

SULIT



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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2019

DCB6252: ACOUSTICS

TARIKH : 08 NOVEMBER 2019

MASA : 3.00 PETANG - 5.00 PETANG (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.

Bahagian A: Struktur (2 soalan)

Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Tiada

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 questions.

Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan berstruktur

Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

CLO2
C2

- a) Calculate the Sound Intensity Level of a machine which has a sound intensity of $9.48 \times 10^{-3} \text{ W/m}^2$.

Kirakan Aras Keamatan Bunyi sebuah mesin yang mempunyai tekanan bunyi sebanyak $9.48 \times 10^{-3} \text{ W/m}^2$.

[5 marks]

[5 markah]

CLO2
C3

- b) Sketch a diagram of a simple vibrating system containing mass, spring and damper.

Lakarkan diagram sebuah sistem getaran yang ringkas mengandungi jisim, spring dan peredam.

[8 marks]

[8 markah]

CLO2
C3

- c) A hall used for choral music has 4000m^3 volume at 500Hz .

Sebuah dewan digunakan untuk muzik coral berisipadu 4000m^3 pada 500Hz .

- i. Calculate the optimum reverberation time using Stephens and Bate's Formula.

Given $r = 6$.

Kirakan tempoh kumandang optimum menggunakan Formula Stephens and Bate's. Diberi $r = 6$.

[4 marks]

[4 markah]

- ii. Using Sabine's Formula, calculate the actual reverberation time for the same hall with the capacity of 300 people. The hall has the following surface finishes.

Appendix 1 is given for absorption coefficients of common building materials. Seats are fully upholstered.

Plaster on brickwork	300m^2
3mm glass window	50m^2
Stage, boards on joist	80m^2

*Menggunakan Formula Sabin, kirakan tempoh kumandang sebenar untuk dewan yang sama dengan kapasiti untuk 300 orang. Dewan tersebut mempunyai kemasan permukaan berikut. **Lampiran 1** diberi untuk pekali penyerapan bagi bahan bangunan yang biasa. Tempat duduk adalah semuanya berlapik penuh.*

<i>Lepa pada batu bata</i>	300m^2
<i>3mm tingkap kaca</i>	50m^2
<i>Pentas, papan atas gelegar</i>	80m^2

[8 marks]

[8 markah]

QUESTION 2

SOALAN 2

CLO 2
C2

- a) Identify **FIVE (5)** main causes of vibration.

*Kenalpasti **LIMA (5)** sebab utama getaran.*

[5 marks]

[5 markah]

CLO 2
C3

- b) Using the data provided, calculate the optimum and actual reverberation times at the rate of 500Hz of a hall intended for orchestral music.

Volume of hall	2500m ³
Number of absorption units at 500Hz	350
The constant r in the Stephens and Bate formula	5 for orchestral music

Menggunakan data diberi, kira tempoh kumandang optimum dan sebenar pada 500Hz bagi sebuah dewan yang digunakan sebagai muzik orkestra.

<i>Isipadu dewan</i>	2500m ³
<i>Jumlah unit penyerapan pada 500Hz</i>	350
<i>Kadar tetap r pada formula Stephens and Bate</i>	5 untuk muzik orkestra

[8 marks]

[8 markah]

CLO 2
C3

- c) A sprinkler pump operated and produced sound power of 1000 watts, located in Building Services Laboratory.

Sebuah pam pemercik dihidupkan dan mengeluarkan kuasa bunyi 1000 watt, terletak di Makmal Perkhidmatan Bangunan.

- i. Calculate the sound intensity if measured 5m from the sprinkler pump.

Kirakan keamatan bunyi jika diukur 5m dari pam pemercik.

[4 marks]

[4 markah]

CLO 2
C3

- ii. Calculate the total intensity level if another two sprinkler pumps operated simultaneously.

Kirakan jumlah aras keamatan bunyi jika dua buah pam pemercik lagi dihidupkan serentak.

[8 marks]

[8 markah]

INSTRUCTION: SECTION B

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

ARAHAN:

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

QUESTION 1**SOALAN 1**CLO1
C1

- a) Define Sound Pressure Level including its formula and units.

Definisikan Tahap Tekanan Bunyi termasuk formula dan unitnya.

[5 marks]

[5 markah]

CLO1
C2

- b) There are a few index levels in measuring the level of interference in sound or vibration. Explain the following indexes:

Terdapat beberapa aras indeks dalam mengukur aras gangguan bunyi atau getaran.

Terangkan indek-indek berikut:

- i. Sound Interference Level

Tahap Gangguan Bunyi

- ii. Noise Criteria

Kriteria Kebisingan

[8 marks]

[8 markah]

CLO1
C3

- c) Hearing defects are usually divided into two general types as shown in **Figure 1**.

