MEL 314/ MCL 314: Noise Engineering/ Acoustics and noise control

Minor II

Max Time: One hour | Max. Marks: 40

Note: Make suitable assumptions, if necessary, giving justification.

Q1. A loudspeaker is placed at one end (x = 0) of a tube of cross-sectional area of S = 10cm2, and at the other end (x = 0.3m) the tube is open to the atmosphere. The loudspeaker is driven to produce a single frequency wave and the resulting sound field in the tube is sampled with a microphone. The sound field has a pressure maximum of 100dB re 20μPa at x = 0.03m, 0.15m and 0.27m. The sound field has a pressure minimum of 96.5dB re 20μPa at x = 0.09m and 0.21m. Find
(a) frequency of the sound wave in the tube
(b) the radiation impedance at the open end of the pipe.

(10)

Q2. The noise level from a factory with ten identical machines measured near some residential property was found to be 54 dB. The maximum permitted SPL is 50 dB at night. How many machines could be used during night? (6)

Q3. A pulsating sphere of radius 0.01m has a radial surface displacement which varies harmonically at 50Hz with a surface velocity magnitude of 0.1m/s. a) Calculate the magnitude of the pressure fluctuations generated at a distance of 10m from the center of the sphere. (b) Calculate the phase difference between the radial acoustic particle velocity and acoustic pressure at 0.5m and 10m from the center of the sphere and comment on the difference in the two results. (8)

Q4. Using mass law find the transmission loss over 1/1 octave band frequencies (between 125 hz and 4 kHz) of a 1.6 mm steel sheet having a density of 7800 Kg/m3. (8)

Q5. The sound transmission class (STC) rating desired for insulating office space from the outdoor noise is STC 55 so that the speech audibility is excellent. The Transmission loss characteristics of the existing wall are given in the table below. (8)

1/3 Octave band center freq. in Hz	TL in dB	1/3 Octave band center freq. in Hz	TL in dB
125	24	800	48
160	27	1000	48
200	33	1250	51
250	38	1600	56
315	41	2000	54
400	45	2500	55
500	45	3150	58
630	46	4000	64

Determine the STC rating of the wall and comment whether it will be able to provide the desired sound insulation or not. (Solution should be done on the graph paper on the next page which also shows a standard STC contour made up of three lines of slopes 9dB/octave, 3dB/octave and 0 dB/octave. Write your roll number on the sheet and submit it by inserting it into your answer book.)