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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FCD20402**
SUBJECT TITLE	:	**ACOUSTIC AND VIBRATION**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**3.30 PM – 5.30 PM (2 HOURS)**
DATE	:	**08 JANUARY 2015**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.**
6. **Answer all questions in English.**
7. **Fomula is appended.**

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

a) What is the airborne sound?

(6 marks)

b) What is the direct airborne sound?

(7 marks)

c) What is the structure – borne sound?

(7 marks)

Question 2

a) What is “Speed and Wavelength”?

(4 marks)

b) What are the general characteristics of sound?

(8 marks)

c) A compressor is radiating a pure tone of 1000Hz.
If speed of sound is 1125ft/s and 343 m/s.
What is the wavelength of 1000 Hz?

(8 marks)

Question 3

a) What is “sound Power “?

(2 marks)

b) What is “sound pressure”?

(2 marks)

c) Referring to figure Q3(c), determine the value of radius (r_1) when Sound pressure level (L_p) is 60dB and sound power level (L_w) at the source for free field condition

(16 marks)

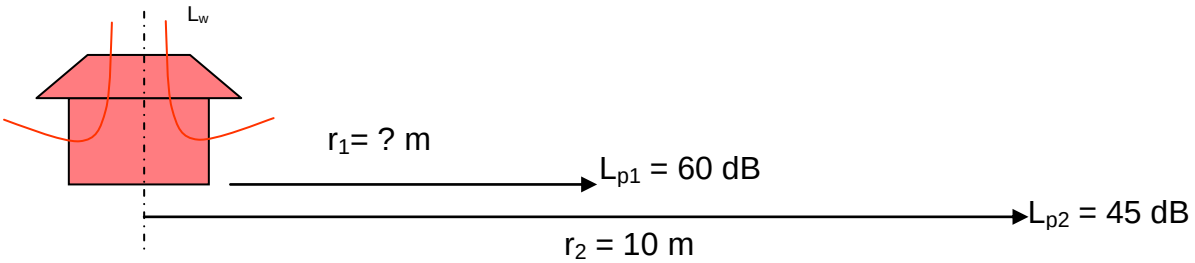


Figure Q3(c): Sound pressure distance

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO questions.
Please use the answer booklet provided.

Question 4

Refer to figure Q4,
Calculate the Sound pressure level (SPL) radiating from an Air conditioning unit received by a worker at the distance of 6m from the Air conditioner. The Air conditioner is installed at the middle of angle of the room of 17.5m x 12.5m x 4.0m. The Air conditioner manufacture specification of the Sound power level (SWL) is 80 dB. The background noise of the room is 70dB and radius from fan coil to reservoir.
The room is constructed by concrete wall, ceiling and floor absorption coefficient of

Door : 1.0m x 2.5 m
Window: 2.5m x 1.5m

$\alpha_{wall} = 0.1$
$\alpha_{floor} = 0.2$
$\alpha_{ceiling} = 0.15$
$\alpha_{window} = 0.25$
$\alpha_{Door} = 0.1$

Calculate:

a) Total absorption area
(4 marks)

b) Average absorption coefficient
(4 marks)

c) Room constant
(4 marks)

d) Reverberation time
(4 marks)

e) Total Sound pressure level (Lp)
(4 marks)