*Kecacatan pendengaran kebiasaannya terbahagi kepada dua jenis seperti yang ditunjukkan pada **Rajah1**.*

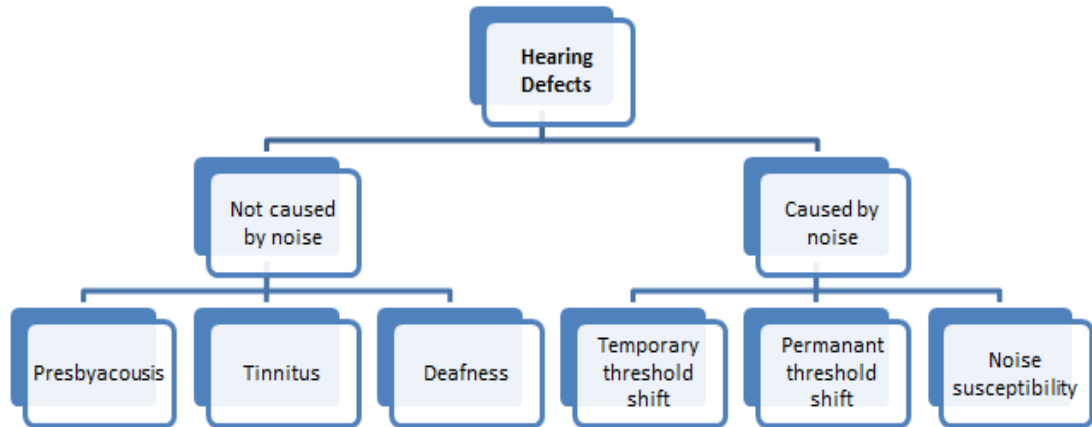


Figure 1: Hearing defects

Rajah 1: Kecacatan pendengaran

- i. Interpret “Tinnitus”.

Tafsirkan “Tinnitus”

[4 marks]

[4 markah]

- ii. Interpret “temporary threshold shift” and “permanent threshold shift”.

Tafsirkan “temporary threshold shift” dan “permanent threshold shift”.

[8 marks]

[8 markah]

QUESTION 2

SOALAN 2

CLO 1
C1

- a) The aim of the design of any hall for speech or music is to obtain the optimum acoustic effect on the audience. List **FIVE (5)** requirements for a room with a good acoustic effect.

*Matlamat reka bentuk mana-mana dewan untuk pertuturan atau muzik mestilah untuk mendapatkan kesan akustik optimum kepada penonton. Senaraikan **LIMA (5)** keperluan ruang untuk kesan akustik yang baik.*

[5 marks]

[5 markah]

CLO 1
C2

- b) Sound is reflected in different ways depending on the shape of the reflecting surface. Differentiate the following surfaces.

Bunyi terpantul dalam cara yang berbeza bergantung kepada bentuk permukaan pantulan. Bezakan permukaan berikut.

- i. Concave surface

Permukaan cengkung

- ii. Convex surface

Permukaan cembung

[8 marks]

[8 markah]

CLO 1
C3

- c) A noise on the site of a proposed school classroom has the following characteristics. Calculate:

Kebisingan di sebuah tapak cadangan untuk bilik darjah mempunyai kriteria seperti berikut. Kirakan:

Octave band centre frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound pressure level (dB)	75	71	70	69	65	62	61	60

- i. The NC level (**Refer Appendix 2**)

Aras Kriteria Kebisingan (Rujuk Lampiran 2)

[4 marks]

[4 markah]

- ii. The sound insulation required to achieve NC25 (**Refer Appendix 2**)

Penebat bunyi diperlukan untuk mencapai NC25 (Rujuk Lampiran 2)

[8 marks]

[8 markah]

QUESTION 3

SOALAN 3

CLO 1
C1

a) Define the following terms:

Definisikan istilah-istilah berikut:

i. Random vibration

Random vibration

ii. Transient vibration

Transient vibration

[5 marks]

[5 markah]

CLO 1
C2

b) Describe the vibration on building attributed by duct borne noise.

Jelaskan getaran terhadap bangunan akibat dari bunyi bising sesalur.

[8 marks]

[8 markah]

CLO 1
C3

c) Workers on construction sites are often subject to continuously loud and noisy environment, and by law they must be protected. There are seven steps of noise control for construction sites where one of them is Engineering Control.

*Pekerja di tapak bina selalunya terlibat secara berterusan dengan persekitaran hingar dan bising, and mengikut undang-undang mereka mestilah dilindungi.**Terdapat tujuh peringkat untuk mengawal kebisingan di mana salah satunya adalah Kawalan Kejuruteraan.*i. Identify another **FOUR (4)** steps of noise control.*Kenalpasti **EMPAT (4)** lagi peringkat kawalan kebisingan.*

[4 marks]

[4 markah]

ii. Sketch an example of noise control for construction site.

