UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME:	ACOUSTIC AND NOISE CONTROL
COURSE CODE:	BDC 40803
PROGRAMME:	BDD
EXAMINATION DATE:	DECEMBER 2018 / JANUARY 2019
DURATION:	3 HOURS
INSTRUCTIONS:	ANSWERS **FIVE (5)** OUT OF **SIX (6)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 **(a)** The audible range of sound pressure is from 2 x 10^{-5} (Pa) to 20 Pa. While, the audible range of sound frequencies is from 20 Hz to 20 kHz. Define and differentiate;

i. above frequency of audible range,

(2 marks)

ii. below frequency of audible range.

(4 marks)

(b) The sound pressure level of a machine is measured in octave band in the presence of a background noise, which is also measured, with the machines turned off. The results of the measurements are shown in **Table Q1.** Calculate;

i. Octave band or corrected sound levels of machines.

(4 marks)

ii. A weighted and unweighted total sound level produce by the machine by using corretecd sound levels.

(4 marks)

Table Q1

OCTAVE BAND (HZ)	MACHINE ON (dB)	MACHINE OFF (dB)	A WEIGHTING
125	90	85	-16
250	85	80	-8.6
500	83	75	-3.2
1000	76	63	0
2000	74	60	1.2
4000	73	53	1
8000	65	50	-1.1

(c) The noise level from machines outdoor was measured at a distance 5 m and 15 m representing near field and far field, respectively. Besides, the sound levels for both distances are 70 dB and 60 dB, respectively.

i. Define the term of near field and far field. Assume the sound propagates in spherical wave form.

(4 marks)

ii. Predict the noise level at 150 m and sound power levet at sound source. Assume the reduction with distance follows same rate at large distance.

(2 marks)

Q2 **(a)** The starting point of any noise measurement is to decide on the main purpose of the measurement. As an example, consider the possible reasons that there could be for the need to measure noise levels produced by a piece of machinery, such as compressor. Discuss another 4 reasons of noise measurement that can be considered.

(8 marks)

(b) As a new engineer, you are requested to conduct a noise assessment an area in a mechanical workshop which this area has a noisy generator.

(i) Describe the appropriate measurement method that could be conducted to measure the noise exposure.

(6 marks)

(ii) If noise measurements are being taken in support of a legal case, why would you use a sound level meter on site, rather than a tape recording.

(3 marks)

(iii) If the noise exposure generated by generator is more than 90 dB, do you think that measuring noise esposure among workers should be conducted using dosemeter.

(3 marks)

Q3 **(a)** There are three type of the sound absorber; porous, panel/membrane and helmholtz/cavity absorber. Referring at **Table Q3(a)** given below, identify the type of absorber of material.

(7 marks)

Table Q3(a)

material	type of absorption					
	125	250	500	1000	2000	4000
a	0.01	0.1	0.2	0.3	0.5	0.7
b	0.1	0.6	0.3	0.2	0.06	0.07
c	0.02	0.4	0.2	0.04	0.05	0.07
d	0.02	0.2	0.6	0.8	0.4	0.2
e	0.2	0.2	0.4	0.6	0.8	0.4
f	0.05	0.05	0.1	0.2	0.45	0.65
g	0.08	0.8	0.1	0.6	0.75	0.8

(b) You are advising on the design of music practice rooms which range in plane area 10 m x 20 m x 2.8 m high. Refer to Sabine Equation, evaluate the main parameters as given below that effects to reverberation time value.

(i) room dimension,

(5 marks)

(ii) surface material.
Use surface materal $A_1 = 10.28\ m^2$, $A_2 = 38.4\ m^2$

(5 marks)

(c) Sabine and Eyring Equation are the equation for predicting the RT. Even though these equations established almost 1930s, but there are still used by acousticains. Evaluate the differences in percentage both equations when;

(i) the reverberation time unoccupied room,

(5 marks)

(ii) the reverberation time when occupied by 10 directors.

