MODEL EXAMINATIONS -   APRIL 2015

AERONAUTICAL ENGINEERING

13.404:   AEROACOUSTICS

(IVth SEMESTER)

Time : Three hours   *Maximum Marks: 100*

Any missing data can be assumed suitably

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 a 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 (ψr) 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 levels*of the human ear ?
7. What are *sources for noise* for a typical aircraft and other aerospace vehicles?
8. Distinguish between *sound absorbingand 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 x 2 = 20marks)

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 type 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 x 20 = 80marks)