Code No: RR312104 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
WIND TUNNEL TECHNIQUIES
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. What is the significance of non dimensional parameters in aerodynamic testing? Explain the importance and effect of Reynolds number on aerodynamic characteristics of a model under testing in a wind tunnel. Hence state the PI theorem and work out dimensionless groups upon which depend the aerodynamic characteristics of a model under tests in a wind tunnel. [16]

2. What is understood by the term low speed wind tunnel in aerodynamic testing? Describe with brief details through sketches and plots, various types of low speed wind tunnels based upon the test section details. Hence explain an open section, open ckt wind tunnel with all details. [16]

3. Describe an In draft type supersonic wind tunnel with a good diagram for explaining each component with its function and necessity for obtaining the desired objectives. How is it superior to a Blow Down type wind tunnel? [16]

4. Define the terms Turbulence and Turbulence factor in a wind tunnel having open test section. What are the ways and means of measuring turbulence in a wind tunnel? Illustrate with the instrumentation used. [16]

5. Describe the basis for the measurement of pressure and instruments used for the purpose. What are its advantages and applications? Illustrate with theory and an example. Hence explain one method of measuring all parameters in the flow past a 2D wing model (for estimating its aerodynamic characteristics) kept in a uniform stream of air in a wind tunnel. [16]

6. Describe an automatic beam type balance; to be used for an airplane model for low speed wind tunnel testing. Explain all details with appropriate illustrations. [16]

7. What are the Principals and requirements of visualizing a flow field in a low speed wind tunnel? Name different techniques along with their specific merits over others. Hence describe one such technique for observing stalling behavior of a 2D wing spanning the test section of a low speed wind tunnel. Illustrate what you obtain with sketches and plots. [16]

8. Explain the superiority of oil flow visualization technique over some other surface flow visualization techniques. What are the factors that contribute to realistic results from this technique? Apply this method for viewing stalled flow over a complete airplane model sting mounted in the test section with pitch-changing mechanisms and present the results in the form of good sketches. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR312104 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2006
WIND TUNNEL TECHNIQUIES
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. What is the significance of non dimensional parameters in aerodynamic testing? Explain the importance and effect of Reynolds number on aerodynamic characteristics of a model under testing in a wind tunnel. Hence state the PI theorem and work out dimensionless groups upon which depend the aerodynamic characteristics of a model under tests in a wind tunnel. [16]

2. What is understood by the term low speed wind tunnel in aerodynamic testing? Describe with brief details through sketches and plots, various types of low speed wind tunnels based upon the details of the flow in test section. Hence explain an open section, suction type wind tunnel with all details. [16]

3. Describe a Blow Down type supersonic wind tunnel with a good diagram for explaining each component with its function and necessity for obtaining the desired objectives. How is it superior to a continuous type wind tunnel? [16]

4. Describe a Hot wire anemometer for the measurement of Turbulence and turbulence factor in the test section of a wind tunnel. Comment on the reliability and the technique involved in the process. [16]

5. Describe an electronic manometer for recording pressures simultaneously from multiple pressure ports with neat sketches. How does it differ from an ordinary multitube manometer? [16]

6. Describe a platform type external balance with line diagrams and sketches for measuring lift , drag , and pitching moments (3-components) on airplane and missile models. Draw good sketches and plots in support of your answer. [16]

7. Explain the phenomenon of separation of flow over a finite span wing with the help of liquid paraffin generated smoke wire technique with good sketches. What are its merits over kerosene generated smoke? [16]

8. Explain the superiority of oil flow visualization technique over some other surface flow visualization techniques. What are the factors that contribute to realistic results from this technique? Apply this method for viewing flow over a 2D wing model spanning the test section for establishing stalled flow patterns and present the results in the form of good sketches. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR312104 **Set No. 3**

III B.Tech I Semester Regular Examinations, November 2006
WIND TUNNEL TECHNIQUIES
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. The drag of a sonar transducer is to be predicted based on wind tunnel tests. The prototype is a 38 cm diameter sphere to be towed at 5 knots in a tow tank at 15 C. The wind tunnel model is 15 cm diameter sphere. Determine the test speed in wind tunnel. Take ρ_{water} as 1000Kg / m^3 and μ_{water} as 1* 10^{-3} Pa s . The drag of the model was measured as 40 N. Estimate the drag of the prototype. [16]

2. Describe in details the necessity of a blower based wind tunnel. What are the special design problems and advantages of this type of wind tunnel? How do you improve the flow quality in this case? Explain the use of a wide angle diffuser if you think is required in this wind tunnel. [16]

3. What are the essential components of a supersonic tunnel not found in a subsonic wind tunnel? Make a good layout sketch to explain the functioning of each of these components for the design and operation of a supersonic wind tunnel. [16]

4. Write notes on

   (a) Determining Mach number in supersonic tunnels,
   (b) Measurement of flow angularity in a supersonic wind tunnel. [16]

5. What is the underlying principle of a pressure manometer? Explain its functioning. Describe an electronic manometer for recording pressures simultaneously from multiple pressure ports with neat sketches. [16]

6. A wire type balance is to be prepared and used for measuring lift, drag and pitching moments on a model airplane. Propose a scheme such that the reliability of the arrangement is not spoiled. Make use of sketches and plots in this respect. [16]

7. Describe the liquid paraffin smoke wire technique for creating a smoke sheet in the test section of a wind tunnel. Explain its superiority over the kerosene generated smoke technique. Hence utilize this technique to observe flow over a circular cylinder mounted from end to end in the test section for explaining the phenomenon of separation in laminar and turbulent flow to students in the aerodynamics laboratory with good sketches. [16]

8. Write notes on

   (a) Split-laser beam technique of flow visualization
   (b) Smoke screen method [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR312104 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2006
WIND TUNNEL TECHNIQUIES
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Explain the term Dynamic similarity in aerodynamic testing. Does it influence the aerodynamic characteristics of a model under testing? Hence state the PI theorem and work out dimensionless groups upon which depend the aerodynamic characteristics of a model under tests in a wind tunnel. [16]

2. Show with good sketches a comparison of the aerodynamics of a closed ckt , open jet wind tunnel with an open test section ,open ckt wind tunnel for the same capabilities. Which of the two is economical in the longer run? Illustrate with reference to operational charges and fabrication cost. [16]

3. Show with a detailed sketch salient features of a continuous type supersonic wind tunnel. What are its similarities with a continuous, return type subsonic tunnel; explain with a sketch. [16]

4. You are in the process of designing and fabricating a new low speed wind tunnel. What is the right location of pressure taps for conducting experiments for speed setting of this tunnel? Describe theory and the procedure to be followed in this case. [16]

5. Describe an electronic manometer for recording pressures simultaneously from multiple pressure ports with neat sketches. How does it differ from an ordinary multi-tube manometer? [16]

6. Describe a platform type external balance with line diagrams and sketches for measuring all six components on airplane and missile models. Draw good sketches and plots in support of your answer. [16]

7. A tuft grid is considered a supplementary flow visualization technique and used in conjunction with smoke flow visualization. Make use of this technique for explaining flow over a circular cylinder and in its field of influence by arranging tuft grid as deemed fit. [16]

8. Explain the superiority of oil flow visualization technique over some other surface flow visualization techniques. What are the factors that contribute to realistic results from this technique? Apply this method for viewing stalled flow over a finite span wing model:sting mounted in the test section in laminar and turbulent flows with pitch-changing mechanisms and present the results in the form of good sketches. [16]

⋆ ⋆ ⋆ ⋆ ⋆