# Sixth Semester B. Tech Degree Examination

## Branch: Aeronautical Engineering

### (Model Question Paper)

### (2013 Scheme)

### 13.606.2: WIND TUNNEL TECHNOLOGY

Time: 3 hours                                                                     Max. Marks:100

## PART A

### ANSWER ALL QUESTIONS

1.  What is understood by dynamic similarity of wind tunnel models?
2.  What do you mean by dimensionless numbers? Name any four dimensionless numbers.
3.  What are the important non-aerospace applications of wind tunnels?
4.  Wind tunnel contraction serves multiple purposes in wind tunnels. What are they?
5.  Define: model, prototype, model analysis.
6.  List some  designing and sizing  parameters of a wind tunnel
7.  Why are air heaters required in hypersonic wind tunnels?
8.  What are the important and desirable properties of the manometric fluids?
9.  What do you mean by flow visualization techniques?
10. How the pressure measuring devices classified.

(10x2=20 marks)

## PART B

ANSWER ANY ONE FULL QUESTION FROM EACH MODULE, EACH QUESTION CARRIES 20 MARKS

### MODULE I

11. a) The variables controlling the motion of a floating vessel through water are the drag force F,the speed V,the length L,the density ρ and dynamic viscosity μ of water and acceleration due to gravity g. Derive an expression for F by dimensional analysis.
    b) State Buckingham's π theorem. Why this theorem is considered superior over the Rayleigh's methods for dimensional analysis.

<div align="center">OR</div>

12. a) A 1/10 model of an aero plane is tested in a variable density wind tunnel. The prototype plane is to fly at 400km/hr. speed under atmospheric conditions. If the pressure

used in the tunnel is 10 times the atmospheric pressure, what would be the velocity of air in the wind tunnel?

b) Explain briefly about the dimensionless numbers.

## MODULE II

13. With the help of a neat sketch explain briefly about a transonic wind tunnel.

### OR

14. An open-jet test-section of a subsonic wind tunnel expands freely into a still environment. The test-section length is 1.5 times the diameter of the contraction cone exit. The friction coefficient for the free jet is 10 times that of the closed throat with as smooth wall. If the friction co efficient of the smooth wall is 0.008, determine the increase of loss when the jet is open, treating the jet as a cylindrical duct.

## MODULE III

15. a) Explain briefly about the calibration of an subsonic and supersonic wind tunnel

### OR

16. a) How will you determine the flow angularity in a tunnel?

b) Illustrate briefly about the effect of Reynolds number in a supersonic and hypersonic wind tunnel.

## MODULE IV

17. a) What are the basic features and characteristics for proper measurements of balances used in wind tunnels?

b) Explain briefly about the flow visualization techniques.

### OR

18. a) Briefly explain about the pressure measurement systems.

b) How the balances are classified and explain briefly about the same.

(20x4=80 marks)