(2 marks)

Table Q3

	abs at 1kH
absp. Area per person	0.45
plasterboard	0.08
hardwood	0.07
glazing	0.05
plaster on concrete blockwork	0.05
carpeting	0.64

Q4 **(a)** A partion between two rooms has dimension 6 m x 3 m and contains a door dimensions 2 m x 1 m and two windows with each dimensions 1.5 x 1 m. In certain octave band the wall has an transmission loss (R) value 45 dB, the door of 35 dB, and the window of 20 dB.

(i) Find the effective or average value (R) of the partition.

(4 marks)

(ii) If air gap around the door is 2 m, get a new average value (R).

(4 marks)

(iii) What general conclusion can you made from the results above.

Given $R_{ave} = 10 \log (1/t_{ave})$

(2 marks)

(b) A large workshop of dimension 5 m x 4 m x 2 m high is to built with reverberation sound level is 90 dB. An technician office is situated in the corner of the workshop so that only two sides and the flat ceiling have to be built on the existing walls. The workshop is made of chipboard with an area of glazing 1.5 m^2 and a door of area 2 m^2 and a door of area 2 m^2.

(i) Calculate the reverberation sound pressure level inside the workshop in this resulting from sound transmission from the office noise outside. Use R for wall 40 dB and door 30 dB and window 20 dB. The absorpttion coefficient of inside surface of the workshop is 0.1.

(5 marks)

(ii) Justify the limitation and the purpose of the equation can you made form the results above.

(5 marks)

Q5 **(a)** Measurement has shown that in a particular case sound from the source reaches the receiver through three paths equally, and the level at the receiver is 70 dB. Three separate noise control treatments are available to reduce sound tranmission through each of three paths by 20 dB.

(i) By how much will the noise at the receiver be reduced if first just one, then two and finally all three treament are used.

(6 marks)

(ii) If instead of treating the three paths there is an alternative treatment which will reduce the source level by 20 dB what would be the level at the receiver.

(2 marks)

(iii) What general conclusion can you draw from this question about noise control process.

(3 marks)

(b) The manager of a factory which contains a large number of different sorts of machinery is aware that there are noise problems in the factory. He receives advertising literature form a producing sound absorbing materials. He ask you to assess and advise on the suitability of this form of noise control for his particular factory.

(i) Describe how to carry out the assessment

(6 marks)

(ii) Give alternative noise control treatment that you could recommend

(3 marks)

Q6 **(a)** The measurement noise levels at the boundary of a proposed new factory are given in **Table Q6**

Table Q6

Hz	63	125	250	500	1000	2000	4000	8000
SPL	60	55	55	50	55	55	50	45

(i) Solve A weighted sound level, NR rating and briefly explain the value of NR rating if acceptable NR for factory is 60.

(4 marks)

(ii) Should the factory be built? If so should its hours of operation be restricted? Give your conclusion if the noise level only reduce 25% from existed noise level.

(4 marks)

Use **Appendix A and B**

(b) As an environment health officer, you have received a complaint about high levels of amplified music from an adjoining flat.

(i) Descibe how you would investigate such a complain to determine whether the amplified music cause a statutory nuisance.

(5 marks)

(ii) If you decide that it would not be appropriate for the local authority to take action, what legal action could the complainant take if he wished to pursue the matter.

(5 marks)