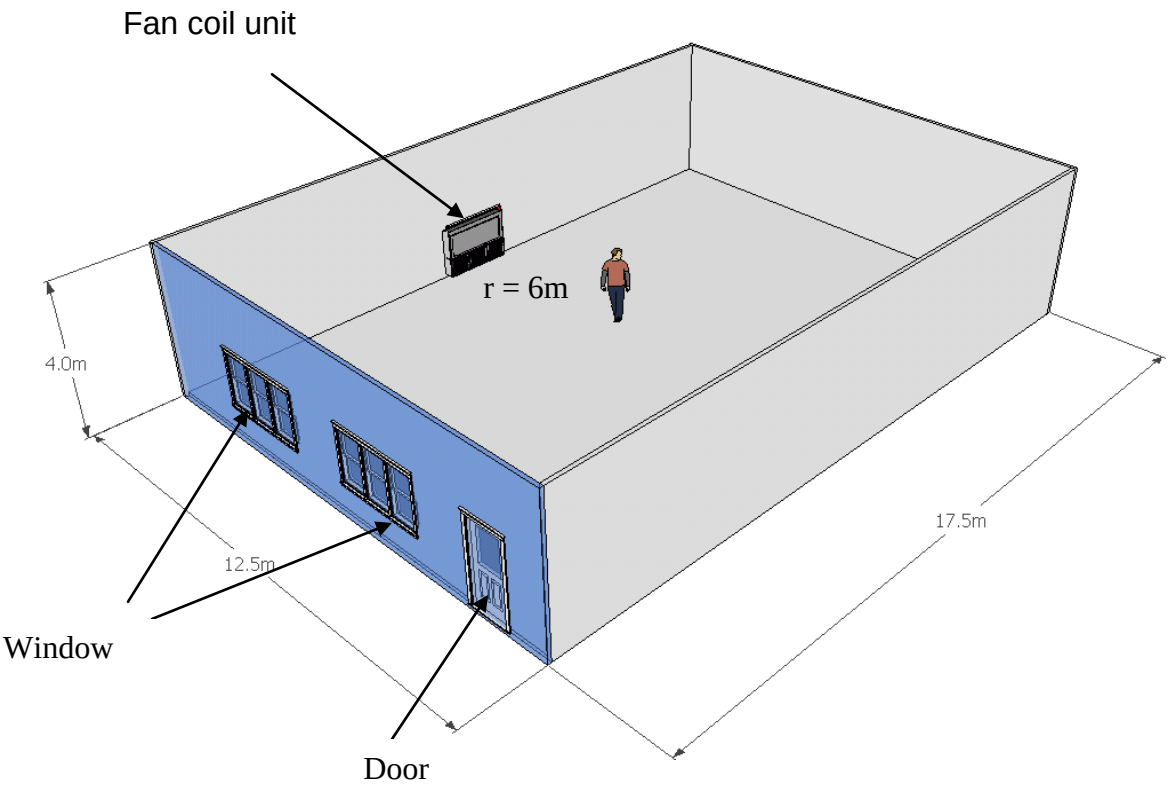


Figure Q4: Indoor unit location

Question 5

(a) What is the definition of :

i. The Coefficient or factor of reflection (r)?

(2 marks)

ii. The Coefficient or factor of absorption (α)?

(2 marks)

iii. The Coefficient or factor of transmission (t)?

(2 marks)

(b) State the formula of :

i. Natural frequency

(2 marks)

ii. Transmissibility

(2 marks)

(c) Referring figure Q5(a) and(b). A 50kg block moves vertically with two spring in different condition. The block is pulled 40mm downward from its equilibrium position and released. Find the natural frequency for (a) and (b).

(10 marks)

