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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	: FCD 20402
SUBJECT TITLE	: ACOUSTIC AND VIBRATION
LEVEL	: DIPLOMA
TIME / DURATION	: 1.00pm – 3.00pm (2 HOURS)
DATE	: 03 MAY 2010

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 answer on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This questions paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A. For section B, answer TWO (2) questions only.
6. Answer all questions in English.
7. Formula is appended.

THERE ARE 7 PAGES OF QUESTIONS AND 3 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

From this formula :

$$P = P_{max}. \sin \left[wt + \frac{2\pi d}{\lambda} \right]$$

a) What is the description and unit for "P"

(2 marks)

b) What is the description and formula for P_{max} .

(3 marks)

c) What is the description, unit and formula for "W"

(4 marks)

d) What is the description , unit and formula for "d".

(5 marks)

e) What is the description and unit for "t" .

(2 marks)

f) What is the description, unit and formula for "λ".

(4 marks)

Question 2

a) What is "Sound pressure"?

(2 marks)

b) What is Sound power?

(2 marks)

c) Calculate the Sound power level (L_w) of:

i) Engine that emits a power of 1nW

(4 marks)

ii) An engine that emits a power of 10M W

(4 marks)

d) Calculate power W when Sound power level (L_w) is:

i) Lw = 8 dB

(4 marks)

ii) Lw = 135 dB

(4 marks)

Question 3

a) An existing fan produces 85 dB measured at a worker's position. A new fan some distance away from the first fan produces 84 dB measured at the same worker's position when operating alone. What is the resulting noise level at the worker's position when both fans are operating?

Your answer should include

i) By rule

(5 marks)

ii) By calculation

(5 marks)

b) What is the resulting dB level when 78dB is added to 81dB (by graph)? Refer to Appendix

(5 marks)

c) What is the resulting dB level when 86 dB(A) is added to 92 dB (A) (by rule) ?

(5 marks)

SECTION B (Total: 40 marks)

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

Question 4

Refer to figure Q4,
Calculate the Sound pressure level (Lp) radiating from an Air conditioning unit received by a worker at the distance of 4m from the Air conditioner. The Air conditioner is installed at the top corner of the room of 40m x 20m x 8m. The Air conditioner manufacture specification of the unit is L_w= 99 dB. The background noise of the room is 88dB.
<Note>
The room is constructed by concrete wall, ceiling and floor absorption coefficient of
$\alpha_{wall/ceiling} = 0.1$
$\alpha_{floor} = 0.2$

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 Lp (4 marks)

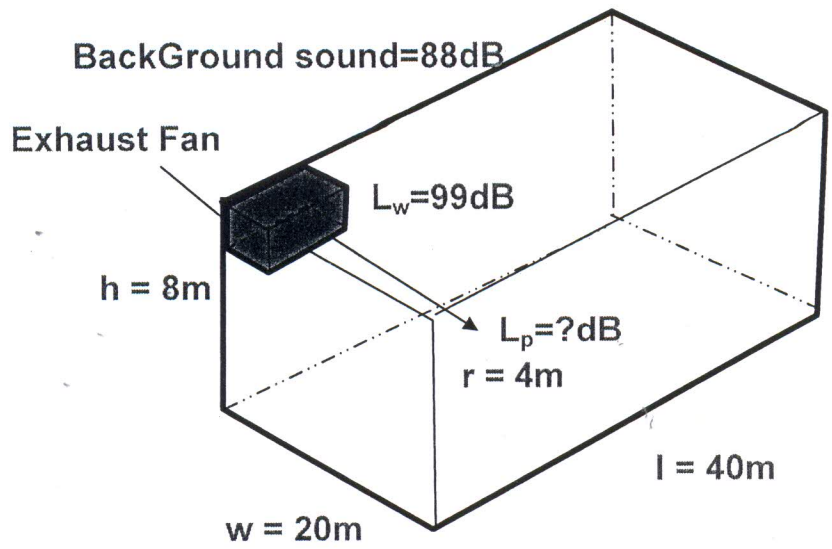


Figure Q4: Indoor unit location

Question 5

A 50kg block moves vertically as shown. The block is pulled 40mm downward from its equilibrium position and released. For each (A) and (B), determine:

a) The Natural Frequency

(10 marks)

b) The Force (F) to pull it down

(10 marks)

