UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 2
SESSION 2010/2011

NAME OF COURSE	:	NOISE AND VIBRATION
COURSE CODE	:	BDC 4013
PROGRAM	:	BACHELOR OF MECHANICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	APRIL / MAY 2011
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	ANSWER **FOUR (4)** OUT OF FIVE QUESTIONS

THIS PAPER CONTAINS EIGHT (8) PAGES INCLUDING COVER PAGE

Q1 **Figure Q1** shows a sport car which is modeled with a capability of pitch and bounce motions. It travels on a rough road whose surface varies sinusoidally with certain amplitude and wavelength. If the eccentric point off the center of gravity is used to obtain the possibility of getting the related coordinate coupling;

(a) Draw free body diagram of the sport car by showing on the 2 degree of freedom system

[5 marks]

(b) Derive the equation of motion (force equilibrium) in vertical direction (Translation).

[8 marks]

(c) Derive the equation of motion (moment equilibrium) about the eccentric point (Rotation).

[8 marks]

(d) Identify the type of coordinate coupling once both translation & rotation are combined.

[4 marks]

Q2 **Figure Q2** shows a line of delivery container system which is connected each other with the spring arranged in a serial orientation. By considering that the system has the mass of $m_1 = m_2 = m$, $m_3 = 2m$ and the spring stiffness of $k_1 = k_2 = k$, $k_3 = 2k$.

(a) Calculate kinetic energy of the system shown

[4 marks]

(b) Calculate potential energy of the system shown

[4 marks]

(c) Derive the equation of motion of the system using Lagrange's Equation by treating the linear displacement of the components as generalized coordinates.

[14 marks]

(d) Express the equation of motion obtained in matrix form.

[3 marks]

Q5 (a) Briefly describe the following;

(i) Workplace noise

(ii) Industrial noise

(iii) Environmental noise.

[9 marks]

(b) **Table Q5(b)** and **Figure Q5(b)** shows a set of octave-band linear sound pressure level and frequency weighting curves graph. Determine;

(i) The total linear sound pressure level

(ii) The total A-weighted sound pressure level

(iii) The average A-weighted sound pressure level, L_{AV}.

[16 marks]

Table Q5 (b)

Center frequency (Hz	Sound Pressure Level (dB)
31.5	90
63	92
125	94
250	88
500	86
1000	88
2000	92
4000	90
8000	81
16000	78

(c) Noise from a building site is caused by five items of plant. The periods of operation of each item of plant during the working day and the noise level each produces at a noise sensitive property at the boundary of the site are as shown in **Table Q5(c);**

(i) Calculate the equivalent continuous noise level, L_{eq} over a 12 hours working day.

(ii) Calculate the effect of spreading the building site operation over an 18 hours period and give the comment on the results obtained.

Table Q5(c)

Items	**Noise Level**	**Operation**
Compressor	84 dB(A)	6 hours
Excavator	87 dB(A)	2 hours
Dumper Truck	76 dB(A)	5 hours
Pump	75 dB(A)	6 hours
Pile-driver	88 dB(A)	2 hours

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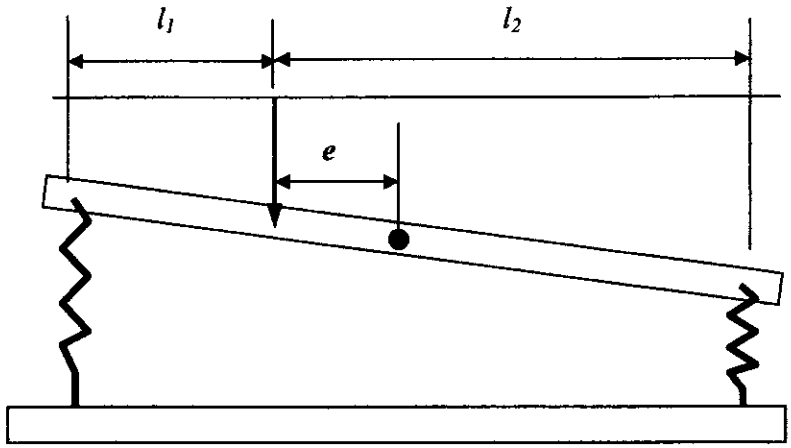