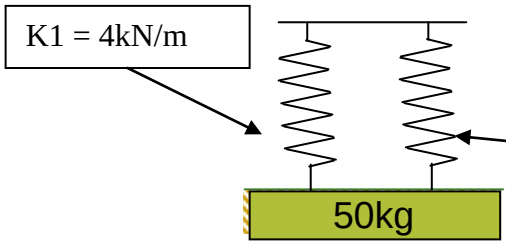


Figure Q5(a): Complete system with parallel spring

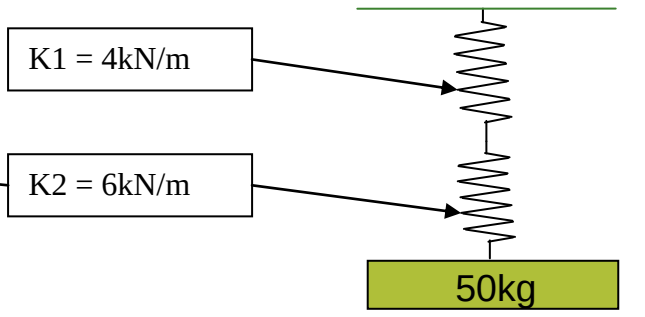


Figure Q5(b): Complete system with series spring

Question 6

A tray of mass m_1=50kg is attached to 3 springs as shown in figure Q6(a). The natural frequency is 3.18Hz. After that, another m_1 block has been placed on top of the first m_1 and spring B is removed, as figure Q6(b) now the natural frequency is observed to be 1.6Hz. Determine the spring stiffness of k_A and k_B.

(20 marks)

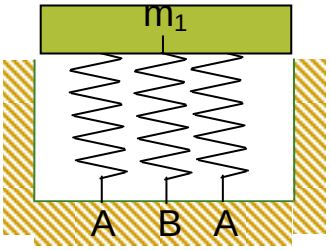


Figure Q6(a): Complete system with all Spring A and B installed

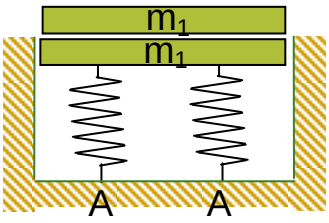
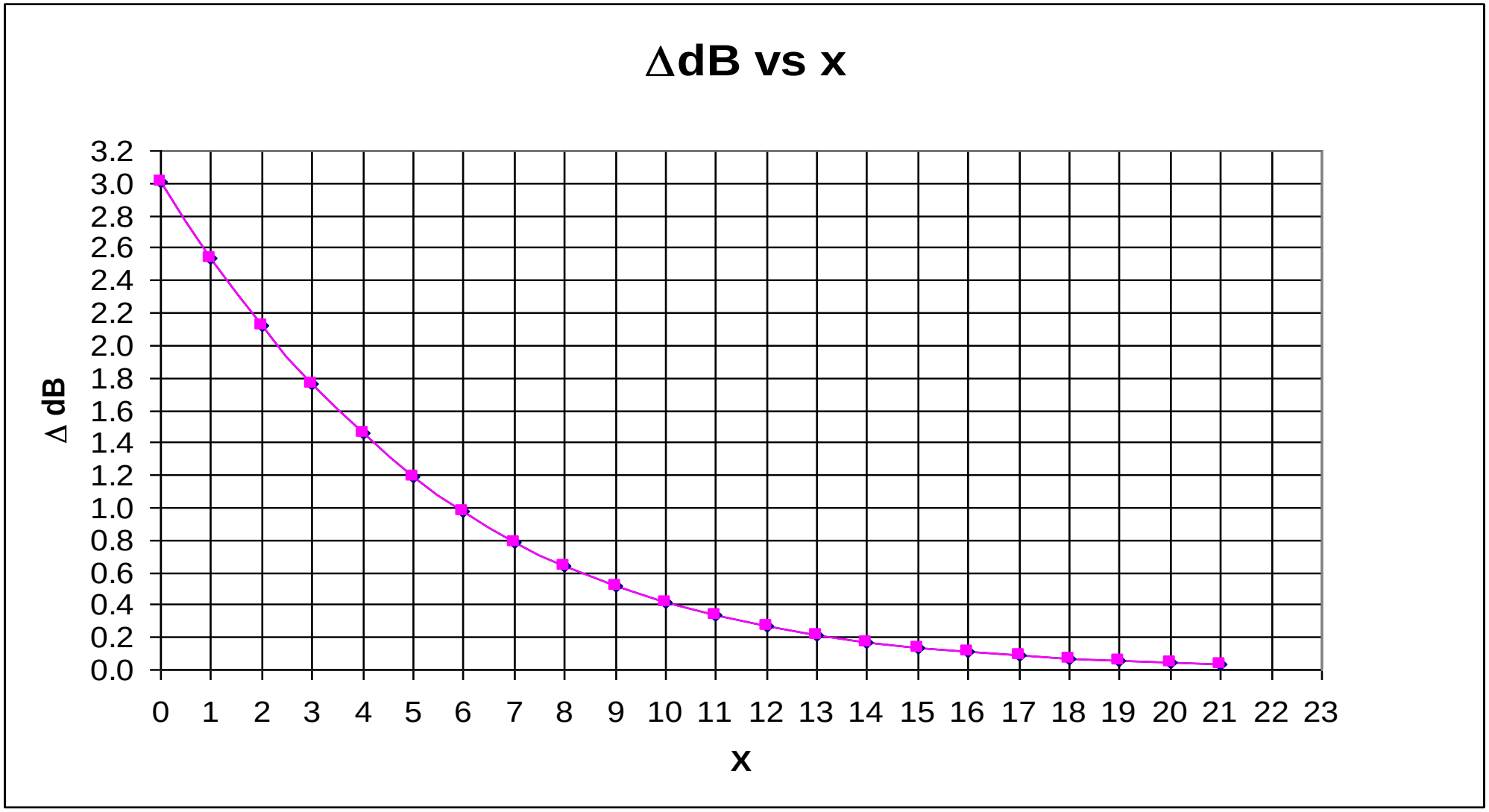