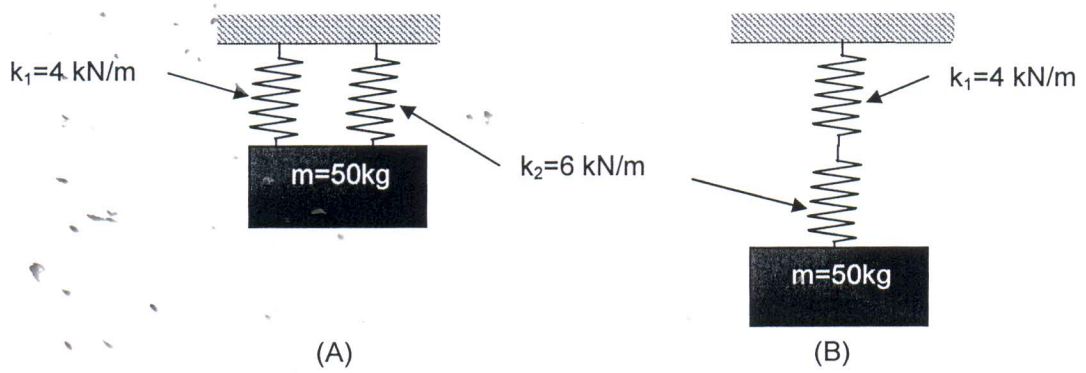


Figure 2: Spring arrangement

Question 6

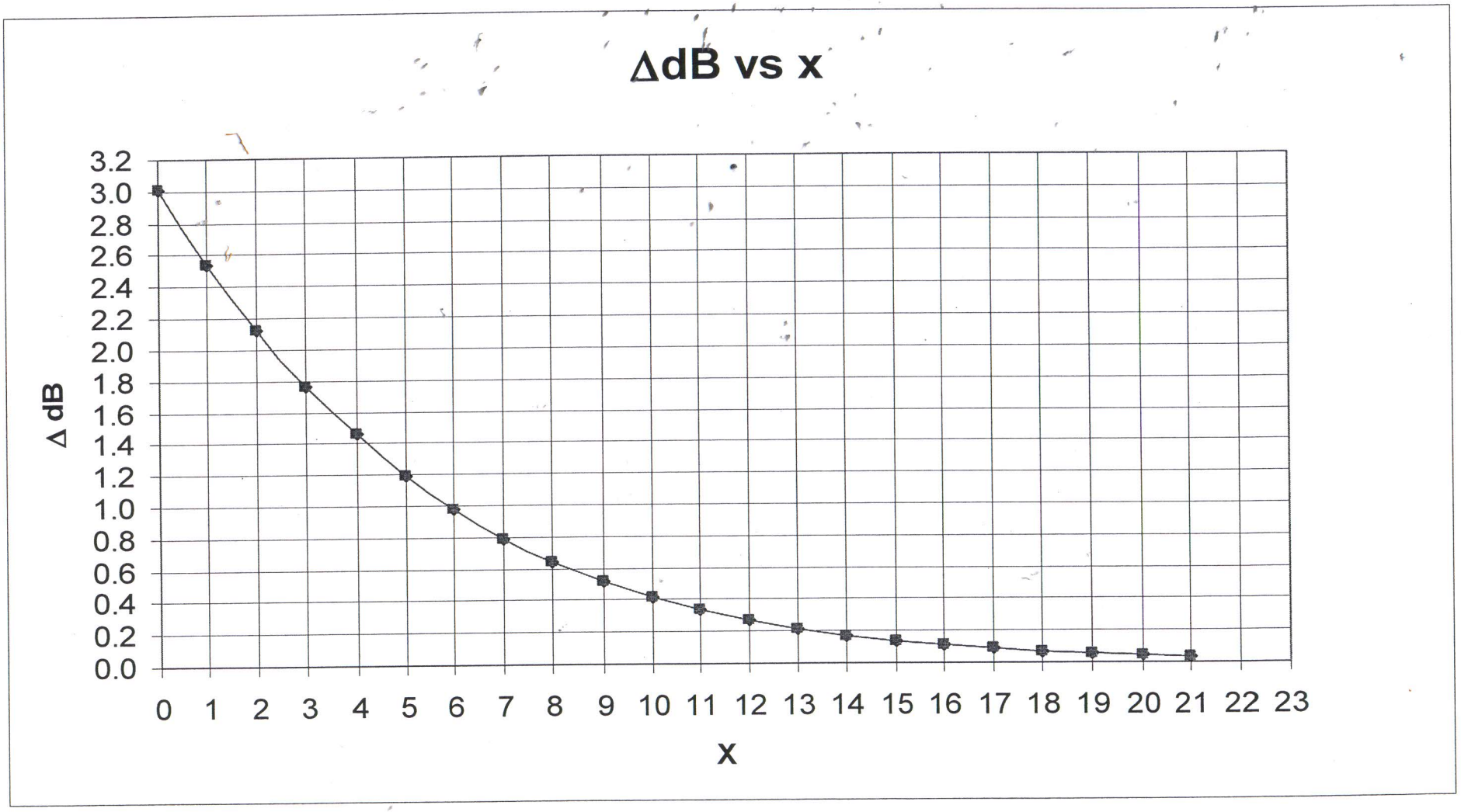
A tray of mass m1 is attached to 3 springs as shown (figure Q6). The natural frequency is 2Hz. After that, a mass m_2=1kg block has been placed in the center of the tray, and spring B of k_B= 10kN/m has been removed and the period of the natural frequency is observed to be 1.5Hz. Determine the mass m1 of the tray.

(20 marks)

Figure Q6: Spring arrangement

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
- $L_{TOTAL} = 10\log\left[\sum_{i=1}^{n} 10^{\frac{L_i}{10}}\right]$
- $L_{P1} - L_{p2} = 20Log\left(\frac{r_2}{r_1}\right)$
- Free Field : $L_p = L_w + 10\log\left(\frac{Q}{4\pi r^2}\right)$ where Q=Directivity (1,2,4,8)
- Closed Room : $L_p = L_w + 10\log\left(\frac{Q}{4\pi r^2} + \frac{4}{R}\right)$

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) $A = \sum S_i\alpha_i$