



# TECHNICAL UNIVERSITY OF MOMBASA

## DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

FIFTH YEAR SECOND SEMESTER UNIVERSITY EXAMINATION FOR THE DEGREE  
IN BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (BSME)

### EMG 2520 INDUSTRIAL & ENVIRONMENTAL NOISE CONTROL

#### END OF SEMESTER EXAMINATIONS

**SERIES:** DECEMBER, 2013

**TIME:** 2 HOURS

#### INSTRUCTION TO CANDIDATES

1. You should have the following for this examination:-
    - Answer Booklet
    - Scientific Calculator
  2. This paper consists of **FIVE** questions.
  3. Question **ONE** is **Compulsory** Question.
  4. Attempt any other **TWO** Questions.
  5. Maximum marks for each part of Question are as shown.
  6. This paper consists of **THREE** printed pages.
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#### Question ONE

- (a) During a 1-hour period, the A-weighted sound level is 80dBA for 32 minutes, 60dBA for 18 minutes and 89dBA for 16 minutes. Determine the energy equivalent sound level. (6

marks)

- (b) A plane sound wave is propagated in air at 15°C (288.2K or 59°F) and 101.3 (14.7 psia). The intensity of the wave is 10mW/m<sup>2</sup>. Determine:
- (i) The rms acoustic pressure
  - (ii) The rms acoustic particle velocity
  - (iii) The acoustic energy density for the sound wave

(9 marks)

- (c) Outline any **FIVE** factors that influence the community tolerance for environmental noise. **(10 marks)**
- (d) Three sounds of different frequencies are to be combined to obtain a total sound pressure level. Let the three sound pressure levels be 90dB, 75dB, 82 dB. Determine the combined sound pressure level. **(5 marks)**

### Question TWO

- (a) Differentiate the following terms used in noise control.
- (I) Free field and Direct field  
 (II) Near field and far field  
 (III) Reverberant field and Reverberant sound decay **(12 marks)**
- (b) A spherical source of sound produces an acoustic pressure of 2pa at a distance of 2.0m from the source in air at 25°C and 101.3kpa. The frequency of the sound wave is 125Hz and characteristic acoustic impedance is 409.8rayl.

Determine:

- (i) The rms acoustic particle velocity  
 (ii) The acoustic energy density  
 (iii) The acoustic intensity for the sound wave  
 Take the density of air to be 1.184kg/m<sup>3</sup> **(8 marks)**

### Question THREE

- (a) Outline any **FOUR** effects of Noise. **(8 marks)**
- (b) (i) Differentiate between the following indices used for rating environmental noise:  
 (I) Perceived Noise Level (PNL) & Equivalent Sound Level (Leq)  
 (II) Noise Pollution Level (NPL) & Exceedence Level (L<sub>N</sub>)
- (ii) At Building Site, the measured A – Weighted Sound Levels are as follows:
- |                    |                        |
|--------------------|------------------------|
| 7:00 am to 4:00pm  | L <sub>A</sub> = 60dBA |
| 4:00 pm to 10:00pm | L <sub>A</sub> = 50dBA |
| 10:00pm to 7:00am  | L <sub>A</sub> = 40dBA |
- Determine the day-night level at the building site. **(12 marks)**

### Question FOUR

- (a) A worker is exposed to a sound level of 100dBA for 30 min in metal forming area; then the worker spends 3 hours in a stock preparation room. The remainder of the 8 hour day is spent in the stockroom, where the noise level is 65dBA. Determine the maximum allowable sound level in the stock preparation room for the worker to be in compliance with the OSHA regulation. **(8 marks)**
- (b) (i) State any **TWO** administrative control measures on noise pollution.
- (ii) With the aid of a diagram, describe the construction features of a piezoelectric microphone. **(12 marks)**

### **Question FIVE**

- (a) Outline any **FIVE** main sources of error in noise measurements using sound level meters. **(10 marks)**
- (b) Outline any **FIVE** main requirements for optimum design of a silencer. **(10 marks)**