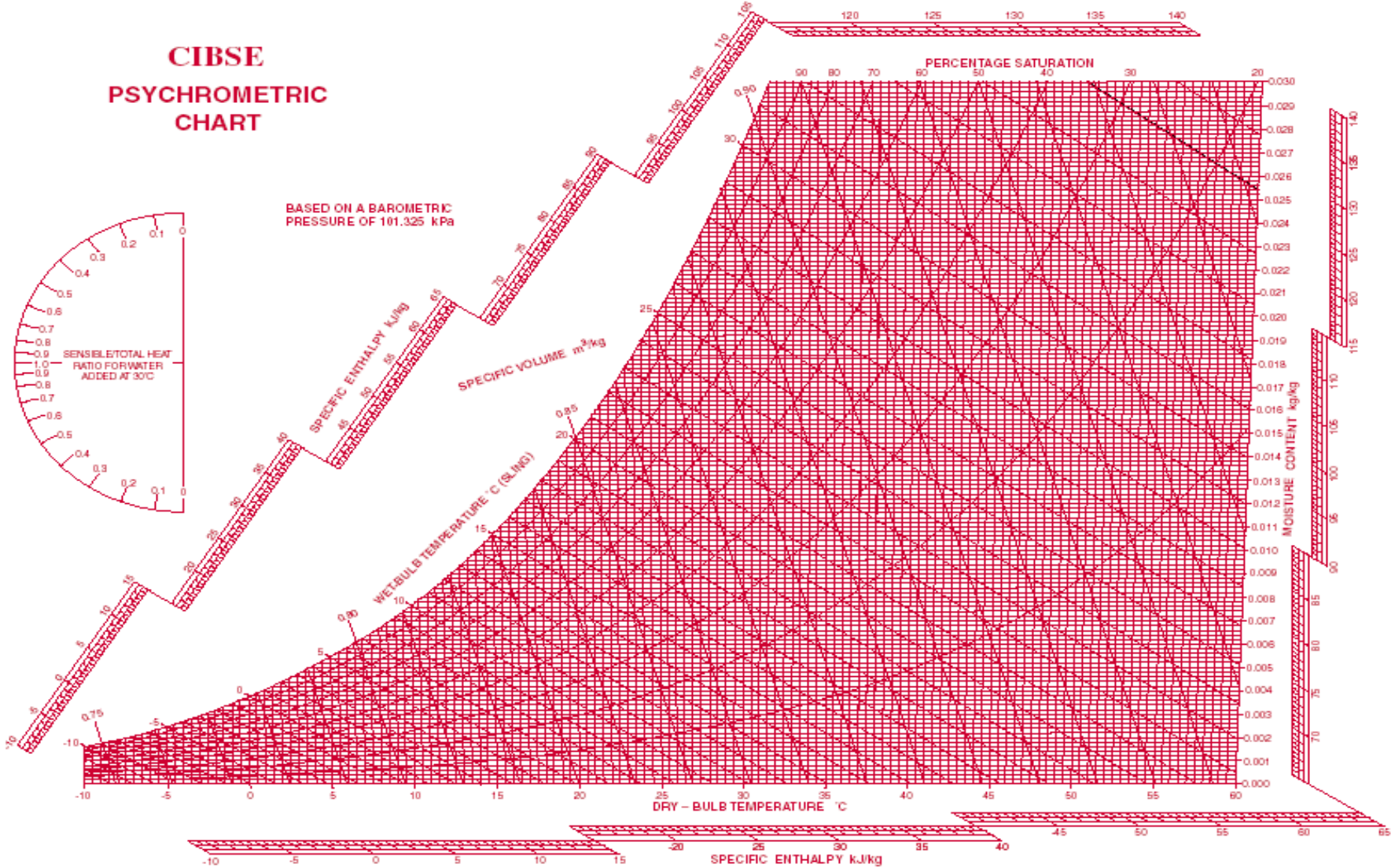
Application	Maximum air velocity (m/s)	Maximum resistance or pressure drop (Pa/m)
Extremely quiet situations such as reading rooms, recording studios and operating theatres	2.5	0.4
Fairly quiet locations, e.g. church, dwellings, private rooms, offices, hospital wards, commercial premises, theatres, restaurants, public buildings, classrooms and conference facilities	6.0	0.6
Less critical situations, such as exhibition centres, factories, workshops, gyms, departmental stores, cafes/fast food centres, warehousing, etc.	10.0	0.8

(c) Air duct design chart/  
*Carta rekabentuk salur udara*





**ATTACHMENT FOR QUESTIONS 6(b)**  
**LAMPIRAN UNTUK SOALAN 6(b)**



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