PART-A

Answer all questions, Each question carries 2 Marks

1. Write down the general expression for the sound wave propagation in a medium and reduce it to the case of an ideal gas under isentropic conditions.
2. Write down the wave equation in spherical coordinates and show how any function in the form of \((\psi r)\) will satisfy it.
3. The noise level in a machine shop, when a milling machine is switched off is 51 dB. When it is switched on the noise level goes up by 7 dB. What is the sound power level generated by the milling machine alone?
4. Describe briefly the functions of an anechoic chamber.
5. Mention some of the internationally followed acoustic standards.
6. What is the audible range of frequencies and the sound pressure level of the human ear?
7. What are sources for noise for a typical aircraft and other aerospace vehicles?
8. Distinguish between sound absorbing and sound insulating materials.
9. What is directivity index and how it is related to beam width?
10. When sound wave travels from one medium to another medium, what are the boundary conditions that are used at the interface between these two media?

\((10 \times 2 = 20\text{marks})\)

PART-B

Answer all questions, Each question carries 20 Marks

MODULE I

11) Starting from the Navier-Stokes equation and the continuity equation in differential form, derive the Lighthill’s classical wave equation describing the propagation of aerodynamically generated noise. Mention all the assumptions involved.

OR
12) Define the particle velocity \( v_p \) and the wave velocity \( v_w \) and deduce the relation between these two quantities, for a plane harmonic wave given by the relation

\[
y(x, t) = A \sin(kx - \omega t)
\]

Calculate also the acceleration of this wave.

**MODULE II**

13) What are standing waves? Describe the standing wave apparatus and explain how it is used to measure the absorption coefficient of an acoustic insulation material.

OR

14) Briefly explain the

(a) Sound level meter
(b) Acoustic impedance
(c) Electrical Analogy of Acoustic Circuits
(d) Phon and Sone Scales

**MODULE III**

15) Explain the noise sources in different types of machinery and the methods used to control them practically.

OR

16) Explain the process of hearing of sound by human ear and establish the need for speech interference levels and the perceived noise levels.

**MODULE IV**

17) What are the different types of materials used in the acoustic design? Explain the construction details adopted for reducing the acoustic effects in various types of rooms with suitable sketches.

OR

18) a) A room contains three sound sources of intensity 50 dB each. What is the combined intensity level of all these three sources?

(b) Write short notes on

   (i) Noise and number index guide (NNI)
   (ii) Methods of control of noise using baffles and mufflers.
   (iii) Acoustic Insulation Materials

\[(4 \times 20 = 80 \text{ marks})\]