Lakarkan sebuah contoh kawalan kebisingan di tapak pembinaan.

[8 marks]

[8 markah]

QUESTION 4

SOALAN 4

CLO 1
C1

a) Define the following noises:
Definisikan kebisingan berikut:

- i. Structure borne noise
Kebisingan bawaan struktur
- ii. Air borne noise
Kebisingan bawaan udara

[5 marks]

[5 markah]

CLO 1
C2

b) Describe **TWO (2)** of the following noise control methods:
Terangkan DUA (2) kaedah kawalan kebisingan yang berikut:

- i. Architectural control
Kawalan senibina
- ii. Engineering control
Kawalan kejuruteraan

[8 marks]

[8 markah]

CLO 1
C3

c) Interpret the noise from the building services equipment below:
Jelaskan kebisingan dari peralatan kemudahan bangunan berikut:

- i. Lift and escalator system
Sistem lif dan eskalator

[4 marks]

[4 markah]

- ii. Plumbing system
Sistem perpaipan

[8 marks]

[8 markah]

FORMULA DCB 6252 ACOUSTICS

1. $SWL = 10\log_{10} \frac{W}{W_0}$

2. $SIL = 10\log_{10} \frac{I}{I_0}$

3. $SPL = 20\log_{10} \frac{P}{P_0}$

4. $I = \frac{W}{4\pi r^2}$

5. Threshold of hearing intensity is 10^{-12}

6. Threshold of hearing pressure is 20×10^{-6}

7. Optimum reverberation times by Stephens and Bate's formula,

$$t = r(0.012\sqrt[3]{V} + 0.1070)$$

8. Actual reverberation times by Sabine's formula at 500Hz,

$$t = \frac{0.16V}{A}$$

Appendix 1
Lampiran 1

Appendix 1: Absorption coefficients of common building materials

Material and method of fixing	Absorption coefficients			
	Low frequency	Medium frequency	High frequencies	
	125Hz	500Hz	2000Hz	4000Hz
Boarded roof; underside of pitched slate or tile roof	0.15	0.1	0.1	0.1
Boarding ('match') about 20mm thick over air space on solid wall	0.3	0.1	0.1	0.1
Brick work – plain, plastered or painted	0.02	0.02	0.04	0.05
Clinker ('breeze') concrete unplaster	0.2	0.6	0.5	0.4
Carpet (medium) on solid concrete floor	0.1	0.3	0.5	0.6
Carpet (medium) on joist or board and batten floor	0.2	0.3	0.5	0.6
Concrete, constructional or tooled stone or granolithic finish	0.01	0.02	0.02	0.02
Cork slab, wood blocks, linoleum or rubber flooring on solid floor (or wall)	0.05	0.05	0.1	0.1
Curtains (medium fabrics) hung straight and close to wall	0.05	0.25	0.3	0.4
Curtain (medium fabrics) hung in folds or spaced away from wall	0.1	0.4	0.5	0.6
Floor tiles (hard) or 'composition' flooring	0.03	0.03	0.05	0.05
Glass; windows glazed with up to 3mm glass	0.2	0.1	0.05	0.02
Glass; 7mm plate or screen or thicker in large sheet	0.1	0.04	0.02	0.02
Plaster, lime or gypsum on solid backing	0.02	0.02	0.04	0.04
Plaster, lime or gypsum on lath, over air space on solid backing,	0.3	0.1	0.04	0.04

or on joists or studs including decorative fibrous and plaster board				
Plaster, lime or gypsum or fibrous, normal suspended ceiling with large air space above	0.2	0.1	0.04	0.04
Plywood mounted solidly	0.05	0.05	0.05	0.05
Water – as in swimming baths	0.01	0.01	0.01	0.01
Wood boards on joists or battens for stage	0.15	0.1	0.1	0.1
Wood wool slabs 25mm thick (unplaster) solidly mounted	0.1	0.4	0.6	0.6
Wood wool slabs 80mm thick (unplaster) solidly mounted	0.2	0.8	0.8	0.8

Absorption of special items	Absorption units m ²			
	Low frequency	Medium frequency	High frequencies	
	125Hz	500Hz	2000Hz	4000Hz
Air (per m³)	-	-	0.007	0.020
Audience seated in fully upholstered seats (per person)	0.19	0.47	0.51	0.47
Audience seated in wooden or padded seats (per person)	0.16	0.4	0.43	0.4
Seats (unoccupied) fully upholstered (per seat)	0.12	0.28	0.31	0.37
Theatre proscenium opening with average stage set (per m²)	0.2	0.3	0.4	0.5

Appendix 2: Noise criteria (NC) curves