Figure Q1

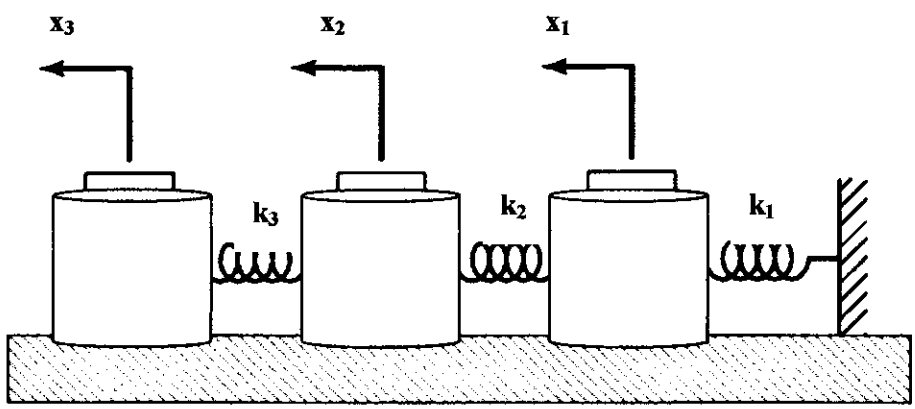

Figure Q2

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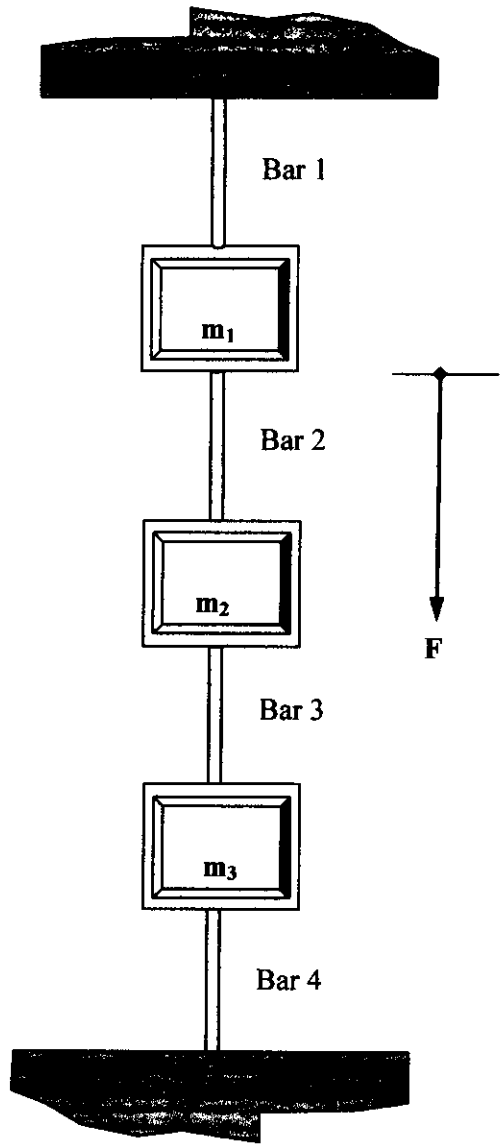

Figure Q3

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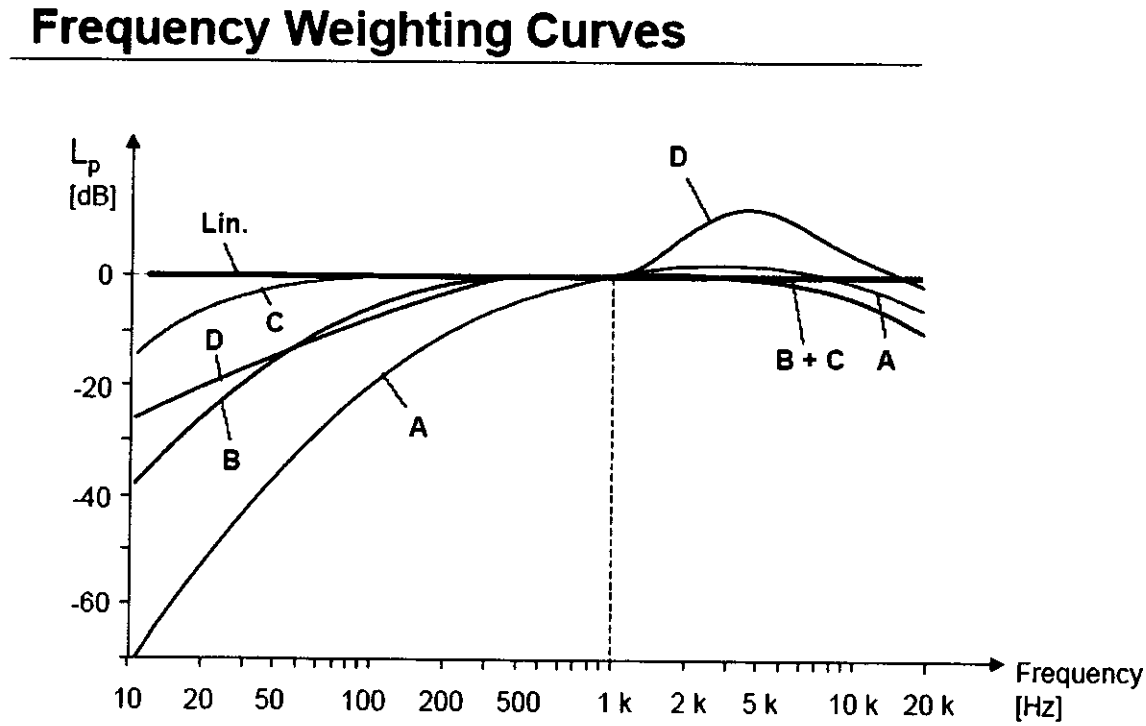

Figure Q5 (b)