Figure Q6(b): After spring B is remove And additional M_1

END OF QUESTION

Appendix Technical Document



Formulae:

- *Log (ab) = log a + log b*
- *Log (a/b) = log a – log b*
- *Log a^b = b log a*
- *Log_a a = 1*
- *Log_a 1 = 0*
- *Log_a b = $\frac{log_c\ b}{log_c a}$*

ACOUSTICS:

- $\lambda = \frac{v}{f}$ where □= wavelength, *v*= speed (m/s); *f*=frequency (Hz)
- $v = \sqrt{\gamma RT}$

  Where $R = \frac{\overline{R}}{M}$, M= Molar Mass; $\overline{R}$ = Universal Gas constant (8.314 kJ/kmol.K)

- For Air : $v = \sqrt{\gamma RT} \approx 20.04\sqrt{T}$ where T in Kelvin
- T(K) = 273 + □C
- $L_w = 10\log\left(\frac{W}{W_{ref}}\right)$ where W_{ref} = 10^{-12} watt
- $L_p = 20\log\left(\frac{P}{P_{ref}}\right)$ where P_{ref} = 20 □Pa
- $L_I = 10\log\left(\frac{I}{I_{ref}}\right)$ where I_{ref} = 10^{-12} watt/m^2
- $L_{TOTAL} = 10\log\left[\sum_{i=1}^{n} 10^{\frac{L_i}{10}}\right]$
- $L_{P1} - L_{p2} = 20Log\left(\frac{r_2}{r_1}\right)$
- <u>*Free Field* :</u> $L_p = L_w + 10\log\left(\frac{Q}{4\pi r^2}\right)$ where Q=Directivity (1,2,4,8)
- <u>*Closed Room* :</u> $L_p = L_w + 10\log\left(\frac{Q}{4\pi r^2} + \frac{4}{R}\right)$

where *R* =Room constant; $R = \frac{S - \bar{\alpha}}{(1 - S\bar{\alpha})}$; absorption coeff. $\alpha_{abs} = \frac{I_{abs}}{I_{inc}}$;

- S= S_1+S_2+S_3+….+S_n, $\bar{\alpha} = \frac{S_1\alpha_1 + S_2\alpha_2 + ... + S_n\alpha_n}{S}$
- Reverberation time in sec $T_{60} = \frac{0.16V}{A}$, where *V*= Room volume,

  Total absoption area (TSA) $A = \sum S_i \alpha_i$