-END OF QUESTIONS-

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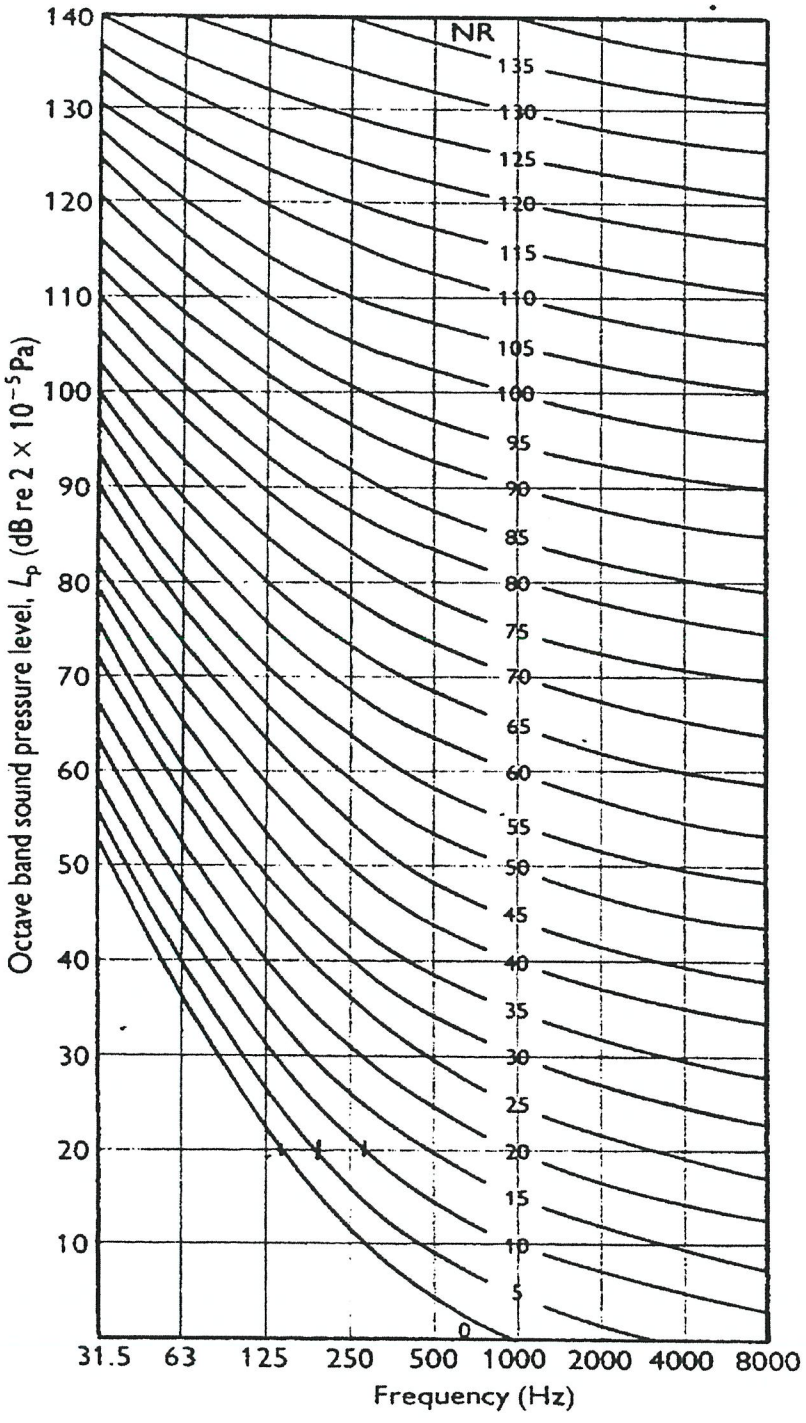
APPENDIX A



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APPENDIX B

FREQUENCY HZ	A WEIGHTED CORRECTION	FREQUENCY HZ	A WEIGHTED CORRECTION	FREQUENCY HZ	A WEIGHTED CORRECTION
10	-70.4	160	-13.4	2500	1.3
12.5	-63.4	200	-10.9	3150	1.2
16	-56.7	250	-8.6	4000	1
20	-50.5	315	-6.6	5000	0.5
25	-44.7	400	-4.2	6300	-0.1
31.5	-39.4	500	-3.2	8000	-1.1
40	-34.6	630	-1.9	10000	-2.5
50	-30.2	800	-0.8		
63	-26.2	1000	0		
80	-22.5	1250	0.6		
100	-19.1	1600	1		
125	-16.1	2000	1.2		