Exercise for Module - 1

Answer the following

1. What are the important non-aerospace applications of wind tunnels?
2. What is understood by dynamic similarity of wind tunnel models?
3. Why are the wind tunnels sections tapered in the direction of flow?
4. Define scale and intensity of turbulence.
5. What is the purpose of using wire meshes in the effuser of a wind tunnel?
6. Why are the wire meshes kept at the largest area section of the wind tunnel intake?
7. How effective is wind tunnel contraction in reducing flow non-uniformity?
8. What is the purpose of honey combs in wind tunnels?
9. Wind tunnel contraction serves multiple purposes in wind tunnels. What are they?
10. Derive and express polytropic efficiency of a subsonic wind tunnel diffuser in terms of total head loss.
11. Show the variation of diffuser efficiency with diffuser angle.
12. What are the possible ways of achieving power economy in wind tunnels?
13. How effective is the use of alternate working substance in reducing power required in a wind tunnel?
14. What is the functional relationship between stagnation temperature and the power required for operating a wind tunnel?

Solve the following numerical problems

1. A low subsonic wind tunnel has a diffuser of area ratio 9. At a test section velocity of 30m/s and a temperature of 330K, the diffuser is found to have an efficiency of 90%. If the pressure at the inlet to the diffuser is 1.195 x 105N/m2 calculate the head loss in the diffuser.

2. A subsonic wind tunnel contraction has an area ratio of 3 and a 5% spatial non uniformity of velocities was observed in the exit section of the contraction. In order to improve the non-uniformity to less than 2% what should be the contraction area?